Public Draft Environmental Assessment

Barstow Training and Range

Marine Corps Logistics Base Barstow

November 2015

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Environmental Assessment for Barstow Training and Range at Marine Corps Logistics Base Barstow

Lead Agency for the EA: United States Marine Corps

Title of Proposed Action: Barstow Training and Range at Marine Corps Logistics Base (MCLB) Barstow

Location of the Proposed Action: State of California, San Bernardino County

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Abstract

The United States Marine Corps (USMC) has prepared this Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA) of 1969, 42 United States Code §§ 4321–4370h, as implemented by the Council on Environmental Quality regulations, 40 *Code of Federal Regulations* Parts 1500–1508, and Marine Corps Order P5090.2A, Change 3, Chapter 12, dated 26 August 2013, *Environmental Compliance and Protection Manual*, which establishes procedures for implementing NEPA. The proposed action includes updating operational capabilities of existing training areas and ranges on MCLB Barstow to support combat readiness of USMC operating forces, including tenant, unit, and Marine Air-Ground Task Force-level training, for the First Marine Expeditionary Force. This EA describes the potential environmental consequences resulting from one action alternative (Alternative 1) and the No-Action Alternative on the following resource areas: airspace; air quality; biological resources; cultural resources; land use; noise; public health and safety; topography and geology; transportation; utilities and infrastructure; and water resources.

Prepared By: United States Marine Corps

Point of Contact: Department of the Navy
Naval Facilities Engineering Command Southwest Central IPT
Mr. Jesse Martinez, Project Manager
1220 Pacific Highway
San Diego, CA 92132-5190

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Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
4-WD	four-wheel drive
A.D.	Anno Domini
ADT	average daily trip
AGL	above ground level
AO	Area of Operations
APE	Area of Potential Effects
ARB	Air Resources Board
B.P.	before present
BGS	below ground surface
BLM	Bureau of Land Management
BMP	Best Management Practice
CAA	Clean Air Act of 1970
CAAQS	California Ambient Air Quality Standards
CalEPA	California Environmental Protection Agency
CalIPC	California Invasive Plant Council
CAOC	CERCLA Area of Concern
CBRN	chemical, biological, radiological, and nuclear
CDFW	California Department of Fish and Wildlife
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CH_4	methane
CMC	Commandant of the Marine Corps
CNDDB	California Natural Diversity Database
CNEL	community noise equivalent level
$CNEL_{mr}$	monthly community noise equivalent level
CNPS	California Native Plant Society
CO	carbon monoxide
CO_2	carbon dioxide
CO2e	CO_2 equivalent
CWA	Clean Water Act of 1972
dB	decibel
dBA	A-weighted sound level
DNL	day-night average sound level
DoD	Department of Defense
DTSC	Department of Toxic Substance Control
EA	Environmental Assessment
EO	Executive Order
EPCRA	Emergency Planning and Community Right-to-Know Act of 1986
ESA	Endangered Species Act of 1973
FAA	Federal Aviation Administration
FARP	forward arming and refueling point
FASP	field ammunition supply point
FFA	Federal Facilities Agreement
FHWA	Federal Highway Administration
GHG	greenhouse gas

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GIS	geographic information system
GWP	global warming potential
Hz	hertz
I MEF	First Marine Expeditionary Force
I-15	Interstate 15
I-40	Interstate 40
IFR	Instrument Flight Rule
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
ISO	International Organization for Standardization
KD	Known Distance
LEED®	Leadership in Energy and Environmental Design
L_{eq}	equivalent sound level
LHA	Landing Helicopter Assault
LHD	Landing Helicopter Dock
LID	Low-Impact Development
LOS	level of service
LZ	landing zone
MAG	Marine Aircraft Group
MAGTF	Marine Air-Ground Task Force
Marine Corps	United States Marine Corps
MAW	Marine Aircraft Wing
MBTA	Migratory Bird Treaty Act
MCAGCC	Marine Corps Air Ground Combat Center
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCIWEST	Marine Corps Installations West
MCLB	Marine Corps Logistics Base
MCO	Marine Corps Order
MDAB	Mojave Desert Air Basin
MDAQMD	Mojave Desert Air Quality Management District
MEB	Marine Expeditionary Brigade
MEF	Marine Expeditionary Force
MEU	Marine Expeditionary Unit
MILCON	Military Construction Program
MOA	Military Operations Area
MSL	mean sea level
MTR	military transit route
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
Navy	Department of the Navy
NEPA	National Environmental Policy Act of 1969
NFA	no further action
NHPA	National Historic Preservation Act of 1966
NO_2	nitrogen dioxide
NOA	Notice of Availability
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRHP	National Register of Historic Places

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O_3	ozone
OHWM	ordinary high water mark
OU	operable unit
PCB	polychlorinated biphenyl
PK 15(met)	peak level exceeded 15 percent of the time
PM_{10}	particulate matter less than or equal to 10 microns in diameter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in diameter
PSD	Prevention of Significant Deterioration
RBC	risk-based concentration
RCMP	Range Complex Management Plan
RCRA	Resource Conservation and Recovery Act of 1976
REVA	Range Environmental Vulnerability Assessment
ROD	Record of Decision
ROI	region of influence
ROW	right-of-way
RSOP	reconnaissance, selection, and occupation of position
RTA	Range and Training Area
RWQCB	Regional Water Quality Control Board
SDZ	surface danger zone
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO_2	sulfur dioxide
SPCC	Spill Prevention, Control, and Countermeasures
SPL	sound pressure level
SWDA	Solid Waste Disposal Act of 1976
SWMU	solid waste management unit
SWPPP	Stormwater Pollution Prevention Plan
TNW	traditional navigable water
TRI	Toxic Release Inventory
TRI-DDS	Toxic Release Inventory-Data Delivery System
U.S.	United States
UAS	unmanned aerial systems
UFC	Unified Facilities Criteria
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USMC	U.S. Marine Corps
UST	underground storage tank
VFR	Visual Flight Rule
VOC	volatile organic compound

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Executive Summary

The United States Marine Corps (Marine Corps or USMC) has prepared this Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA) of 1969, 42 United States Code §§ 4321-4370h, as implemented by the Council on Environmental Quality regulations, 40 Code of Federal Regulations Parts 1500-1508, and Marine Corps Order P5090.2A, Change 3, Chapter 12, dated 26 August 2013, *Environmental Compliance and Protection Manual*, which establishes procedures for implementing NEPA. This EA describes the potential environmental consequences resulting from a proposal to update operational capabilities of existing training areas and ranges on Marine Corps Logistics Base (MCLB) Barstow to support combat readiness of USMC operating forces, including tenant, unit, and Marine Air-Ground Task Force (MAGTF)-level training, for the First Marine Expeditionary Force (I MEF). The proposed action would include: (1) construction and operation of a Simulated Flight Deck (Landing Helicopter Assault [LHA]/Landing Helicopter Dock [LHD]) and superstructure [e.g., temporary modular structure]), construction of a new access road, and improvements to an existing trail to provide access to the LHA/LHD site in the Range West training area; (2) establishment of a Landing Zone (LZ) and access roads, new firing lines (700-, 800-, and 900-yard lines) at the Known Distance (KD) Rifle Range, modernization/upgrades to the KD Rifle Range and 100-yard shotgun range, establishment of three designated bivouac areas, a forward arming and refueling point site, and vehicle loading and refueling area, construction of a new tear gas training facility, and upgrades and/or replacement of existing KD Range Complex support facilities within the Range East and KD Range Complex training area; (3) establishment of a vehicle loading and refueling area near the West Gate in the Range Main Supply Route training area; and (4) establishment of a new LZ and access roads and installation of permanent fencing at the Yermo Stables training area. All ground and aviation training activities would occur on land managed by the USMC within general aviation, unrestricted (Class G) airspace. Training operations would be consistent with existing airspace conditions, and no new military requirement for restricted airspace would be required.

The purpose of the proposed action is to enhance and update operational capabilities at MCLB Barstow, thereby improving training and readiness opportunities and maximizing range use and throughput. The proposed action is needed because MCLB Barstow's existing industrial facilities and supporting infrastructure, open training lands, and live-fire ranges do not adequately accommodate combined ground and aviation training operations, support the ability for multiple units to conduct simultaneous training, or provide the flexibility to meet evolving USMC operational requirements. Furthermore, the proposed action is needed to ensure range maintenance and sustainment of MCLB Barstow's training ranges. The proposed action would update and enhance MCLB Barstow's existing training and readiness capability and capacity in accordance with the Commandant of the Marine Corps' mandates in the *Marine Corps Vision and Strategy 2025* and *Expeditionary Force 21* (USMC 2014; USMC 2008) to support local and regional operational training requirements. Enhancing training opportunities, areas, and ranges at MCLB Barstow to provide components of integrated regional I MEF training is consistent with historical and continuing activities at MCLB Barstow and, further, is critical to the quality, quantity, and variety of training for USMC units to maintain operational readiness.

The following resource areas were evaluated for potential environmental consequences: Airspace; Air Quality; Biological Resources; Cultural Resources; Land Use; Noise; Public Health and Safety; Topography and Geology; Transportation; Utilities and Infrastructure; and Water Resources. The potential environmental consequences associated with implementation of Alternative 1 and the No-Action Alternative are summarized in Table ES-1. As shown in Table ES-1, no significant impacts to any resource area would occur with implementation of the proposed action with the inclusion of Special Conservation Measures. Based on the analysis presented in this EA, the USMC has identified Alternative 1 as the Preferred Alternative.

Table ES-1. Summary of Potential Environmental Consequences

Resource	Alternative 1	No-Action Alternative
Airspace	Alternative 1 would not require changes or additions to the existing airspace structure. In addition, no changes would be required to those procedures that have been implemented by MCLB Barstow per the FAA for scheduling and managing use of this airspace environment. Aircraft operations associated with Alternative 1 would be consistent with activities permitted within general aviation, non-restricted Class G airspace and the overlying Class E airspace. FAA-mandated restrictions, military aviation operations guidance, and other safety initiatives that regulate military flight operations throughout the region of influence would serve to effectively and safely integrate proposed aircraft operations into the existing airspace environment. Aircraft operations at nearby public and private airfields would not be affected by the proposed aircraft operations. Therefore, no significant impacts on airspace would occur.	For the No-Action Alternative, the proposed action would not occur, and there would be no change in existing conditions. No impacts on airspace would occur.
Air Quality	Construction and operations (i.e., ground and aviation training and range maintenance and sustainment activities) emissions generated by Alternative 1 would be below the conformity *de minimis* levels of the USEPA PSD threshold. Implementation of Special Conservation Measure 1 (*Fugitive Dust Control Measures*) and Special Conservation Measure 2 (*Construction Equipment Emission Control Measures)* would minimize fugitive dust and equipment combustion emissions from construction activities. Implementation of Special Conservation Measure 3 (*Fugitive Dust Control Measures for Operations*) would minimize fugitive dust emissions from proposed training activities at the vehicle loading and refueling area in the Range East and KD Range Complex training area. Therefore, no significant impacts on air quality would occur.	For the No-Action Alternative, the proposed action would not occur, and there would be no change in existing conditions. No impacts on air quality would occur.

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Table ES-1. Summary of Potential Environmental Consequences (continued)

Resource	Alternative 1	No-Action Alternative
Biological Resources	Proposed construction and operations would result in impacts to vegetation and potentially increase the spread of invasive non-native plant species. The potential for establishment or spread of invasive plants would be minimized through implementation of Special Conservation Measure 4 (*Invasive Plant Species Control*) and Special Conservation Measure 5 (*Restoration of Disturbed Habitats*). Potential direct and indirect impacts on general wildlife and associated habitat would be reduced by Special Conservation Measures 5 (*Restoration of Disturbed Habitats*), Special Conservation Measures 6 (*Vehicle Speed Limit Restrictions*), Special Conservation Measures 12 (Pet Prohibitions) and Special Conservation Measure 20 (*Seasonal Avoidance for MBTA-protected bird species*). Alternative 1 would result in direct impacts to Agassiz's desert tortoise and associated occupied habitat. Proposed activities would indirectly affect designated critical habitat for this species. Impacts on Agassiz's desert tortoise would be minimized by implementing vehicle speed limit restrictions, designating a MCLB Barstow Desert Tortoise Management Representative, continuing to implement a desert tortoise education program, conducting vehicle inspections, conducting pre-construction surveys, performing on-site biological monitoring, enforcing pet restrictions, providing waste management, preparing a MCLB Barstow Desert Tortoise Conservation Plan, performing annual desert tortoise surveys and reporting, coordinating with USFWS, delineating desert tortoise critical habitat, performing predator management, and adhering to wildfire prevention measures (Special Conservation Measures 6 - 19). Implementation of Special Conservation Measure 20 *(Seasonal Avoidance for MBTA-protected Bird Species*) would minimize impacts associated with the loss of nesting habitat for MBTA-protected species. Impacts to other special status species would be minimized with implementation of Special Conservation Measure 4 (*Invasive Plant Species Control*), Special Conservation Measure 5 (*Restoration of Disturbed Habitats*), Special Conservation Measure 6 (*Vehicle Speed Limit Restrictions),* Special Conservation Measure 10 (*Clearance Surveys during Construction and Range Maintenance and Sustainment Activities),* and Special Conservation Measure 20 (*Seasonal Avoidance for MBTA-protected Bird Species*). Therefore, no significant impacts on biological resources would occur.	For the No-Action Alternative, the proposed action would not occur. There would be no change in existing conditions, and the potential disturbance to biological resources would be avoided. No impacts on biological resources would occur.
Cultural Resources	Under Alternative 1, four potentially NRHP-eligible sites (i.e., CA-SBR-73. CA-SBR-11840, CA-SBR-8319, and MCLB-SITE-7) could be affected by proposed activities. However, implementation of Special Conservation Measure 21 (*NRHP-eligible Site Buffer Zone*) would require clearly defined limits of construction, ground training, aircraft operations, and range maintenance and sustainment activities to minimize impacts to potentially eligible archaeological resources within the APE. Although highly unlikely, potential impacts to possible post-review discoveries would be minimized because MCLB Barstow would manage these resources in accordance with the NHPA and other federal laws and regulations, Marine Corps and DoD regulations, instructions, and orders, and DoD American Indian and Alaska Native Policy. MCLB Barstow would also follow the procedures stipulated in the MCLB Barstow ICRMP (Standard Operating Procedures). Therefore, no significant impacts on cultural resources would occur.	For the No-Action Alternative, the proposed action would not occur, and there would be no change in existing conditions. No impacts on cultural resources would occur.

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Table ES-1. Summary of Potential Environmental Consequences (continued)

Resource	Alternative 1	No-Action Alternative
Land Use	Alternative 1 would increase the intensity of training activities within the project footprint and include new training activities (e.g., aircraft operations). However, proposed activities would be compatible with existing and surrounding land uses (operations and training). Proposed activities would optimize the training assets at MCLB Barstow, consistent with the guidelines stipulated in the MCIWEST-MCB Camp Pendleton Regional RCMP. Alternative 1 would also be sited, designed, and constructed consistent with the guidelines stipulated in the MCLB Barstow Master Plan regarding future development within the project footprint. Therefore, no significant impacts on land use would occur.	For the No-Action Alternative, the proposed action would not occur, and there would be no change in existing conditions. Existing training opportunities would not be maximized to meet evolving USMC operational requirements. No impacts on land use would occur.
Noise	Construction activities would temporarily increase noise in the project vicinity. However, construction-related noise levels at sensitive receptor sites would remain at or below 75 dB CNELmr during construction activities and would decrease to levels not anticipated to adversely affect sensitive receptor locations. Noise generated by tactical vehicle operations within the project footprint would not substantially differ from the existing noise environment within the project vicinity. The increase in noise levels associated with the change in munition types at the KD Range Complex would not be substantially higher than existing conditions (approximately 2 dB and barely audible). Noise impacts associated with unrestricted firing of blanks in the project footprint could generate significant noise impacts on sensitive receptors. However, implementation of Special Conservation Measure 22 (*Munitions Firing Restrictions*) would restrict the use of blanks during training in portions of the Range Main Supply Route and Yermo Stables training areas. The increase in aircraft operations and addition of new aircraft types would result in noticeable changes in ambient noise levels and an increased frequency of potentially disturbing noise events. Proposed aircraft training at LZ 2 would result in a substantial increase in the number of low-altitude overflights of the Yermo Stables that could cause strong reactions from the horses at the stables. However, implementation of Special Conservation Measure 23 (*Aircraft Flight Restrictions*) would restrict low-level overflights such that the risk of strong behavioral reactions in horses at the Yermo Stables and noise exposure to noise-sensitive receptors would be minimized, and require scheduling aircraft training at LZ 2 to avoid coinciding with rodeos. Therefore, no significant impacts on noise would occur.	For the No-Action Alternative, the proposed action would not occur, and there would be no change in existing conditions. No impacts on noise would occur.

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Table ES-1. Summary of Potential Environmental Consequences (continued)

Resource	Alternative 1	No-Action Alternative
Public Health and Safety	Alternative 1 would not expose children to environmental conditions or military activities in the project vicinity. Alternative 1 would install permanent fencing along the boundary of the Yermo Stables training area to preclude public access and provide enhanced public safety. All other portions of the project footprint have controlled, secured access gates. Current aviation safety procedures, including FAA-mandated restrictions and military aviation operations guidance, would continue to be implemented and additional flight operations at MCLB Barstow would adhere to established safety procedures. In addition, the emergency and mishap response guidelines stipulated in the MCLB Barstow Regulations for Ranges and Training Areas and Airspace (Range Regulations) would be updated, as needed, to include procedures and response actions necessary to address a mishap involving any new aircraft platforms. Proposed CS gas grenade training would be conducted in accordance with required safety regulations. Proposed construction and operations would not occur within a hazard zone and communications used during command/logistics post exercises and aviation training would not generate large amounts of electromagnetic radiation. Alternative 1 would require the continued implementation of policies and procedures associated with the reporting, management, and recovery of ordnance-related residue. Proposed construction and training operations would occur within and adjacent to an IRP site. However, all activities conducted in the Yermo Stables training area would be coordinated and reviewed by MCLB Barstow Environmental Division and Range Operations before initiating any ground disturbing activities to reduce potential exposure of on-site personnel to contaminated soil (Special Conservation Measure 24). Therefore, no significant impacts on public health and safety would occur.	For the No-Action Alternative, the proposed action would not occur, and there would be no change in existing conditions. Potential safety risks associated with public access to the Yermo Stables training area would still occur. No impacts on public health and safety would occur.
Topography and Geology	Site development would be designed to maximize the balance of cut and fill on-site to the extent feasible, limiting the amount of import fill. Fill would be excavated on-site to elevate the LHA/LHD landing platform above the floodplain and limit the change in topography for approaching aircraft. Grading for LZ 1 would generally follow the orientation of the existing topography and only minor slopes (less than 6 feet [1.8 meters]) would be required to construct this LZ. Minimal grading would be required to construct LZ 2. Active faults are located within 60 miles (96 kilometers) of the project footprint. However, new facilities would be designed and constructed to comply with federal, state, and local seismic design criteria and per California Code of Regulations Title 24, a standard, site-specific, geotechnical investigation that includes recommendations for design and construction would be prepared before construction. Therefore, no significant impacts on topography and geology would occur.	For the No-Action Alternative, the proposed action would not occur, and there would be no change in existing conditions. No impacts on topography and geology would occur.

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Table ES-1. Summary of Potential Environmental Consequences (continued)

Resource	Alternative 1	No-Action Alternative
Transportation	Construction-related traffic would comprise only a small portion of the total existing traffic volume in the area and at MCLB Barstow. Increased traffic associated with these activities could contribute to short-term, increased congestion at the Nebo Annex and/or Yermo Annex Main Gates. Potential congestion impacts could be avoided or minimized by scheduling truck deliveries outside the morning and afternoon peak traffic periods. Also, many of the heavy construction vehicles could be kept at designated construction staging and laydown areas within the project footprint, resulting in fewer additional trips. Potential congestion impacts would be temporary, ending once construction activities have ceased. Proposed training activities would primarily result in temporary/transient increases in military personnel. Proposed road improvements and maintenance activities would minimize deterioration of the existing access routes/trails associated with increased convoys during training activities. All training activities would be conducted in accordance with Marine Corps Reference Publication 4-11.3F and FHWA-HOP-05-029, which address military deployments and convoy operations on public roads. There would be a negligible increase in overall traffic volumes or circulation patterns within the Base associated with the four additional, permanent military and/or government civilian employees that could be required to support proposed operations. Therefore, no significant impacts on transportation would occur.	For the No-Action Alternative, the proposed action would not occur, and there would be no change in existing conditions. No impacts on transportation would occur.
Utilities and Infrastructure	Alternative 1 would increase demands on electricity, water, sewer, and solid waste disposal. Alternative 1 would include new infrastructure (e.g., permanent restroom facility with septic system and portable water storage tank at the KD Range Complex) and upgrades/modifications to existing utility infrastructure to accommodate proposed training operations. Proposed upgrades to the electrical system, water system, and sewer system would be sized to meet the needs of the proposed facilities and associated training activities. In addition, sufficient capacity exists within the Barstow Sanitary Landfill to accommodate the small volume of solid waste expected to be generated by proposed construction and operations (e.g., training and range maintenance and sustainment) activities. Therefore, no significant impacts on utilities would occur.	For the No-Action Alternative, the proposed action would not occur, and there would be no change in existing conditions. Inadequate facilities (e.g., portable toilets) and limited water infrastructure would continue to support existing training activities. No impacts on utilities and infrastructure would occur.

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Table ES-1. Summary of Potential Environmental Consequences (continued)

Resource	Alternative 1	No-Action Alternative
Water Resources	Alternative 1 would incorporate BMPs for erosion and sedimentation control, as identified in Order No. 2009-0009-DWQ and as specified in a site-specific SWPPP (Special Conservation Measure 25) to mitigate the adverse effects of construction-related erosion on water quality. The potential increase in stormwater runoff under Alternative 1 would be managed such that discharge exiting the project footprint post-construction would be equal to or less than existing conditions through the design of proposed project components and use of appropriately designed runoff reduction features (Special Conservation Measure 26). Potential surface water and/or shallow groundwater quality impacts associated with the inadvertent dispersion of contaminants during construction would be minimized by implementation of a SPCC Plan and BMPs as required under the General Permit for Storm Water Discharges Associated with Construction Activity from the State Water Resources Control Board. Implementation of Special Conservation Measure 27 (*LHA/LHD Access Road Design Requirements*), Special Conservation Measure 28 (*Levee Repair),* and Special Conservation Measure 29 (*800-yard Line Flood Wall*) would minimize impacts associated with increased flooding on- or off-site. Potential surface water and groundwater quality impacts associated with hazardous materials within small arms ammunition would be limited due to side berm control structures and low precipitation. Downwash/rotor wash associated with proposed aviation training activities would not significantly alter the drainage pattern within the desert washes in the project footprint. Implementation of Special Conservation Measure 30 (*MCLB Barstow Range Regulations for Water Resources)* would minimize impacts to surface waters from storage and disposal of wastewaters, storage and use of petroleum products, and/or containment and cleanup of spills during construction and training activities. Therefore, no significant impacts on water resources would occur.	For the No-Action Alternative, the proposed action would not occur, and there would be no change in existing conditions. No impacts on water resources would occur.
Notes: APE = Area of Potential Effects; BMP = Best Management Practice; CNEL = community noise equivalent level; dB = decibel; EA = Environmental Assessment; FAA = Federal Aviation Administration; ICRMP = Integrated Cultural Resources Management Plan; IRP = Installation Restoration Program; KD = Known Distance; LHA = Landing Helicopter Assault; LHD = Landing Helicopter Dock; LZ = landing zone; MBTA = Migratory Bird Treaty Act; MCB = Marine Corps Base; MCIWEST = Marine Corps Installations West; MCLB = Marine Corps Logistics Base; NHPA = National Historic Preservation Act; NPDES = National Pollutant Discharge Elimination System; NRHP = National Register of Historic Places; PSD = Prevention of Significant Deterioration; SHPO = State Historic Preservation Officer; SPCC = Spill Prevention, Control, and Countermeasures; SWPPP = Stormwater Pollution Protection Plan; and USEPA = United States Environmental Protection Agency.		

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1 Purpose and Need

1.1 Introduction

This Environmental Assessment (EA) has been prepared by the United States Marine Corps (Marine Corps or USMC) in accordance with the National Environmental Policy Act (NEPA) of 1969 and other applicable laws. It presents an analysis of the potential environmental consequences resulting from a proposal to enhance and integrate independent and combined ground and aviation training on Marine Corps Logistics Base (MCLB) Barstow, California (Figures 1.1-1 and 1.1-2). MCLB Barstow provides a training venue that supports combat training for USMC operating forces. The proposed action would update operational capabilities of existing training areas and ranges on MCLB Barstow to support combat readiness of USMC operating forces, including tenant, unit, and Marine Air-Ground Task Force (MAGTF)-level training, for the First Marine Expeditionary Force (I MEF). This EA more clearly quantifies the scope, frequency, and intensity of reasonably foreseeable USMC training activities required to meet the Commandant of the Marine Corps' (CMC) mandates in the *Marine Corps Vision and Strategy 2025* and *Expeditionary Force 21* (USMC 2014; USMC 2008).

1.2 Background

As directed by law (10 United States Code [USC] Section 5063), the USMC must be able to field, on virtually immediate notice, a self-sufficient, combined arms combat force that can operate in three dimensions (land, air, and sea) under a single command. The USMC task organizes its ground combat divisions, air wings, logistics elements, and an integrated command element into MAGTFs. This forms the fundamental cornerstones of modern USMC combat doctrine and is one of the first front-line combat forces that the nation turns to in times of crisis. MAGTFs are scalable in size and can be tailored for specific missions (e.g., humanitarian assistance, emergency response, peacekeeping, specific regional threats, and/or major war abroad). This scalability provides the flexibility to address the full spectrum of possible military operations by sizing and tailoring MAGTFs to fit the situation and optimize forces as needed for forward presence, engagement, crisis response, antiterrorism, and war fighting. Regardless of their size, all MAGTFs are composed of common organizational elements that include command, ground combat, air combat, and logistics. A Marine Expeditionary Force (MEF) is the largest size MAGTF and is built around a division, an aircraft wing, and a logistics group. A Marine Expeditionary Brigade (MEB) is the middle size MAGTF and is built around a reinforced infantry regiment, a composite aircraft squadron, and a reinforced logistics element. A Marine Expeditionary Unit (MEU) is the USMC's standing global response force and consists of a reinforced infantry battalion, an aircraft squadron, and a combat logistics battalion. There are three MEUs forward deployed (i.e., rapid relocation of military forces to operational areas) throughout the world on a continual basis and two of these MEUs conduct pre-deployment training on Department of Defense (DoD) ranges within the Marine Corps Installations West (MCIWEST)-Marine Corps Base (MCB) Camp Pendleton Area of Operations (AO).

Major subordinate commands that form I MEF consist of 1st Marine Division (Ground Combat Element), 3rd Marine Aircraft Wing (MAW) (Air Combat Element), and 1st Marine Logistics Group (Combat Service Support Element). The specialized training requirements of these elements are stipulated in the MCIWEST-MCB Camp Pendleton Regional Range Complex Management Plan (RCMP) (USMC 2013a), and support I MEF's ability to train and certify MEUs and conduct periodic MEB- and MEF-level training on a recurring annual basis. The training operations addressed under the proposed action would primarily be conducted by these I MEF combat elements.

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Figure 1.1-1. Regional Map

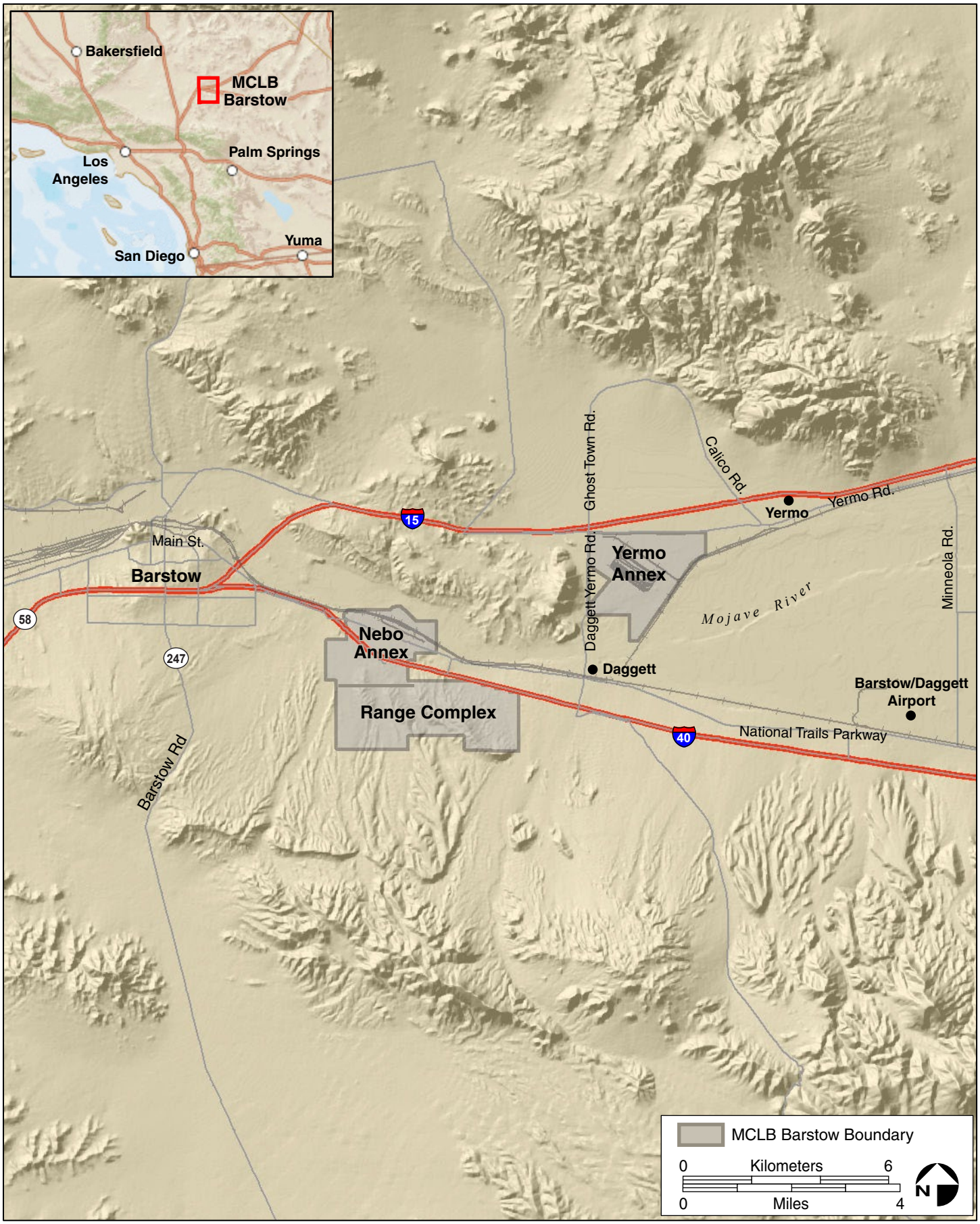

Figure 1.1-2. Project Vicinity

Figure 1.1-3 depicts an example of a large-scale MAGTF exercise, its distribution across the Marine Corps ranges within the MCIWEST-MCB Camp Pendleton AO, and MCLB Barstow's relationship to these other installations.

As shown in Figure 1.1-3, a distributed concept of operations starts with an amphibious landing at MCB Camp Pendleton. From there, forces advance inland via ground and aviation movements to other Marine Corps ranges in the region. During MAGTF-level training within the MCIWEST-MCB Camp Pendleton AO, all of the MAGTF forces distribute throughout the larger area of the western United States (U.S.). For example, only smaller, sub-elements of that MAGTF would conduct training at, or pass through, MCLB Barstow for specific training missions within the larger construct of these training scenarios or as standalone events.

The CMC's vision and guidance contained in the *Marine Corps Vision and Strategy 2025* (USMC 2008) and *Expeditionary Force 21* (USMC 2014) establish the foundation for the USMC's operational concepts and identify the critical steps needed to meet tomorrow's challenges today. As the nation's "force in readiness," Marines must be properly trained, organized, equipped, and prepared for employment across all forms of warfare. Responding rapidly to crisis and strategic surprise is fundamental to combat readiness for Marine operating forces. To ensure Marines continue to fulfill their responsibilities as an expeditionary fighting force, they must continue to refine their capabilities to accommodate diverse missions across the full range of military operations.

MAGTFs will remain the primary construct for organizing USMC operating forces. However, to meet coming challenges the USMC will also implement organizational refinements to improve their capability to be a strategically mobile force (USMC 2014). The following organizational refinement stipulated in *Expeditionary Force 21* is specifically relevant to updating the operational capabilities of existing training ranges and areas on MCLB Barstow:

> ***Infantry Battalions and Company Landing Teams.*** *Infantry battalions will remain the Marine Corps' standard unit of deployment; however, company landing teams may take on a larger role in crisis response and may form the ground combat element component of a Special Purpose MAGTF. The tables of organization and equipment for the infantry battalion will be reviewed over the next few years in order to ensure that they have the capability and capacity to support one or more employed company landing teams simultaneously. Company landing teams provide a means to engage forward in more locations and respond to crises. During entry operations they enable dispersed operations to secure landing sites or maneuver deep to inland objectives. Lastly, they must have the maneuver capability to disperse and mass throughout the littorals. During crisis response they can form the basis of an immediate response (USMC 2014).*

To implement the CMC's mandates in the *Marine Corps Vision and Strategy 2025* and *Expeditionary Force 21* (USMC 2014; USMC 2008), the USMC must sustain, upgrade, and modernize existing training ranges and areas, like those at MCLB Barstow. This would allow for enhanced small unit training, which would improve ground tactical mobility and assault support. Such small unit training would also increase the capacity for infantry battalions and company landing teams to effectively operate in a decentralized manner.

1.3 Mission of MCLB Barstow

MCLB Barstow is located in western San Bernardino County, California, 3.5 miles (6 kilometers) east of the City of Barstow (Figure 1.1-1). MCLB Barstow encompasses 5,567 acres (2,253 hectares) and is situated within the DoD Southwest Range Complex and MCIWEST-MCB Camp Pendleton AO.

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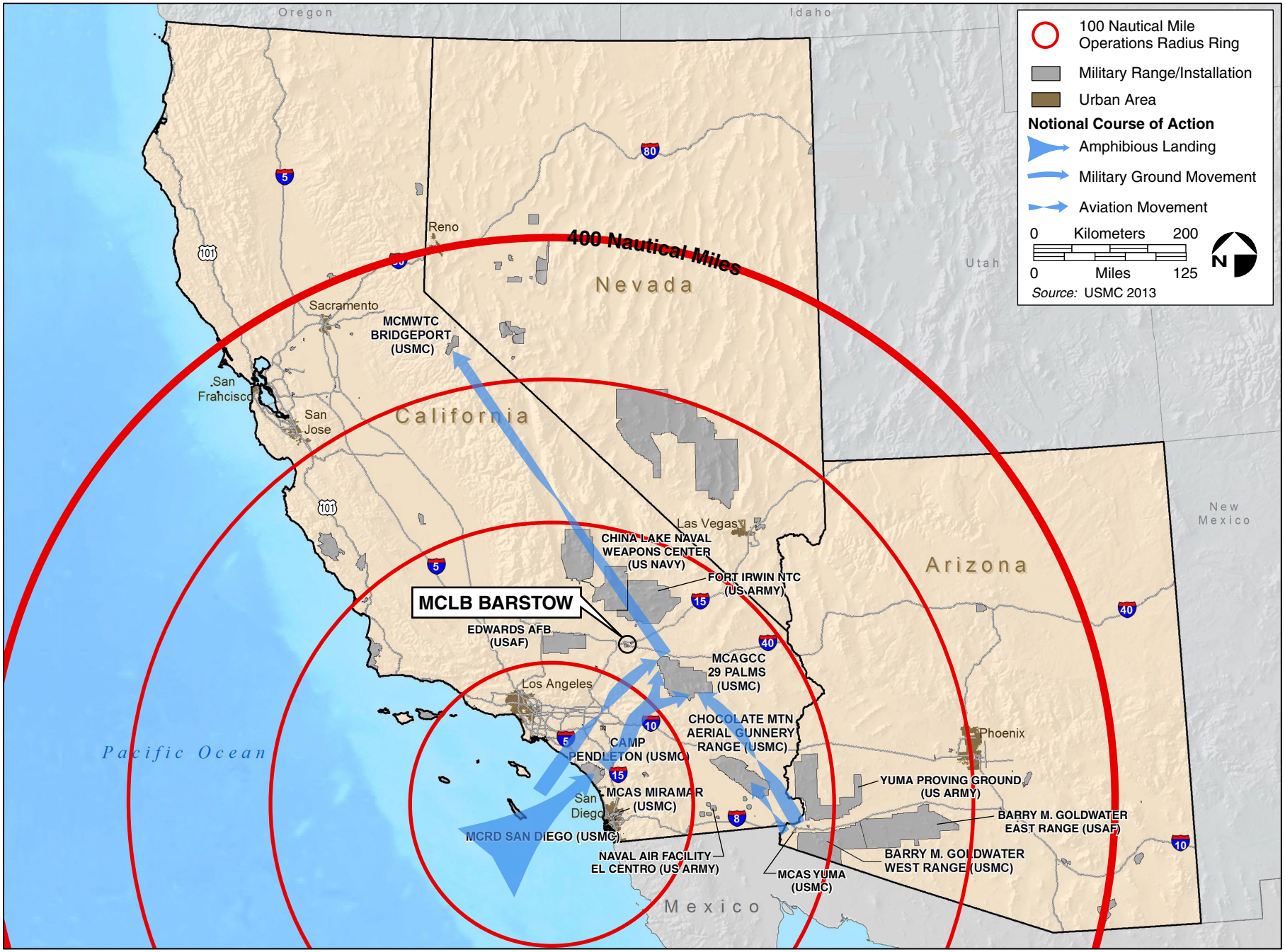

Figure 1.1-3. Large-Scale MAGTF Exercise

The key function and activity at MCLB Barstow is to receive, store, distribute, maintain, and repair military supplies and equipment and conduct training for mission-related and combat tasks. As one of only three logistics Bases operated by the USMC, MCLB Barstow serves an important role as a primary west coast Marine Corps Logistics and Maintenance Center. Its mission is twofold: to procure, maintain, store, and distribute supplies and equipment as needed and to repair and rebuild USMC and other DoD equipment. MCLB Barstow furnishes supplies for USMC facilities worldwide and is a direct support provider for all installations. Secondarily, MCLB Barstow is responsible for the technical training of Marines, including developing and maintaining their skills and job efficiency. Training at MCLB Barstow generally consists of annual marksmanship and tactical combat training. Existing training activities occur on a periodic basis based on training demands.

MCLB Barstow is separated into three primary (functional) use areas: one range area (a live-fire Known Distance [KD] Range Complex) and two cantonment areas (i.e., developed areas that support military training and operations) (Nebo Annex and Yermo Annex). The KD Range Complex is located southeast of the Nebo Annex and supports a small arms KD Rifle Range, a KD Pistol Range, a 100-yard shotgun range, and associated infrastructure. The KD Rifle Range is approximately 20 acres (8 hectares) and supports rifle marksmanship training. The KD Rifle Range includes 100-, 200-, 300-, 500-, and 600-yard firing lines with 30 firing positions at each firing line. A 1,000-yard firing line is located near the range entrance gate; this firing line is not currently active. A Range Safety Officer platform is located at the 200-, 300-, and 500-yard firing lines. The pit area includes a retaining wall, target storage building (Building 252), pit operations building (Building 254), temporary portable restroom, public address system, and a safety system. The KD Pistol Range is 0.3 acre (0.1 hectare) and supports pistol marksmanship training. The pistol range includes 7-, 10-, 15-, 25-, and 50-yard firing lines with a mechanized target system, concrete walkways, storage shed, and public address system. The 100-yard shotgun range is 0.9 acre (0.3 hectare) and supports live-firing training with pistols and shotguns. The 100-yard shotgun range includes 25- and 35-yard firing lines, a range office and classroom building (Building 249), shop building (Building 243), portable shed building, tables, and bleachers. When live-fire training is not occurring at the KD Range Complex, this training area supports ground activities such as land navigation, patrolling, and command/logistical support.

The Nebo Annex is located northwest of the Range Complex and functions as the MCLB Barstow headquarters. The Yermo Annex is located approximately 5 miles (8 kilometers) east of the Nebo Annex. The Yermo Annex is primarily a storage and industrial complex. The Yermo Annex is bounded by Interstate 15 (I-15) to the north and the Mojave River to the south. The Yermo Annex also supports U.S. Army deployments for National Training Center rotations with a railhead and temporary billeting for soldiers supporting these operations. A similar railhead is under development at the Nebo Annex under a separate Military Construction Program (MILCON) (Figure 1.1-2).

1.4 Purpose and Need for the Proposed Action

The purpose of the proposed action is to enhance and update operational capabilities at MCLB Barstow, thereby improving training and readiness opportunities and maximizing range use and throughput. The proposed action is needed because MCLB Barstow's existing industrial facilities and supporting infrastructure, open training lands, and live-fire ranges do not adequately accommodate combined ground and aviation training operations, support the ability for multiple units to conduct simultaneous training, or provide the flexibility to meet evolving USMC operational requirements. Furthermore, the proposed action is needed to ensure range maintenance and sustainment of MCLB Barstow's training ranges.

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There is one key need for the proposed action:

- *Proximity/Compatibility with Southwest Ranges and Air Stations*. A basic requirement of USMC and inter-service ground and aviation training is proximity and availability to USMC and sister service military Bases and air stations for fully exercising the spectrum of combat-ready forces' annual training requirements. Training at MCLB Barstow allows combat forces to distribute their training at sufficient distances from their home stations, and in the required operational context, so as to fully challenge their range of operational capabilities. While MCLB Barstow provides a unique training opportunity, it is nonetheless centralized and proximate to all regional USMC and sister service home stations, allowing ground vehicles, troop movements, and aircrews to spend a larger proportion of the limited flight time available for training on productive activities rather than en route to and from the training area.

Twelve years of operational experience by DoD forces, and more specifically the USMC, in both Iraq and Afghanistan demonstrates that MCLB Barstow is a needed synergistic component of regional training given its strategic physical location at the center of regional USMC and sister-service training facilities in the MCIWEST-MCB Camp Pendleton AO (Figure 1.1-1). MCLB Barstow provides land that is suitable for limited scope, MAGTF-level training and aviation unit-level training required to meet operating forces' training needs. MCLB Barstow's relatively open training lands, many industrial facilities, and three live-fire ranges provide a unique resemblance to key foreign, forward operating areas. The proposed action would update and enhance MCLB Barstow's existing training and readiness capability and capacity in accordance with the CMC's mandates in the *Marine Corps Vision and Strategy 2025* and *Expeditionary Force 21* (USMC 2014; USMC 2008) to support local and regional operational training requirements. Through a process of modernization, training facilities would be upgraded and training lands and live-fire ranges better utilized, maintained, and managed to support maximum throughput by increasing the capability of MCLB Barstow to support greater training opportunities. This would better integrate the MCLB Barstow training platform into the regional training strategy for USMC operating forces. To this end, MCLB Barstow would be able to increasingly accommodate the various components of MAGTF-level training events, including independent and combined air-ground operations.

Furthermore, the mixed industrial use areas that are suitable for applied Military Operations in Urban Terrain training, the previously disturbed open land, and existing ranges at MCLB Barstow provide unique ground and airspace to accommodate key aspects of regional I MEF readiness training, including but not limited to, command-and-control, dispersion, and maneuvers. Although other nearby military ranges within the MCIWEST-MCB Camp Pendleton AO (e.g., Marine Corps Air Ground Combat Center [MCAGCC] Twentynine Palms and Barry M. Goldwater Range West) are able to fulfill most mission requirements, these ranges often experience crowded training conditions, for both ground and airspace, as well as scheduling conflicts with fixed/rotary wing training and other advanced training exercises. These conflicts limit opportunities for the types of limited-scale MAGTF integrated ground and aviation training addressed in this EA. Therefore, enhancing training opportunities, areas, and ranges at MCLB Barstow to provide components of integrated regional I MEF training is consistent with historical and continuing activities at MCLB Barstow and, further, is critical to the quality, quantity, and variety of training for USMC units to maintain operational readiness.

1.5 Scope of Analysis

Resource areas analyzed in detail in this EA include the following: Airspace; Air Quality; Biological Resources; Cultural Resources; Land Use; Noise; Public Health and Safety; Transportation; Topography and Geology; Utilities and Infrastructure; and Water Resources.

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Some resource areas have not been carried forward for detailed analysis in this EA because potential impacts were determined to be nonexistent or negligible. Resources not analyzed further include environmental justice, public services, and socioeconomics.

Environmental Justice: The proposed action would not result in disproportionate impacts to minority and low-income populations and would not result in environmental health or safety risks to children. Therefore, no impacts on environmental justice would occur.

Public Services: There would be only temporary construction contractor-support personnel working at MCLB Barstow to perform the proposed construction activities. An inconsequential number of additional permanent military and/or government civilian employees would be working at MCLB Barstow as a result of the proposed action. Consequently, the proposed action would result in negligible long-term or temporary increases in public services (e.g., fire protection, police protection, health care services, and public schools). Therefore, no impacts on public services would occur.

Socioeconomics: Construction and maintenance of the proposed action would have no demonstrable long-term economic or socioeconomic effect on the surrounding communities. Construction activities would not attract a long-term worker population to the project vicinity or affect the need for housing in the area. It is expected that the crews required for construction activities would be comprised of local construction contractors and military and government civilian employees from the surrounding area. Therefore, no impacts on socioeconomics would occur.

1.6 Intergovernmental Coordination

This EA has been prepared in accordance with applicable federal regulations, instructions, and public laws, including but not limited to those identified in Appendix A. NEPA requires consideration of potential impacts to the environment in the decision-making process for federal actions. Council on Environmental Quality (CEQ) regulations represent the "action forcing" provisions of NEPA to ensure that federal agencies comply with NEPA. Marine Corps Order (MCO) P5090.2A, *Environmental Compliance and Protection Manual*, provides specific guidance for the Marine Corps in preparing environmental documentation for proposed actions subject to NEPA.

1.7 Public/Agency Participation

The Department of the Navy (Navy) will publish a Notice of Availability (NOA) in a local and/or regional news and information source (e.g., the *Barstow Desert Dispatch*). The Public Draft EA will be circulated for review and comment to government agencies, local organizations, the public, and other interested parties. The Draft EA can be downloaded from the USMC website at TBD. The Public Draft EA will be available for review and comment for 30 days. The Public Draft EA will also be available for review at the Barstow Branch Library. Public comments will be reviewed and appropriately incorporated into the Final EA. The Navy will announce the release of the Final EA by publishing an NOA in the above-listed information sources.

(Note to reviewers: Please provide the website where the public can review the Public Draft EA.)

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2 Description of Proposed Action and Alternatives

The proposed action would update operational capabilities of existing training areas and ranges on MCLB Barstow to support combat readiness of USMC operating forces, including tenant, unit, and Marine Air-, MAGTF-level training, for the I MEF. CEQ *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* establish a number of policies for federal agencies, including "using the NEPA process to identify and assess the reasonable alternatives to the proposed action that will avoid or minimize adverse effects of these actions on the quality of the human environment" (40 Code of Federal Regulations [CFR] 1500.2 [e]). This EA only carries forward for detailed analysis those alternatives that could meet the purpose and need for the proposed action as defined in Chapter 1, *Purpose and Need*, and the alternative screening factors listed in Section 2.1, *Reasonable Alternative Screening Factors*.

2.1 Reasonable Alternative Screening Factors

The following screening factors were used to develop the reasonable range of alternatives:

- An underutilized USMC property within the DoD Southwest Range Complex and MCIWEST-MCB Camp Pendleton AO;
- Sufficient ground and airspace to enhance existing training ranges and areas and establish landing zones (LZs), including a Simulated Flight Deck (Landing Helicopter Assault [LHA]/Landing Helicopter Dock [LHD]), to support components of MAGTF-level training activities; and
- Adequate airspace conditions (e.g., lack of air traffic congestion and airspace restrictions) to support flight operations by rotary wing and tilt-rotor aircraft.

Based on a review of available sites within the DoD Southwest Range Complex and MCIWEST-MCB Camp Pendleton AO, the USMC determined that MCLB Barstow represents an ideal location for the proposed action (refer to Section 2.4, *Alternatives Considered But Not Carried Forward for Detailed Analysis*, for more details).

2.2 History of MCLB Barstow

The Nebo Annex of MCLB Barstow was commissioned in 1942 as the Marine Corps Depot of Supplies and served as a staging area for supplies and equipment needed by armed forces deployed in the Pacific Region during World War II. After the war, MCLB Barstow grew in size and expanded the scope of its operations. Equipment that was damaged during the war was repaired, and new equipment was added. In 1946, the USMC acquired a nearby World War II U.S. Army post known as U.S. Army Quartermaster Depot at Yermo. Therefore, the Base was composed of two separate areas: the original location, known as the Nebo Annex, and the newly acquired Yermo Annex (Navy and MCLB Barstow 2011).

Throughout the Korean Conflict (1950 to 1953), the Base performed the same supply function as it did during World War II, with the addition of the new Yermo repair facility. During the conflict, the Base was able to enhance its capabilities, upgrading existing systems and adding new storage and housing projects. In 1955, the Base expanded to include a rifle range area south of the Nebo Annex along Highway 66.

From 1958 on, MCLB Barstow was responsible for all USMC logistics west of the Mississippi River, as well as the Pacific and Far East. During this time, MCLB Barstow constructed a repair facility building at Yermo (Building 573), which elevated the Base's level of support during the Vietnam War.

The Base changed names several times before becoming MCLB Barstow on 1 November 1978 (Navy and MCLB Barstow 2011).

In addition to general storage, distribution, and repair facilities, MCLB Barstow has historically supported and currently supports training ranges (MCLB Barstow 2014). Table 2.2-1 summarizes the 11 formerly active ranges and 5 active ranges and facilities associated with MCLB Barstow.

Table 2.2-1. MCLB Barstow Training Ranges

Range	Time Frame of Use	Description and Range Status
Nebo Annex		
Old Skeet and Trap Range	1954 to 1975	Consisted of one trap and two skeet positions. Currently undeveloped land near the industrial wastewater treatment ponds.
Small Arms Test Range (Building S-42)	1948 to 1961	Was used for testing rifles and pistols after they were repaired. Currently used for storage of flammable materials.
R.A. Wells Recreational Skeet Range	1980s to 1993	Built in the early 1980s to replace the Skeet and Trap Range. Currently undeveloped land.
Morale, Welfare, and Recreation Trap Range	1980s to 1993	Built in the early 1980s to replace the Skeet and Trap Range. Currently undeveloped land.
Magazine	1987 to present	This structure (S-367) is used for ammunition storage and consists of a masonry bunker surrounded by an earthen revetment.
KD Range Complex		
KD Rifle Range	1955 to present	Consists of target firing lines for a 30-target frontage at the 25-, 100-, 200-, 300-, 500-, 600-, and 1,000-yard firing lines. Currently used for rifle qualification.
KD Pistol Range	1955 to present	Consists of 12 target electro-pneumatic turning mechanism and firing points at the 7-, 10-, 15-, 25-, and 50-yard firing lines. Currently used for pistol qualification.
Close Combat Pistol Range (100-yard Shotgun Range)	1955 to present	Currently supports live-fire maneuver training with shotguns and pistols.
Tear Gas Training Facility	1955 to present	From 1995 to 2009, a trailer was used as a tear gas training facility for CBRN training. The trailer was subsequently removed and a tent was used for conducting CBRN training in approximately the same location (2010 to 2012). Recently, two ISO containers were welded together to form a new, temporary tear gas training facility.
Tire Target Area	1950s to 1980s	Consists of rubber tires embedded in the ground; was used for assault and demolition training. Currently remains idle.
Rifle Range Maneuver Area	1950s to 2000s	Was used as a maneuver area. Currently serves as a safety zone/non-dudded impact area for the KD Rifle and Pistol Ranges.
Yermo Annex		
Function Firing Room (Building 573)	1961 to 2005	An indoor range that was built to replace the Small Arms Test Range (Building S-42). The range consisted of a room with a water trap to contain bullets fired from machine guns and pistols. The room was removed in 2005 when operations were relocated off-site.
Function Firing Room (Building 616)	1998 to 2005	Constructed to provide function firing capabilities for rifles. Function firing ceased in 2005 when operations were relocated off-site.
Old Ammunition Storage Buildings	1950s to 1982	Buildings 430, 431, 432, and 433 were used for hazardous materials and flammable storage.
Formerly Used Defense Sites[1]		
Old West Ranges (rifle and pistol)	1949 to 1954	Rifle and pistol ranges that were closed when the adjacent land use became residential. Majority of site currently used as a quarry.
North Nebo Maneuver Area	1950s to 2000s	Historically used for maneuvers. Currently remains undeveloped.

Notes: [1] Formerly Used Defense Sites are defined as a facility or site (property) that was owned by, leased to, or otherwise possessed by the DoD at the time of actions leading to contamination by hazardous substances.
CBRN = Chemical, Biological, Radiological, and Nuclear; ISO = International Organization for Standardization; KD = Known Distance; and MCLB = Marine Corps Logistics Base.
Source: MCLB Barstow 2014.

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2.3 Description of Proposed Action and Alternatives

2.3.1 Alternative 1

Alternative 1 would enhance and update operational capabilities of existing training ranges and areas, including establishing general aviation areas and designating rotary wing/tilt-rotor LZs and an LHA/LHD site to accommodate components of regional MAGTF training activities on approximately 1,306 acres (528 hectares) on MCLB Barstow (Figure 2.3-1). All ground and aviation training activities would occur on land managed by the USMC within general aviation, unrestricted (Class G) airspace. Training operations would be consistent with existing airspace conditions and no new military requirement for restricted airspace would be required.

Proposed training would primarily be conducted by the following I MEF combat elements:

- *1st Marine Division (Ground Combat Element)*. The mission of the 1st Marine Division is to function as the Ground Combat Element of I MEF. It also provides task-organized forces for assault operations and such operations as may be directed. The 1st Marine Division must be able to provide the ground and helicopter-borne, over-the-horizon, amphibious forcible entry capability to the naval expeditionary force, and to conduct subsequent land operations in any environment;
- *3rd MAW (Aviation Combat Element)*. The mission of the 3rd MAW is to provide combat-ready, expeditionary aviation forces capable of short-notice, worldwide deployment to MAGTF, fleet, and unified commanders. The 3rd MAW currently operates 19 squadrons (about 330 aircraft) of rotary wing and tilt-rotor aircraft under two Marine Aircraft Groups (MAGs), including MAG 16 stationed at Marine Corps Air Station (MCAS) Miramar and MAG 39 stationed at MCAS Camp Pendleton; and
- *1st Marine Logistics Group (Logistics Combat Element)*. The mission of the 1st Marine Logistics Group is to provide direct support to the MEF Ground Combat Element and sustained tactical logistics to each element of the MEF in the functional areas of logistics. For example, the 1st Marine Logistics Group can establish beach support areas, LZ support areas, Combat Service Support areas, and Force Combat Service Support areas consistent with the level of operations to ensure responsive, timely support for the sustainment of the MEF.

2.3.1.1 Training Areas

The enhanced training ranges would provide range management delineations for mostly undeveloped land that has sufficient area to accommodate integrated tactical training and maneuvers for independent and combined ground and aviation training. In addition, updating the operational capabilities of these existing training areas would ensure range maintenance and sustainment of MCLB Barstow's training ranges located within the Range Complex and Yermo Annex. Proposed training activities would occur on the Range West training area, Range East and KD Range Complex training area, Range Main Supply Route training area, and Yermo Stables training area (Figure 2.3-1).

Range West Training Area

The Range West training area is located on the western portion of the Range Complex and consists of approximately 301 acres (122 hectares) (Figure 2.3-2). The proposed LHA/LHD site would support day and nighttime aircraft operations and would be located within the southern portion of Range West. The LHA/LHD site would be a high-intensity training area (i.e., Pre-Designated Range Training Area), with less intensive training operations occurring in more remote areas of the training area.

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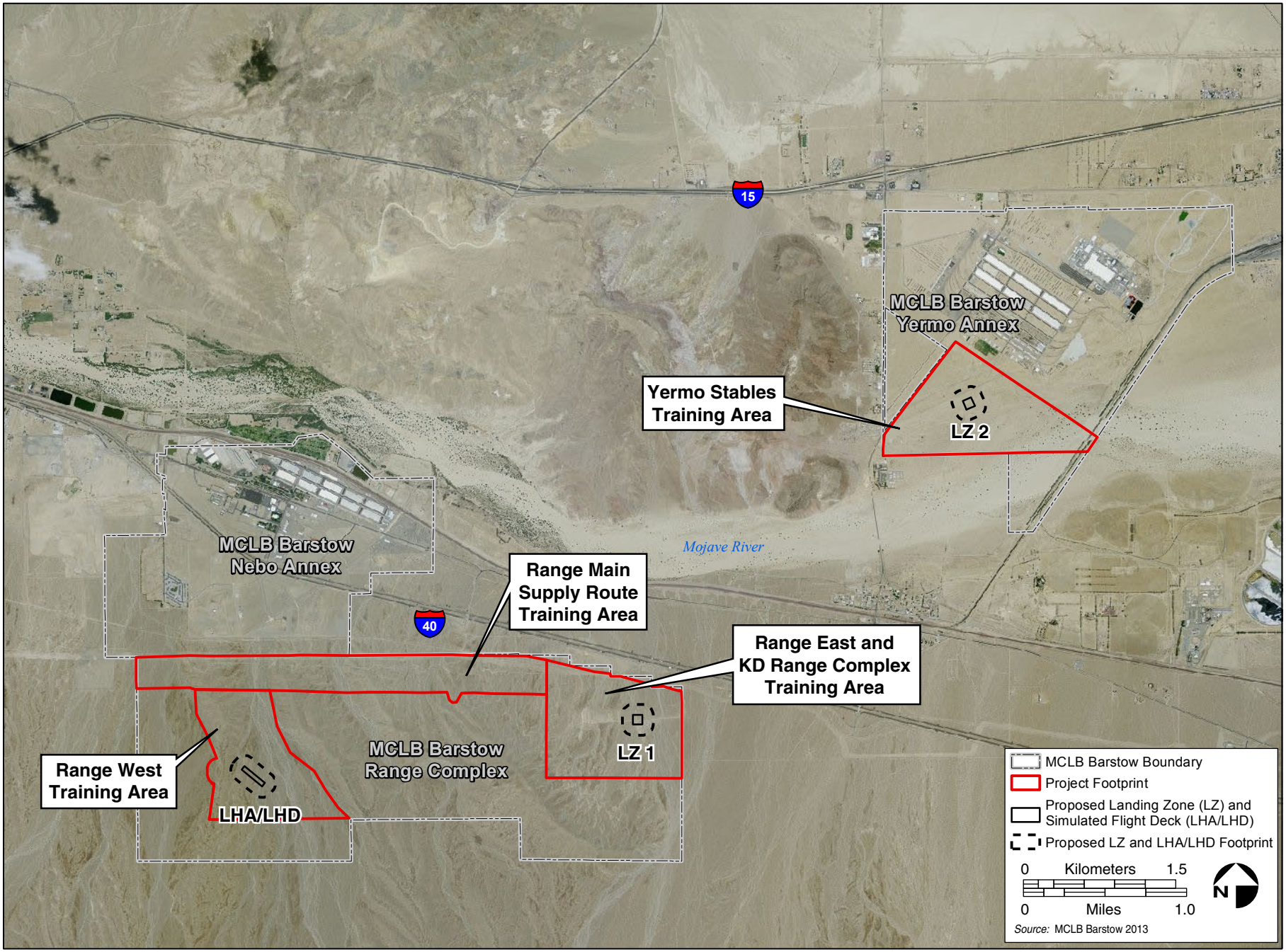

Figure 2.3-1. Project Location

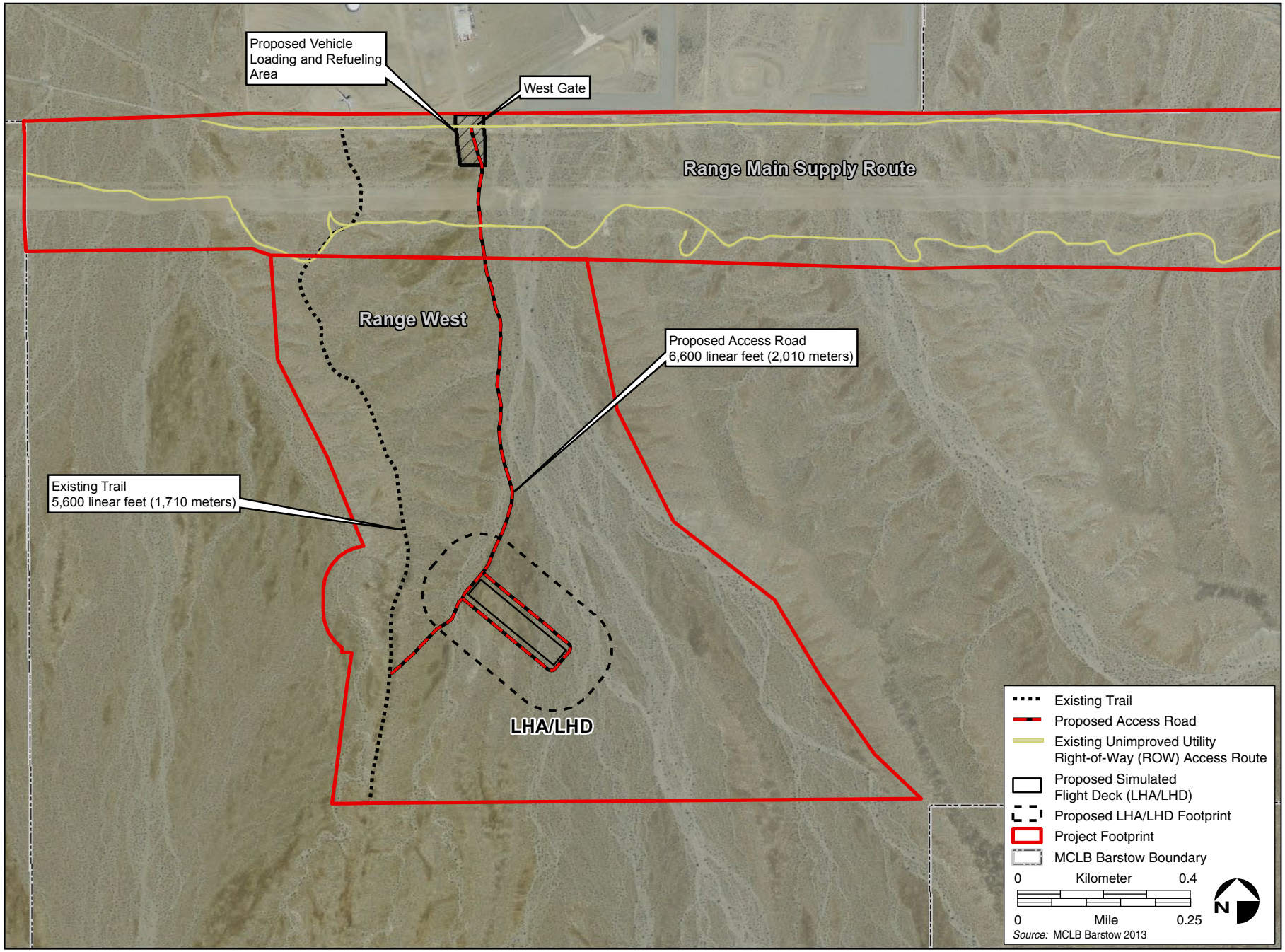

Figure 2.3-2. Range West Training Area

The LHA/LHD would be constructed as a landing platform that would resemble an amphibious assault ship deck. A superstructure with a maximum design footprint of 40 feet by 48 feet (12.2 meters by 14.6 meters) and approximately 29 feet (8.8 meters) high could be constructed on the LHA/LHD landing platform. The LHA/LHD superstructure would be a temporary modular structure (e.g., CONNEX boxes and/or standard shipping containers) used to simulate confined aerial landing. Temporary tactical bivouac sites could be established at the LHA/LHD site (i.e., vehicles would park with camo nets). Training activities at the LHA/LHD site would include the use of blanks, CSM grenades, and pyrotechnics.

The LHA/LHD landing platform conceptual design includes infiltration trenches and sedimentation or detention basins downstream of the site to prevent concentrated off-site runoff. An earthen levee would be installed upstream of the LHA/LHD site at the west bank of the floodplain and connect to the outer edge of the LHA/LHD landing platform (Figure 2.3-3). The levee would protect the LHA/LHD site by rerouting flow of the small channel on the western edge toward the main channel in the center of the floodplain. Approximately 17,300 cubic yards (13,227 cubic meters) of soil (fill) would be required to construct the LHA/LHD landing platform (Figure 2.3-3). The fill would be required to elevate the LHA/LHD landing platform above the floodplain and limit the change in topography on the southeastern edge of the landing platform for approaching aircraft. The fill could be excavated on-site from the two ridges south of the LHA/LHD landing platform. Temporary stockpile areas for soil would be located within the LHA/LHD footprint.

The LHA/LHD site would support forward arming and refueling point (FARP) operations. FARP operations would establish a designated area to support ground and aviation units. The FARP site would provide logistical operations including refueling unit vehicles and/or aircraft, ordnance distribution, distribution of supplies, and maintenance of weapons/equipment. Local security training would be conducted with foot mobile patrols throughout the general area and mounted patrols along established roads/trails. Equipment and personnel drop zones would be designated in close proximity to the FARP site to support aerial resupply scenarios. The FARP site would be occupied, activated, and operate aircraft and/or ground sustainment functions for approximately 10 days and then all aircraft and ground personnel would be re-deployed.

The Range West training area would support tactical logistics sustainment training, such as command/logistics post exercises, reconnaissance, selection and occupation of position (RSOP) operations, refueling operations, field ammunition supply point (FASP), and vehicle/equipment maintenance activities. Field engineering units would use Range West to conduct survivability, counter mobility, and mobility training that would include setting up and taking down berms and concertina wire, sand bagging, and trenching to dig fighting positions. This area would also be used for Chemical, Biological, Radiological, and Nuclear (CBRN) and personnel and equipment decontamination training. Additionally, Range West would support aircraft training, including aerial delivery of personnel and equipment, training with hand-launched unmanned aerial systems (UAS) (Group 1 UAS), and tactical dispersed landings of rotary wing and tilt-rotor aircraft throughout the general area.

Range East and KD Range Complex Training Area

The Range East and KD Range Complex training area is located on the eastern portion of the Range Complex and consists of approximately 333 acres (135 hectares). This training area would be a Pre-Designated Range Training Area. The KD Range Complex (i.e., KD Rifle Range, KD Pistol Range, and 100-yard shotgun range) would be the most intensive development area within the project footprint (Figures 2.3-4 and 2.3-5). A stabilized LZ (LZ 1) would be located north of the 500- and 600-yard firing line berms and would support troop transport to the KD Range Complex.

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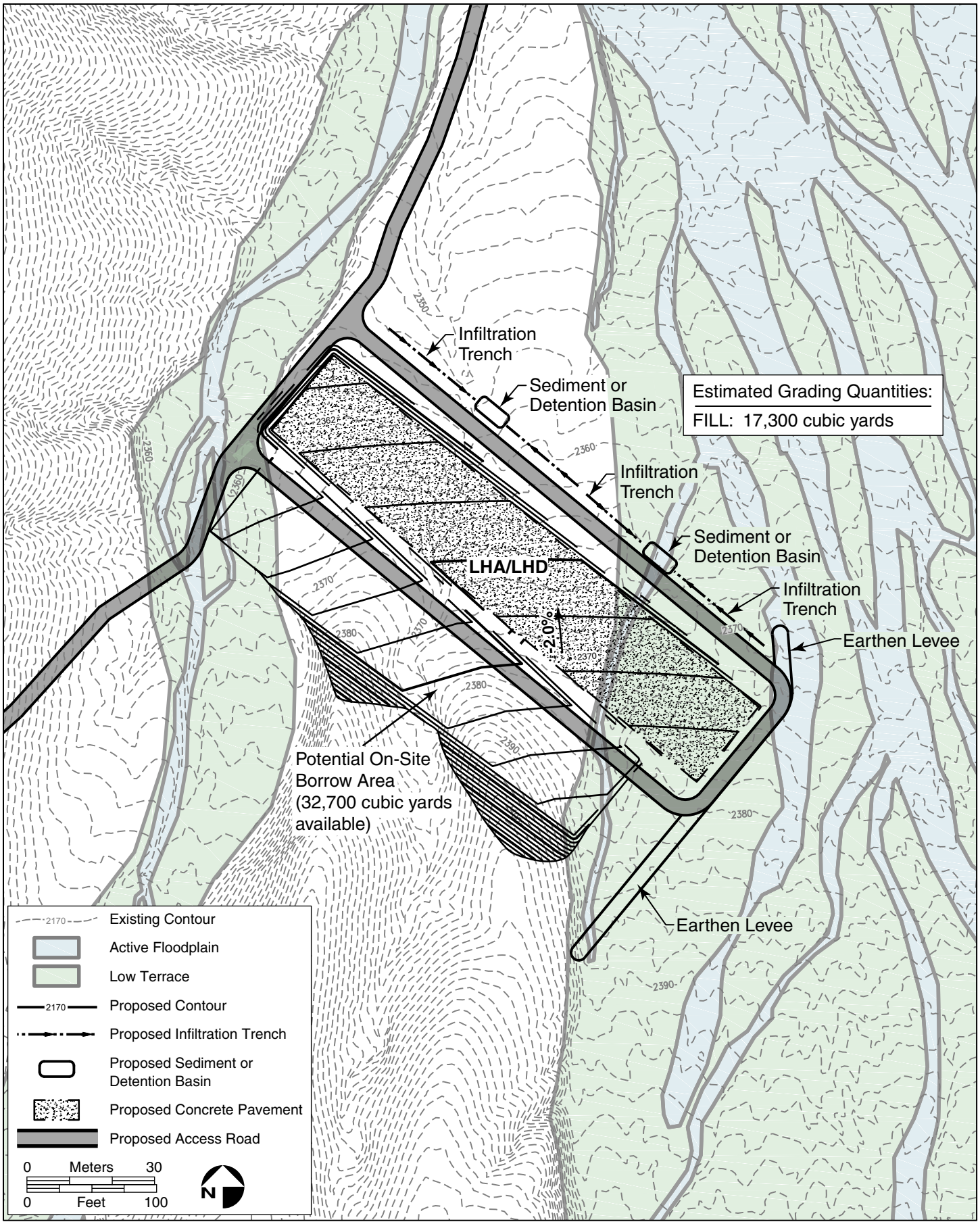

Figure 2.3-3. LHA/LHD Conceptual Site and Grading Plan

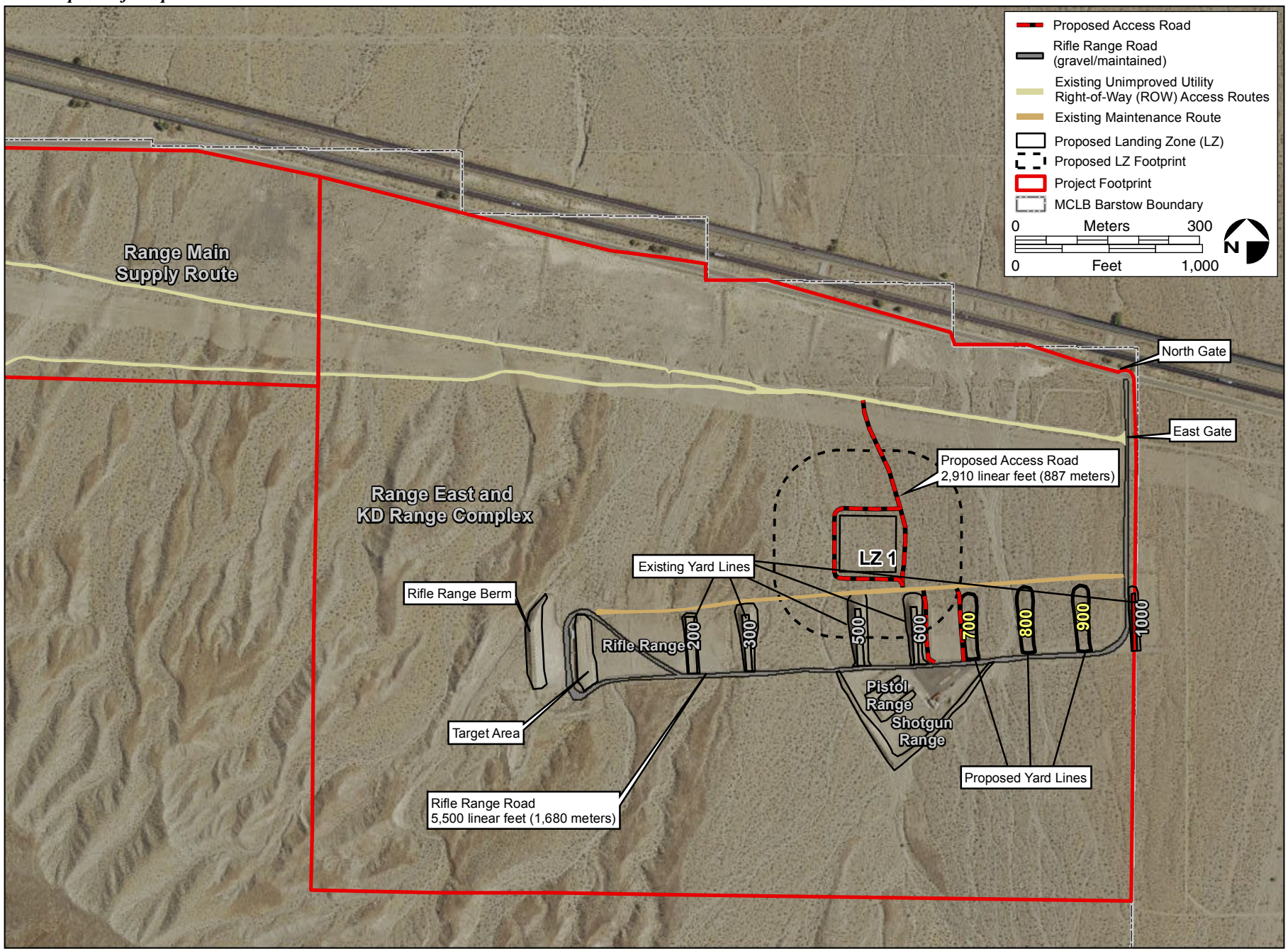

Figure 2.3-4. Range East and KD Range Complex Training Area

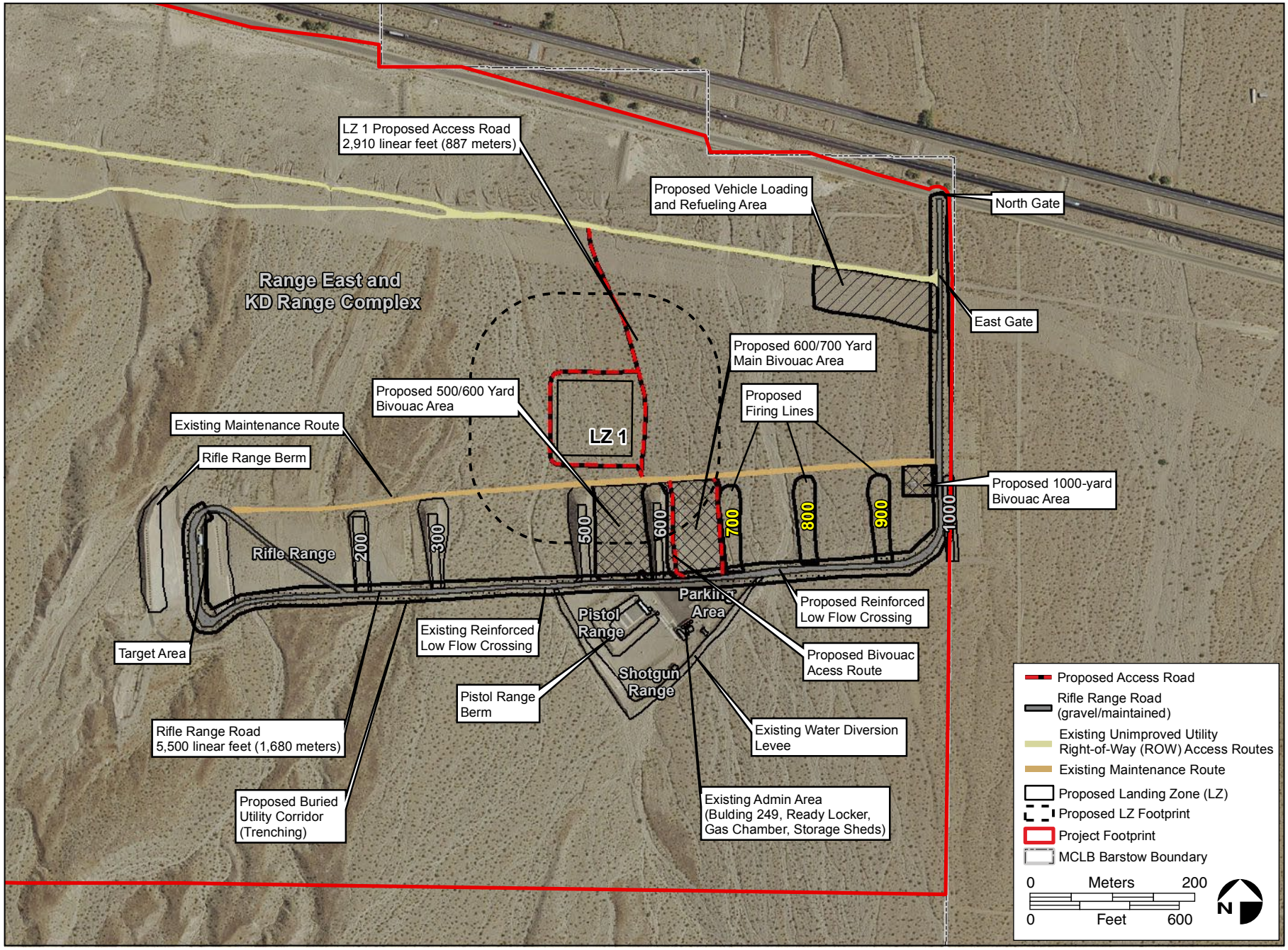

Figure 2.3-5. KD Range Complex Conceptual Site Layout

Approximately 4,730 cubic yards (3,616 cubic meters) of soil (cut and fill) would be required to construct LZ 1. All cut/fill would be balanced on-site and obtained from areas within the LZ 1 footprint (Figure 2.3-6). Temporary stockpile areas for soil would be located within the LZ 1 footprint. New access roads would be provided from LZ 1 to the KD Range Complex administration area and to the Range Main Supply Route (Figure 2.3-4). A tactical ground and aviation refueling area would be established north of the 600-/700-yard firing line bivouac site within the LZ 1 footprint. A designated vehicle loading and refueling area would be located near the East Gate entrance of the KD Range Complex (Figure 2.3-5).

Under Alternative 1, individual and smaller-scale, unit-level training would continue at the KD Range Complex to support live-fire marksmanship training with small arms. Rifle marksmanship training and sniper rifle proficiency training would occur at the KD Rifle Range and include training from the 200-, 300-, 500-, and 600-yard firing lines; sniper rifle proficiency training would also occur at the 1,000-yard firing line. Alternative 1 would also include a new 700-, 800-, and 900-yard firing line at the KD Rifle Range to provide more advanced training requirements for sniper team training (Figure 2.3-4). Pistol marksmanship training would occur at the KD Pistol Range from the 7-, 15-, 25-, and 50-yard firing lines. Shotgun training would occur at the 100-yard shotgun range. Alternative 1 would also modernize/upgrade the KD Rifle Range and 100-yard shotgun range to include mechanized targets, concrete walkways, and gravel fill. A shade structure and bleachers (i.e., covered classroom bleachers) would be installed adjacent to the KD Pistol Range and 100-yard shotgun range, east of the 600-yard firing line.

Approximately 33,800 cubic yards (25,842 cubic meters) of soil (import fill) would be required to construct the proposed 700-, 800-, and 900-yard firing lines at the KD Rifle Range. Imported soil would be obtained from quarry sites in the project region (e.g., Victorville and Apple Valley). All imported soil would be certified clean material or clean tested soil. Soil would be temporarily stockpiled within previously disturbed areas in the KD Range Complex (e.g., parking area.)

The KD Range Complex would be used by the USMC, MCLB Barstow police department, and other authorized users for qualification training and other authorized uses consistent with MCO P3550.10, *Policies and Procedures for Range and Training Area (RTA) Management*, and MCO 3570.2. Units conducting live-fire marksmanship training at the KD Range Complex would preclude concurrent use of the other training areas within the Range Complex, including Range East, Range West, and Range Main Supply Route. However, when the KD Rifle Range, KD Pistol Range, and 100-yard shotgun range are not active, the Range East and KD Range Complex training area would support various components of individual, unit, and MAGTF-level training.

A tear gas training facility would be constructed, maintained, and operated at the same location as the existing, temporary facility in the KD Range Complex administration area (Figure 2.3-5). The existing facility consists of two International Organization for Standardization (ISO) containers (8 feet by 20 feet [2.4 meters by 6.1 meters]) that are welded together. The existing facility would be demolished before construction of the new facility. The proposed tear gas training facility would be used for annual CS gas (i.e., tear gas) training that allows Marines to experience the effects of CS gas, a non-lethal, riot control agent. CS gas is also commonly used as a training agent for simulation of chemical warfare conditions and for testing of respirators. In accordance with MCO 3400.3G, *Chemical, Biological, Radiological and Nuclear Defense Training Requirement*, the proposed tear gas training facility would be designed and constructed to contain and filter CS gas because it would be within 3,280 feet (1,000 meters) of the Base boundary and 1,640 feet (500 meters) from proposed aircraft operations. MCLB Barstow safety personnel (or their appointed equivalent) would approve the facility.

The KD Range Complex would include three designated bivouac areas: at the 500-/600-yard firing line; 600-/700-yard firing line; and 1,000-yard firing line (Figure 2.3-4).

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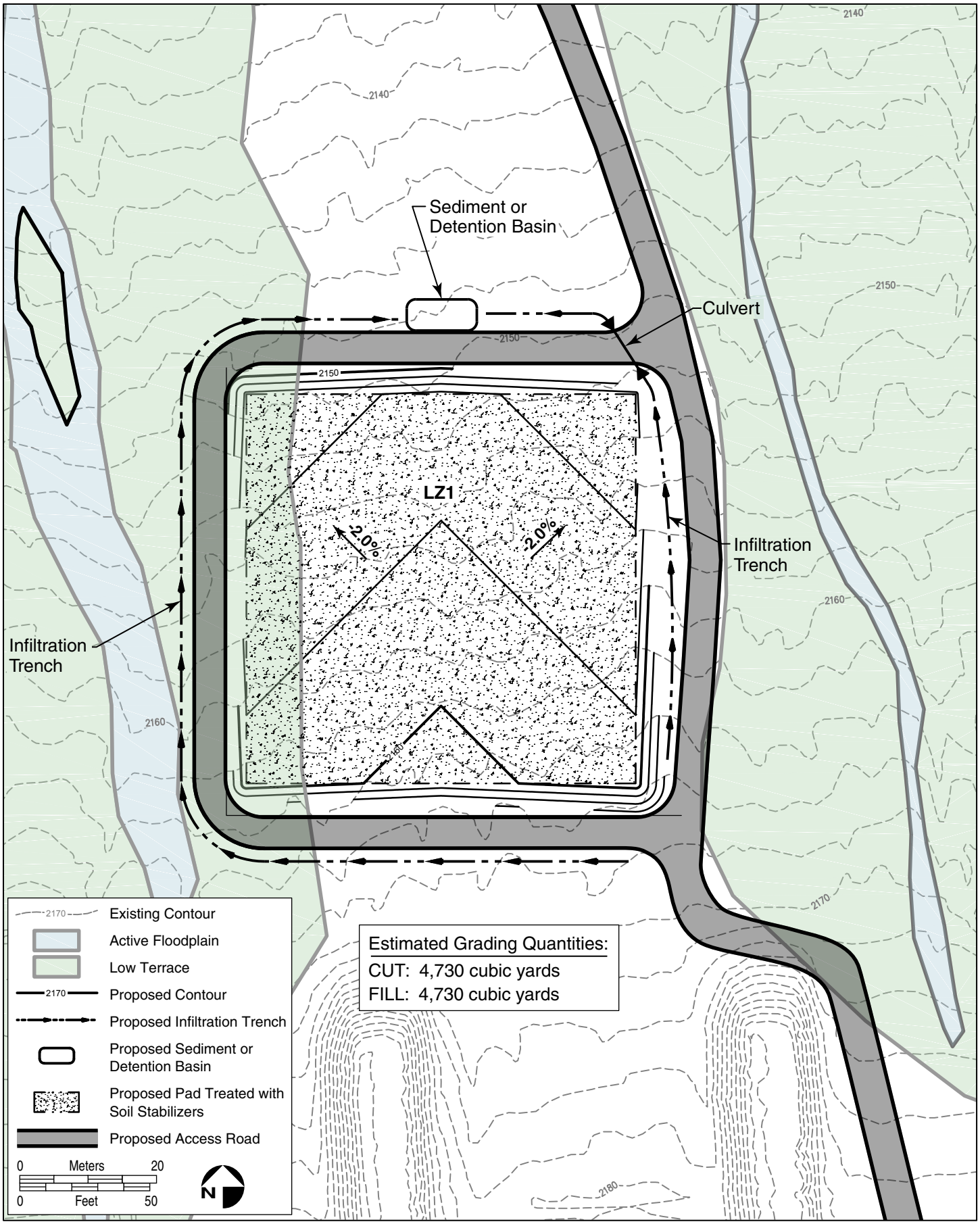

Figure 2.3-6. LZ 1 Conceptual Site and Grading Plan

These areas would be cleared of vegetation and graded. Bivouacking would include establishing a temporary encampment (administrative/support area) as the base of operations to support tactical training in the field. Bivouac operations would include erecting temporary tents or improvised shelters, portable toilets, showers, and laundry facilities, and vehicle/equipment maintenance sites. All greywater would be captured in secondary containment tanks and disposed of in accordance with federal, state, and local regulations. Portable toilets would be placed in secondary containment trays and serviced in accordance with applicable regulations. Primary access to these sites would be provided via the existing Rifle Range Road. However, two new access routes would be provided at the 600- and 700-yard firing lines from the existing range maintenance access route to the Rifle Range Road (Figure 2.3-5).

Alternative 1 would maintain, modernize, upgrade, and/or replace existing support facilities within the KD Range Complex administrative area (Figure 2.3-5). New buildings/structures would be constructed within the existing disturbance footprint. Alternative 1 would include the following: (1) the existing range office and classroom building (Building 249) would be replaced; (2) a new, permanent restroom facility would be constructed in the KD Range Complex administrative area; (3) existing portable toilets within the KD Range Complex would be upgraded (e.g., with dry pit toilets); (4) the existing ready locker would be replaced; (5) existing storage sheds would be upgraded and/or replaced; (6) the existing parking area would be improved and maintained; (7) a new, pressurized propane gas storage tank would be installed; and (8) existing trash bins would be modified (e.g., enclosed containers). In addition, current maintenance activities associated with the existing buildings and structures in the KD Range Complex administrative areas would continue under this alternative.

Range Main Supply Route Training Area

The Range Main Supply Route training area runs east–west along the northern boundary of the Range Complex and consists of approximately 345 acres (140 hectares) (Figure 2.3-7). The northern boundary of the Range Main Supply Route training area is the fence line that separates the Nebo Annex and the publicly accessible Interstate 40 (I-40) frontage road from the Range Complex.

The southern boundary of this training area encompasses the existing underground gas and overhead electrical public utility easement area. Two existing unimproved, four-wheel-drive (4-WD) utility right-of-way (ROW) access routes and numerous trails are located within this training area. The existing utility ROW access routes would provide access to the Range West and Range East and KD Range Complex training areas. These access routes would continue to be used by public utility personnel to conduct periodic inspections and maintenance activities.

Convoy operations would be conducted in the Range Main Supply Route training area to support tactical maneuvers (e.g., vehicle-mounted weapons coverage of dismounted personnel), including mounted and dismounted movements of approximately 40 personnel in 5 to 10 vehicles transiting along specified routes. Tactical sustainment training would also occur in this training area (e.g., refueling operations, RSOP, FASP, and vehicle/equipment maintenance). This area would also be used for CBRN training to allow personnel to experience the effects of CS gas as well as perform personnel and equipment decontamination training. Training activities would include the use of blanks, CS grenades, and pyrotechnics. A designated vehicle loading and refueling area would be located near the West Gate; this area would be graded and cleared of vegetation (Figure 2.3-7).

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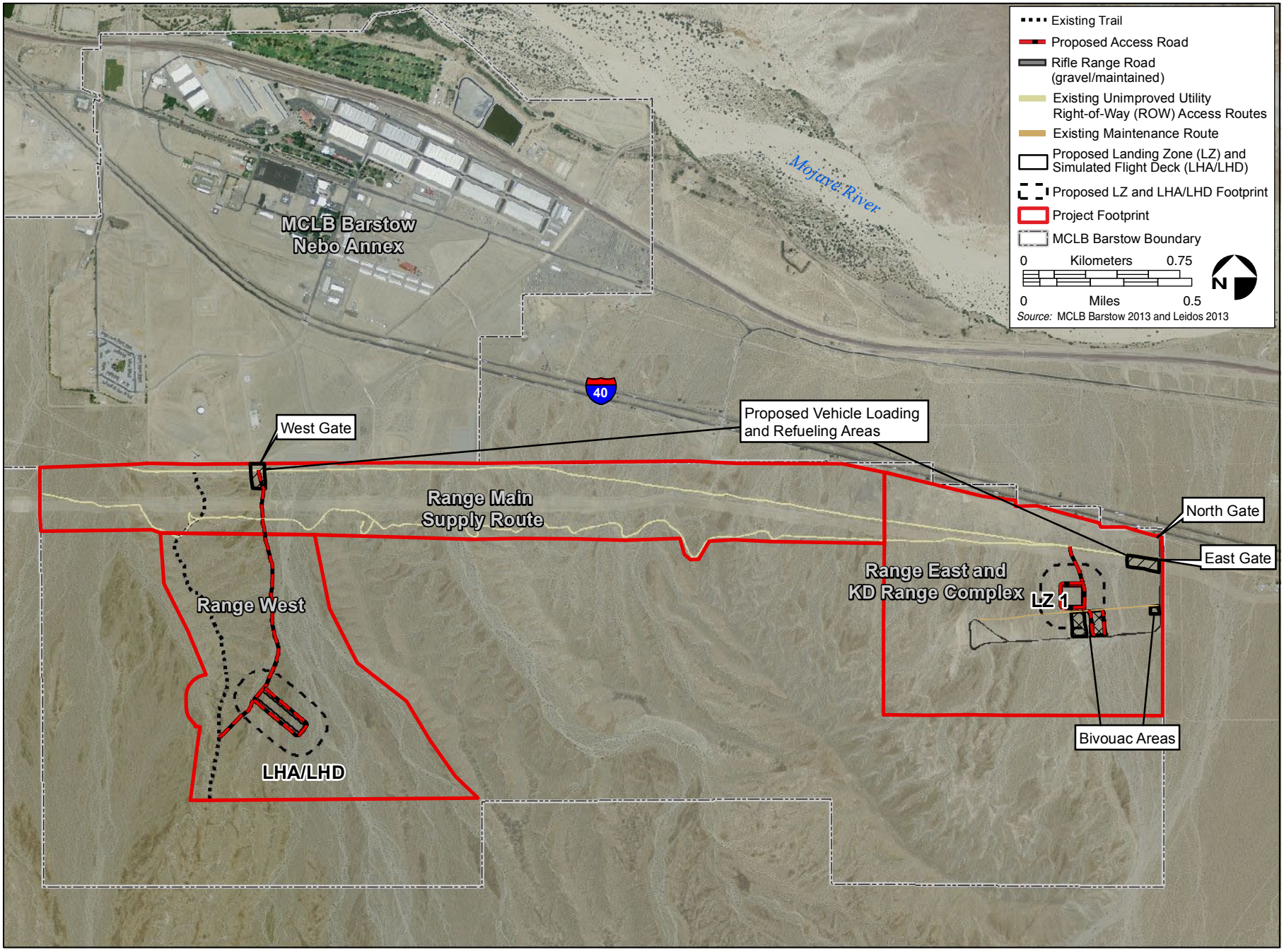

Figure 2.3-7. Range Main Supply Route Training Area

Yermo Stables Training Area

The Yermo Stables training area is located approximately 3 miles (4.8 kilometers) northeast of the Range Complex and consists of approximately 327 acres (132 hectares). This training area is located in a publicly accessible area south of the Yermo Annex fence line. The proposed LZ 2 site would be located within the Yermo Stables training area adjacent to the gravel test track (Figure 2.3-8). Two new access roads would be located on the east and west sides of LZ 2. The Yermo Stables training area would support a non-live-fire tactical training area for individual, unit, and MAGTF-level training. Training activities would include the use of blanks, CSM grenades, and pyrotechnics.

2.3.1.2 Training Operations

Alternative 1 would enhance and integrate independent and combined ground and aviation training on MCLB Barstow. Proposed training activities would be conducted in accordance with the requirements stipulated in the MCLB Barstow Regulations for Ranges and Training Areas and Airspace (Range Regulations) (MCB Order 3570.1). A description of the proposed training operations is provided in Table 2.3-1. Alternative 1 would result in a change in the level of operational activities within the project footprint. Up to four additional, permanent military and/or government civilian employees could be stationed at MCLB Barstow to support this alternative (e.g., range maintenance and sustainment activities).

Ground Training

Proposed training operations at MCLB Barstow would support the full spectrum of I MEF non-live-fire training elements. Depending on the specific mission, ground training could range from a single company commander conducting maneuvers with three infantry platoons to battalion or larger headquarters/command post training (300 personnel), with integrated air and logistics support. Ground guiding procedures would be implemented during vehicle operations to ensure personnel and equipment are maneuvered safely and to minimize impacts to environmentally sensitive resources. The training ranges and areas would be available for operations 24 hours per day and year-round. Table 2.3-2 summarizes the maximum annual tactical vehicle and support equipment usages that would occur from the proposed training operations at MCLB Barstow.

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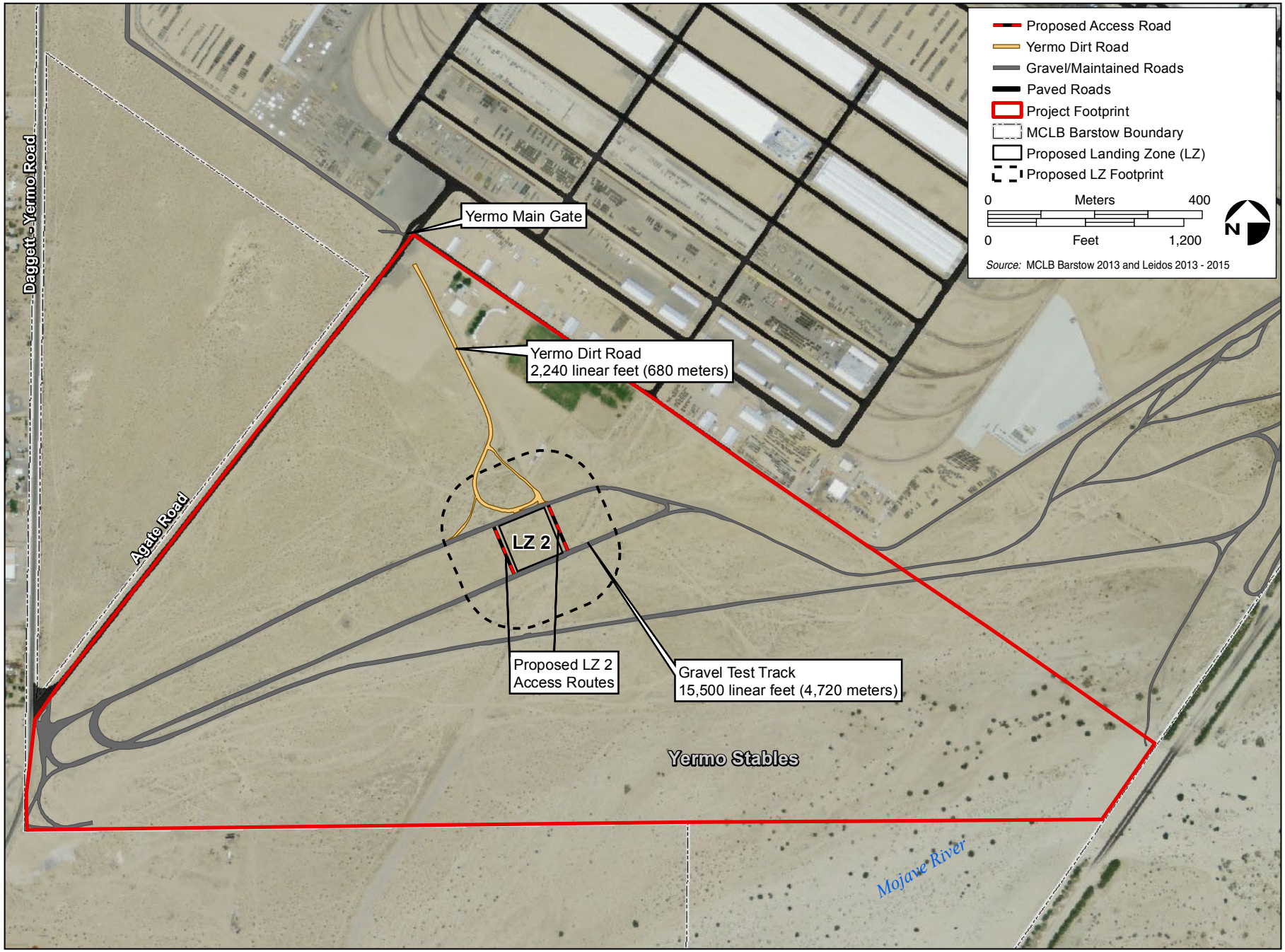

Figure 2.3-8. Yermo Stables Training Area

Table 2.3-1. Proposed Training Operations

Training Activity (Scale)	Location	Description
Ground Training		
Land Navigation (Individual/Aircrew-Level)	Range West, Range East, Range Main Supply Route, and Yermo Stables training areas	Land navigation includes traversing through unfamiliar terrain and using maps, compasses, and other navigational skills.
Patrolling and Local Security Training (Dismounted) (Unit-Level)	Range West, Range East and KD Range Complex, Range Main Supply Route, and Yermo Stables training areas	Patrolling and local security training would include dismounted personnel moving throughout the training areas in a variety of dispersed foot mobile formations to gather information and/or set up ambushes/raids. These activities would include the use of blanks, pyrotechnics for signaling and obscuration effects, battlefield effects simulators, MILES gear and/or SESAMS, and Group 1 UAS (i.e., small hand-held UAS).
Bivouacking (Unit-Level)	KD Range Complex (500-/600-yard firing line, 600-/700-yard firing line, and 1,000-yard firing line) and Yermo Stables training area	Bivouacking would include establishing a temporary encampment (administrative/support area) as a base of operations to support tactical training in the field.
Combat Conditioning/Hiking (Unit-Level)	Range West, Range East and KD Range Complex, Range Main Supply Route, and Yermo Stables training areas	Physical conditioning (strength building exercises/circuit training) and hiking would be conducted to build physical endurance. A safety vehicle would follow the units to provide support for these transitory foot mobile activities.
Command/Logistics Post Exercises (MAGTF and Unit-Level)	Range West and Yermo Stables training areas	Command/logistics post exercises would involve units occupying a tactically dispersed area as a command post. The command post/logistics post would be adjacent to an area that could be used as a landing area for re-supply, transport of personnel/equipment, and/or medical evacuation aircraft. Vehicles would utilize existing roads/trails to approach the command post site, dismount individual vehicle ground guides, and then units are led to their positions off the roads/trails. A remote radio transmitting site would be established and a series of cables would connect the main site with the remote radio transmitting site. Blanks, pyrotechnics for signaling and obscuration, simulated battlefield effects, SESAMS, and/or MILES gear would be used during training.
Field Engineering (MAGTF and Unit-Level)	Range West, Range East and KD Range Complex, Range Main Supply Route, and Yermo Stables training areas	Field engineering training includes combat and general engineering activities to support expeditionary operations. Training activities include breaching/constructing fortified positions, obstacles, and minefields; clearing and constructing road/trail obstructions; hardening fighting positions for personnel, weapons, and equipment; construction activities (tactical bridging); and utility services. Training equipment would include bucket loaders/back hoes, bull dozers, graders, dump trucks, cranes, and forklifts. Ground-disturbing activities would occur to establish berms, trenches, fighting positions, and tank ditches. Units would also conduct range sustainability projects, including road/trail construction and maintenance, LZ construction/maintenance, and other range upgrades and/or modernization.
Notes: All acronyms used in Table 2.3-1 are defined on the last page of the table.		

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Table 2.3-1. Proposed Training Operations (continued)

Training Activity (Scale)	Location	Description
CBRN Training (MAGTF and Unit-Level)	Range West, Range Main Supply Route, and Yermo Stables training areas	This training would include simulated CBRN attacks in the field using CS gas grenades and chemical agents. This training would include simulated mass casualties and ground or aerial medical evacuations, decontaminating personnel and equipment, and establishing decontamination stations (i.e., protective equipment gear removal areas, tactical shower tents, and vehicle/equipment wash-down areas). Potable water would be stored on-site in tactical water tankers and mobile electric generators would be used to operate pumps and heaters.
FARP Operations (MAGTF and Unit-Level)	Range West, Range Main Supply Route, and Yermo Stables training areas	FARP operations would establish a designated area to provide logistical support for ground and aviation units. The FARP site would provide logistical operations including refueling unit vehicles and/or aircraft, ordnance distribution, distribution of supplies, and maintenance of weapons/equipment. Equipment and personnel drop zones would be designated in close proximity to the FARP site to support aerial resupply scenarios.
RSOP Training (Unit-Level)	Range West, Range East and KD Range Complex, Range Main Supply Route, and Yermo Stables training areas	RSOP training would involve the tactical dispersion of personnel, weapons, and vehicles/equipment to occupy an area. Training activities would include units occupying an area, performing security sweeps, establishing a security perimeter, designating weapons and vehicle/equipment areas, and setting up temporary, remote communication assets. Non-live-fire activities associated with mobile artillery rocket systems would also occur. Ground-disturbing activities would occur to establish berms, trenches, fighting positions, and temporary structures/communication cables. Blanks, simulators, pyrotechnics, and tear gas could be used for local security training. Temporary, tactical LZs and drop zones would be established for aerial resupply and medical evacuation training scenarios.
Convoy Operations (Unit-Level)	Range Main Supply Route training area	Convoy training scenarios would include immediate action drills for blocked, unblocked, and IED-simulated attacks and simulated air attacks on the convoys. Simulated convoy attacks and immediate action drills would include the use of blanks and pyrotechnic simulators (e.g., grenades, artillery, and IEDs), pyrotechnic signaling devices (e.g., parachute flares), temporary obscurants (e.g., smoke grenades), MILES equipment, simulated munitions, and SESAMS.
Special Reconnaissance (MAGTF-Level)	Range West, Range East and KD Range Complex, Range Main Supply Route, and Yermo Stables training areas	Special reconnaissance missions would include conducting covert surveillance on targets, including observing activity patterns and gathering intelligence for reporting and subsequent operations. Temporary structures/buildings would be used to replicate a remote village/site. Special reconnaissance teams would be tactically inserted by foot, parachute, rotary wing/tilt-rotor aircraft, and/or ground vehicles along roads and/or trails.
Direct Action (MAGTF-Level)	Range West and Range East and KD Range Complex training areas	Direct action missions would include short-duration strikes and other small-scale offensive actions conducted as a special operation in a hostile environment. Direct action engagements would include dynamic entry techniques (e.g., grenades) followed by close-quarter battle training with small arms (e.g., blanks, MILES, or SESAMS only).
MEF-Directed Training Exercises (MAGTF-Level)	Range West, Range East and KD Range Complex, Range Main Supply Route, and Yermo Stables training areas	MEF-directed training exercises would involve multiple DoD installations throughout the MCIWEST-MCB Camp Pendleton AO. Training would include command, control, and logistical support of dispersed forces over an extended battlefield.

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Table 2.3-1. Proposed Training Operations (continued)

Training Activity (Scale)	Location	Description
KD Range Complex Training		
Rifle/Pistol/Shotgun Training (Live-Fire)1 (Individual/Aircrew-Level)	KD Rifle Range, KD Pistol Range, and 100-yard shotgun range	Live-fire training would include rifle and pistol marksmanship training, shotgun training, and sniper rifle proficiency training. Rifle marksmanship and sniper rifle proficiency training would occur at the KD Rifle Range from the 200-, 300-, 500-, 600-, 700-, 800-, 900-, and 1,000-yard firing lines. Pistol marksmanship training would occur at the KD Pistol Range from the 7-, 15-, 25-, and 50-yard firing lines. Shotgun training would occur at the 100-yard shotgun range.
Tear Gas Training (Individual/Aircrew-Level)	KD Range Complex Administrative Area	A new tear gas training facility would be constructed to support individual CBRN training requirements.
Aviation Training		
Rotary Wing/Tilt-rotor Aircrew Proficiency Training	Range West, Range East and KD Range Complex, Range Main Supply Route, and Yermo Stables training areas	Rotary wing/tilt-rotor aircraft aircrew proficiency training would include touch and go landings, training with external loads, general navigation/tactical training, and night vision goggle training.
UAS Training – Group 1 UAS	Range West training area	Group 1 UAS training would include the use of small, hand-held, remotely piloted aircraft. Training activities would not exceed flight altitudes of 1,500 feet (457 meters) AGL.
Parachute Operations (MAGTF and Unit-Level)	Range West training area	Parachute operations would involve the aerial deployment of personnel, equipment, and/or supplies using parachute techniques. Fixed wing aircraft may also be utilized in multiple overflights to deploy parachute personnel and/or equipment without landing. Parachute techniques would be conducted at altitudes of approximately 1,500 to 3,500 feet (457 to 1,067 meters) AGL. Rotary wing/tilt-rotor aircraft would conduct multiple cycles of parachute operations by landing, picking up personnel and/or equipment, taking off, returning to deploy personnel/equipment to the drop zone, and then landing again to pick up more personnel and/or equipment. Aerial delivery crews on the ground would load and transport equipment/supplies for delivery.
Special Insertion Techniques Training (MAGTF and Unit-Level)	Range West, Range East and KD Range Complex, Range Main Supply Route, and Yermo Stables training areas	Fast rope, rappel, and SPIE training would occur within the training areas. Fast roping includes a large-width rope that is suspended from a hovering rotary wing/tilt-rotor aircraft and personnel slide down the rope to the ground. Rappelling uses a smaller diameter rope that is suspended from a hovering aircraft and personnel use a suspension harness to hook-up to the rope and descend to the ground. Training would also involve aircraft hovering above the ground and deploying the SPIE rigging to personnel on the ground. Personnel would use a suspension harness to attach themselves to the SPIE rigging and would be suspended externally while the aircraft transits to another location.
TRAP (MAGTF and Unit-Level)	Range West training area	TRAP training would include searching and locating pilot(s)/crew at a simulated downed aircraft site. TRAP operations could include the use of blanks, pyrotechnics for signaling/obscuration, battlefield effects simulators, SESAMS, and MILES.
NEO (MAGTF-Level)	Range Main Supply Route and Yermo Stables training areas	NEO would involve deploying personnel to a simulated hostile diplomatic site to reinforce diplomatic security, secure non-combatant American citizens, and then evacuate them to a safe location. NEO training would include the use of blanks, pyrotechnics for signaling/obscuration, battlefield effects simulators, SESAMS, MILES, and non-lethal weapons.

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Table 2.3-1. Proposed Training Operations (continued)

Training Activity (Scale)	Location	Description
HA/DR (MAGTF-Level)	Range Main Supply Route and Yermo Stables training areas	Personnel would be transported to a simulated HA/DR site to evaluate the situation, provide logistics sustainment requests, and deliver supplies and/or medical support to the affected relief victims.

Notes: [1] Live-fire marksmanship training at the KD Range Complex precludes concurrent use of the other training areas within the Range Complex, including Range East, Range West, and the Range Main Supply Route.
AGL = above ground level; AO = Area of Operations; CBRN = Chemical, Biological, Radiological, and Nuclear; DoD = Department of Defense; FARP = Forward Area Refueling Point; HA/DR = Humanitarian Assistance/Disaster Relief; KD = Known Distance; LZ = Landing Zone; MAGTF = Marine Air-Ground Task Force; MCIWEST = Marine Corps Installations West; MCB = Marine Corps Base; MEF = Marine Expeditionary Force; MILES =Multiple Integrated Laser Engagement System; NEO = Non-Combatant Evacuation Operations; RSOP = Reconnaissance, Selection, and Occupation of Position; SESAMS = simulated-munitions; SPIE = special purpose insertion and extraction; TRAP = Tactical Recovery of Aircraft and Personnel; UAS = unmanned aerial systems.

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Table 2.3-2. Existing and Proposed Maximum Annual Tactical Vehicle and Support Equipment Usages

Vehicle/Equipment Type	Existing	Proposed
Tactical Vehicle Type	Annual VMT	
Abrams M1A1 Main Battle Tank	-	1,120
Assault Breacher Vehicle	-	160
High-Mobility Artillery Rocket System	-	864
High-Mobility Multipurpose Wheeled Vehicle	2,400	5,760
Internally Transportable Vehicle	-	5,760
Joint Assault Bridge	-	160
Light Armored Vehicle	430	1,920
Landing Vehicle Tracked	-	1,600
Logistics Vehicle System	-	2,880
M60A1 Bridge Vehicle	-	160
M88A2 Hercules Recovery Vehicle	-	160
Medium Tactical Vehicle Replacement	3,600	5,760
Total Annual VMT	6,430	26,304
Tactical Support Equipment Type	Annual Hours	
Armored Backhoe	-	896
Armored Tractor	-	896
D7 Bulldozer	-	896
Excavator, Combat	-	1,792
Extended Boom Forklift	-	896
Grader	-	896
Light-Capacity, Rough-Terrain Truck Forklift	-	896
Medium Crawler Tractor	-	896
Tractor, Rubber Tired, Articulated Steering	-	896
Total Annual Hours	0	8,960
Notes: MCLB = Marine Corps Logistics Base; VMT = Vehicle Miles Traveled.		

In most cases, individual and unit-level training for ground units would be mostly foot-mobile training or unit-level small arms training on the KD Range Complex that would include up to approximately 200 personnel and up to 4 administrative/logistics vehicles parked in static locations while that training is being conducted. This type of training would occur over a period of 210 days annually with no iteration exceeding 10 days.

In some cases, individuals and units may perform mission readiness training in an MAGTF-level training context, which would consist of a training unit configuration that would not exceed approximately 300 personnel. It would also include the use of 10 to 20 high-mobility, multipurpose wheeled vehicles; 10 to 20 medium tactical vehicle replacements; 8 to 10 logistics vehicle systems, 2 to 4 light forklifts (4,000-pound [1,814-kilogram]) and/or 2 to 4 heavy forklifts (10,000-pound [4,536-kilogram]); and 8 to 10 tactical mobile electric power generators. This type of training would occur at the Range West, Range East and KD Range Complex, Range Main Supply Route, and Yermo Stables training areas. These MAGTF-level training activities would entail movement along existing roads, access routes, and trails to occupy static locations to set up and perform command and/or logistical functions. This type of training would occur over a period of 60 days annually with no iteration exceeding 10 days.

On occasion, units may employ hand-held UAS (Group 1 UAS) as well as conduct parachute drops of up to 20 personnel anywhere within the project footprint where these routine training actions can be safely conducted. Additionally, there would be occasions where tactical refueling points and FASPs would need to be established for unit distribution. Equipment/vehicle maintenance and personnel/equipment decontamination training for CBRN warfare would be conducted at the Range West, Range Main Supply

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Route, and Yermo Stables training areas. CS gas grenades would be used for training within the Range West training area for tactical scenarios. Field engineering units would also use the training areas to conduct survivability, counter mobility, and mobility training that would include setting up and taking down berms and concertina wire, sand bagging, and trenching to dig fighting positions. All areas disturbed during ground training activities at the training areas would be restored by Marines to their original condition.

In conjunction with these MAGTF-level training activities, smaller sized units of up to approximately 200 personnel with 20 to 30 vehicles would be required to temporarily pass through MCLB Barstow. These temporary units would transit along established roads and trails at MCLB Barstow to receive administrative and/or logistical support from command/logistical support tactical elements in the field. These units would then immediately continue along the existing roads and trails, connect with off-Base roads and trails, and then continue to other locations outside of MCLB Barstow. All training activities would be conducted in accordance with Marine Corps Reference Publication 4-11.3F, *Convoy Operations Handbook*, which provides guidelines for the planning and execution of MAGTF convoy operations (USMC 2001). To the extent feasible, proposed training activities would be conducted in accordance with FHWA-HOP-05-029, *Coordinating Military Deployments on Roads and Highways: A Guide for State and Local Agencies* (FHWA 2005), which addresses military deployments and convoy operations on public roads.

Aviation Training

Proposed aviation training would add approximately 1,240 annual aircraft sorties (i.e., one arrival and departure or visit) and 3,868 operations (e.g., a touch and go or pad landing for rotary wing and tilt-rotor aircraft, or a flyover for any rotary wing, tilt-rotor, and fixed wing aircraft) at MCLB Barstow (Table 2.3-3). All aircraft operations within the project footprint would require prior authorization by MCLB Barstow Range Operations. Proposed aircraft operations could occur as part of MAGTF-level training operations or as standalone events. In general, standalone aviation training would occur at the designated LZs and LHA/LHD site. However, integrated MAGTF aviation training would generally occur at variable locations within the general aviation areas to facilitate pilot judgment and safety training/risk management. Rotary wing (helicopter) and tilt-rotor (MV-22) aircraft would conduct touch and go or pad landings, aircrew proficiency training with external loads, troop/equipment lift, aerial delivery of troops and equipment, cargo drops, fast-roping (e.g., personnel slide down a rope suspended from an aircraft to the ground), hover-holds (e.g., hovering above the ground), general navigation/tactical training, night vision goggle training, and terrain-flight (following the terrain). All aircraft training activities would occur within general aviation, non-restricted airspace (Federal Aviation Administration [FAA] Class G). No changes in airspace designations would be required to support proposed aircraft operations.

Tactical aircraft operations (e.g., stop and go landings) would occur on suitable landing areas within the project footprint. Approximately 438 annual tactical landings would occur in the project footprint (Table 2.3-4). Suitable landing areas include areas outside of active desert washes, with slopes less than 10 percent, and free of obstructions (i.e., not within 60 feet [18.3 meters] of buildings, fence lines, power lines, gas lines, and wind turbine). Approximately 44 percent (429 acres [174 hectares]) of the Range Complex and 78 percent (255 acres [103 hectares]) of the Yermo Stables training area support suitable landing areas. However, tactical aircraft operations would be limited in the Range Main Supply Route training area due to existing obstacles (i.e., existing utility lines and wind turbine).

Table 2.3-3. Existing and Proposed Annual Aircraft Sorties and Operations

Aircraft Type	Existing[1]		Proposed[1]	
	Sorties	Operations	Sorties	Operations
UH-1 and AH-1	-	-	96	348
MV-22	-	-	672	2,496
CH-53	-	-	192	732
UH-72	96	96	96	96
C-130	-	-	36	36
C-23	-	-	4	16
CH-47	-	-	72	72
UH-60	-	-	72	72
Total	96	96	1,240	3,868

Notes: [1]An aircraft sortie equates to one arrival and departure or visit to MCLB Barstow and an operation equates to one activity on Base (e.g., a touch and go or pad landing).
MCLB = Marine Corps Logistics Base.

Table 2.3-4. Proposed Annual Tactical Landings by Aircraft Type

Aircraft Type	Proposed Number of Tactical Landings (Stop and Go)
UH-1 and AH-1	40
MV-22	270
CH-53	78
UH-72	0
CH-47	25
UH-60	25
Total	438

Notes: MCLB = Marine Corps Logistics Base.

Aviation training could involve one or two rotary wing aircraft, but no more than one aircraft would land at an LZ or the LHA/LHD landing platform at a time. The general aviation areas and designated LZs and LHA/LHD site are expected to support operations of the various models of the following military helicopter and tilt-rotor aircraft: Super Stallion (CH-53); Huey (UH-1); Super Cobra (AH-1); Lakota (UH-72); Chinook (CH-47); Black Hawk (UH-60); and Osprey (MV-22). Parachute operations may also employ fixed wing aircraft such as the Hercules (C-130) and or Sherpa (C-23).

Flight activities would be conducted in conformance with FAA-mandated restrictions and in accordance with military aviation operations guidance. Pilots are restricted from landing within U.S. Fish and Wildlife Service (USFWS)-designated critical habitat. All aircraft would also operate in accordance with their corresponding training manuals, which identify measures and limitations on how a particular aircraft is flown.

Landing Zones

Three new aircraft landing areas – two proposed LZs and an LHA/LHD – and access routes/trails and roads to these landing areas would be established to support aviation training operations. The designated LZs would consist of an approximately 300-foot by 300-foot (91-meter by 91-meter) (i.e., 90,000-square-foot [8,361-square-meter]) landing area (i.e., where the aircraft would physically land). The proposed LZs would be graded, leveled, and stabilized (e.g., application of dust palliatives [e.g., polymer emulsion or synthetic fluid], Soiltac, or rhino snot) to reduce impacts from dust and debris. Soil stabilizers would be

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periodically maintained. The LHA/LHD landing platform would be approximately 850 feet by 150 feet (259 meters by 46 meters) and would resemble an amphibious assault ship deck. The total construction area for the LHA/LHD site would be approximately 300 feet by 1,000 feet (91 meters by 305 meters), which includes all laydown/staging areas. A footprint would be established around the LZs and LHA/LHD landing platform to account for areas disturbed by aircraft rotor wash, grading/vegetation clearing, construction, and operations (training and range maintenance and sustainment activities).

Transit Routes

The majority of aircraft utilizing the general aviation areas and designated LZs and LHA/LHD site would originate from MCAS Camp Pendleton and MCAS Miramar. Aircraft would fly along military transit routes (MTRs) and/or normal departure routes from an airfield and then along established routes to reach general aviation areas and designated landing areas. While transitioning to the general aviation areas from an airfield, rotary wing aircraft usually would fly between 1,000 to 2,000 feet (305 to 610 meters) above ground level (AGL), while the tilt-rotor aircraft usually would fly between 8,000 to 12,000 feet (2,438 to 3,658 meters) AGL.

The primary users would include MAG-16 based at MCAS Miramar and MAG-39 based at MCAS Camp Pendleton. Other users would include rotary wing/tilt-rotor 2nd MAW and 4th MAW squadrons based at MCAGCC Twentynine Palms Strategic Expeditionary Landing Field, California Air National Guard troops/squadrons from Barstow-Daggett Airport, Navy helicopter squadrons based in San Diego, California, and regional U.S. Air Force helicopter squadrons.

2.3.1.3 Training Use Categories

The project footprint would be separated into three training use categories: high-intensity training areas (Category 1); moderate-intensity training areas (Category 2); and low-intensity training areas (Category 3) (Figures 2.3-9 and 2.3-10). Limited vehicle access for emergency range maintenance and sustainment activities could occur in all training use categories within the project footprint.

High-Intensity Training Area – Category 1 (Pre-Designated Range Training Area)

Approximatively 330 acres (134 hectares) of the project footprint would be designated as high-intensity training areas (Category 1). Training operations in these areas would support mobility, counter-mobility, and survivability activities that include breaching/constructing fortified positions, obstacles, and minefields; clearing and constructing road/trail obstructions; construction activities (tactical bridging); refueling unit vehicles and/or aircraft; vehicle/equipment maintenance; and establishing personnel and equipment decontamination areas (i.e., protective equipment gear removal areas, tactical shower tents, and vehicle/equipment wash-down areas). These areas would also be used for CBRN and personnel and equipment decontamination training. Ground-disturbing activities would occur to establish berms, trenches, fighting positions, and tank ditches. These areas would also include designated bivouac areas that would be cleared of vegetation and graded. These areas would support aircraft operations at the designated LZs, LHA/LHD site, and general aviation areas to facilitate pilot judgment and safety training/risk management. Pre-designated Range Training Areas are also designated50 feet (15 meters) from the centerline of existing access routes/trails and proposed access roads.

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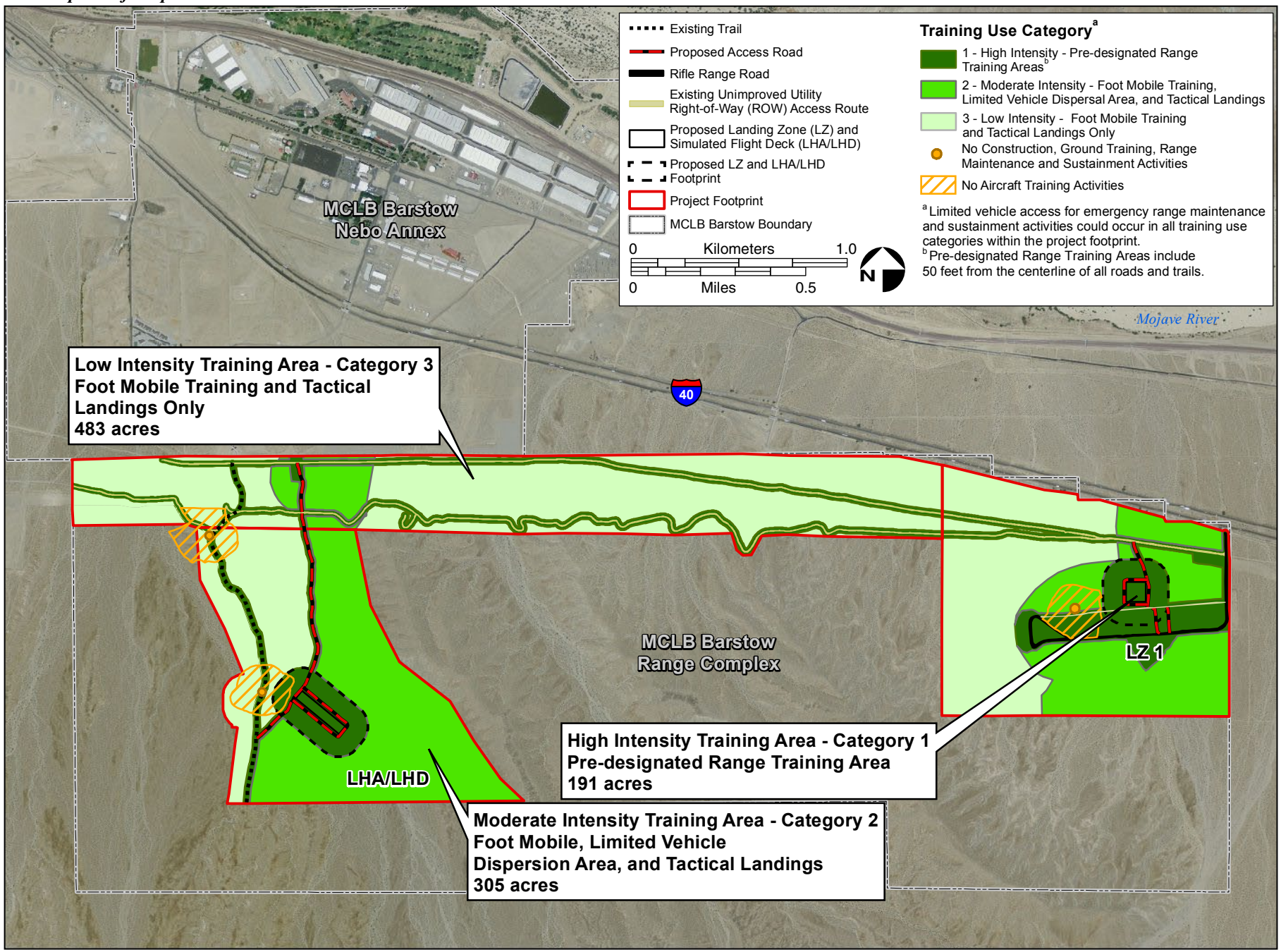

Figure 2.3-9. Range Complex - Training Use Categories

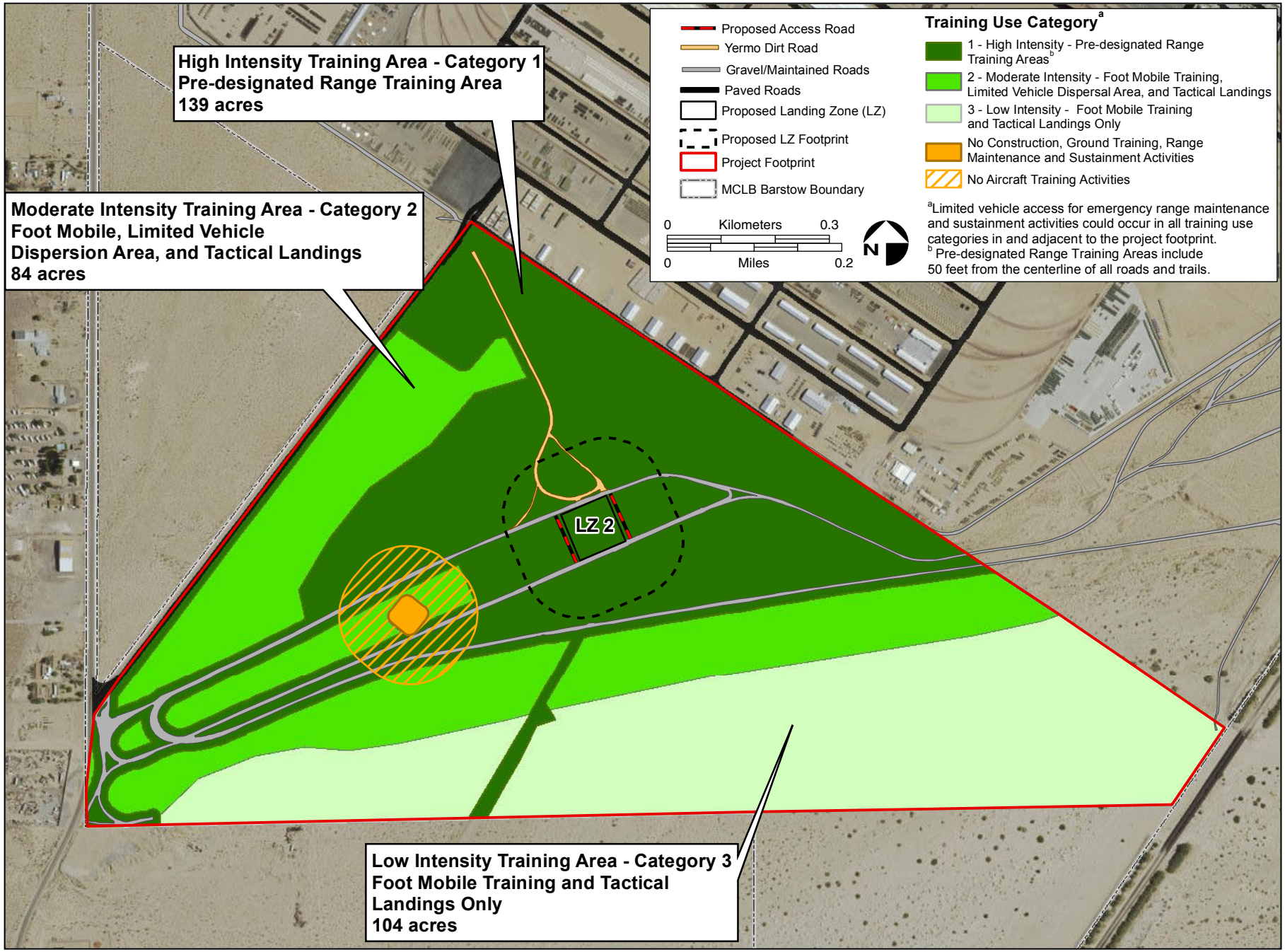

Figure 2.3-10. Yermo Stables Training Area - Training Use Categories

Moderate-Intensity Training Area – Category 2 (Foot Mobile, Limited Vehicle Dispersion Area, and Tactical Landings)

Approximatively 389 acres (157 hectares) of the project footprint would be designated as moderate-intensity training areas (Category 2). Training activities in these areas would include command/logistics post exercises, performing security sweeps, establishing a security perimeter, setting up and taking down berms and concertina wire, sand bagging, setting up temporary, remote communication assets, establishing entry control points, conducting local security patrols, and hardening fighting positions for personnel, weapons, and equipment. Ground-disturbing activities would occur to establish berms, trenches, fighting positions, and temporary structures/communication cables. Limited motorized vehicle activity would occur within these areas to support training operations. Tactical aircraft operations (e.g., stop and go landings) would occur within the moderate-intensity training areas.

Low-Intensity Training Area – Category 3 (Foot Mobile Training and Tactical Landings Only)

Approximately 587 acres (238 hectares) of the project footprint would be designated as low-intensity training areas (Category 3). No motorized vehicles would be authorized in Category 3 areas except under emergency situations. Vehicle access to low-intensity training areas (Category 3) during emergency situations would be coordinated by MCLB Barstow Environmental Division. MCLB Barstow Environmental Division and Range Operations staff would be responsible for notifying all military personnel of the off-road vehicle activity restrictions within these training areas. These areas would be used for limited training activities that result in minimal ground disturbance such as foot patrols, local security training, and tactical aircraft operations (e.g., stop and go landings) within suitable tactical landing areas.

2.3.1.4 Range Maintenance and Sustainment

Range maintenance and sustainment activities are required to ensure the training ranges within the project footprint continue to operate properly and safely for Marine forces. Proposed maintenance activities at the KD Range Complex would include maintaining and periodically replacing approximately 30 target carriages (i.e., small arms training target system) at the KD Rifle Range. This activity would include the removal and disposal (recycling) of old carriages and installation of target carriages that support 6-foot by 6-foot (1.8-meter by 1.8-meter) KD targets.

Alternative 1 would include the maintenance of existing berms within the KD Range Complex. Existing berms at the KD Rifle Range, KD Pistol Range, and 100-yard shotgun range would be fixed by filling in areas that have been eroded (e.g., rip-rap protection). Approximately 2,820 cubic yards (2,156 cubic meters) of soil (import fill) would be required to raise the existing berms around the 100-yard shotgun range by 3 feet (0.9 meter) for safety purposes. Soil would be temporarily stockpiled within previously disturbed areas in the KD Range Complex (e.g., parking area). The bullets embedded in the KD Rifle Range and KD Pistol Range berms would be periodically removed and recycled.

Additional maintenance activities would include periodic range sweeps to collect debris, periodic reapplication of soil stabilizers at the designated LZs, vegetation management between existing firing position berms and along access routes/trails and roads, periodic road maintenance/grading, gravel replacement, and slope stabilization to minimize erosion. The routine inspection and maintenance (repairs and/or replacement) of security gates, barbed wire and chain-linked fencing, and the MCLB Barstow perimeter fence within the project footprint would also occur as part of this alternative. Repairs to portions of the MCLB Barstow perimeter fence not accessible by existing roads/trails would be conducted by foot patrol and horses to the extent feasible.

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2.3.1.5 Utilities

Range Complex

Sustaining and/or upgrading the KD Range Complex and its associated infrastructure would require repairs or upgrades to existing utility infrastructure. The existing overhead electrical transmission lines located approximately 150 feet (45 meters) north of the Rifle Range Road would be demolished. Proposed electrical infrastructure would be installed below-ground in the existing, disturbed utility corridor along the Rifle Range Road (Figure 2.3-5). The existing utility trench would be expanded to approximately 6 feet (1.8 meters) wide and 18 feet (5.4 meters) deep to accommodate the proposed improvements. Electrical power would be provided to the KD Rifle Range, KD Pistol Range, and 100-yard shotgun berms and Rifle Range target area. Electrical power would also be required to motorize the North Gate and East Gate at the northeast corner of the KD Range Complex.

Up to a 10,000-gallon (37,854-liter) above-ground water storage tank would also be installed to support this alternative. The water tank would be located within the KD Range Complex administrative area and filled periodically by water trucks.

Alternative 1 would construct a permanent restroom facility with a 2,000-gallon (7,570-liter) underground waste storage tank and a 20-foot by 40-foot (6.1-meter by 12.2-meter) leach field in the KD Range Complex administrative area. Existing portable toilets in between the firing line berms would also be upgraded (e.g., with dry pit toilets).

Solar lighting would be required to support nighttime training activities and for security purposes. Security lighting would be provided at the North Gate and East Gate at the KD Range Complex and the West Gate at the Main Supply Route training area. The solar lighting would consist of a 4- to 6-inch (10- to 15-centimeter) diameter pole, approximately 20 feet (6 meters) high, in a concrete footing that would support a mounted solar panel (approximately 60 watts). An approximately 10-foot by 10-foot (3-meter by 3-meter) area would be required to support each light pole, which includes an approximately 3-foot (0.9-meter) hole/boring for each pole.

Yermo Stables Training Area

New electrical utilities would be installed below-ground within the northeastern portion of the Yermo Stables training area, and connect directly to an existing transformer at the Yermo Stables. Potable water lines would be constructed within the project footprint and connect to existing lines in the northeastern portion of the training area. Proposed water infrastructure would be designed and constructed in accordance with California Code of Regulations, Title 22 (Lead and Copper Rule). Trenching would be required within and adjacent to previously disturbed areas within the project footprint to connect new utility lines from the proposed bivouac area in the eastern portion of the training area to existing infrastructure and systems.

2.3.1.6 Access

Proposed improvements to existing access routes/trails and construction of new access roads to the LZs and LHA/LHD site would be required to support tactical aviation and ground training activities. All new access roads would be 12 feet to 18 feet (3.7 meters to 5.5 meters) wide and rough-graded and leveled. Ground disturbance (i.e., digging) associated with the new access roads would not exceed 18 inches (46 centimeters). Inspection and maintenance of all access roads/routes in the project footprint would occur twice a year (i.e., before and after the rainy season) and on an as-needed, emergency basis to fix

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any issues. Drainage improvements would occur, as necessary, along portions of the existing access routes within the project footprint to dissipate surface flows during storm events.

The two existing unimproved, 4-WD utility ROW access routes in the Range Main Supply Route training area, which provide primary access to the Range West training area and LHA/LHD site, would be improved as part of Alternative 1 (Figures 2.3-2 and 2.3-7). The existing trail along the ridgeline on the western boundary of the Range West training area would be improved to provide access to the LHA/LHD site. The existing trail along the ridgeline would also provide access to the southern project boundary for maintenance/inspections and security purposes. An additional spur from the existing trail would be included as an extension of the proposed access road to the LHA/LHD site. A new permanent access road would be constructed from the West Gate and it would connect to the proposed ingress/egress loop at the LHA/LHD site (Figure 2.3-2).

Access to the Range East and the KD Range Complex training area, including LZ 1, would be provided from the existing Rifle Range Road (gravel/maintained). The existing maintenance access route on the northern boundary of the KD Rifle Range firing berms would be cleared and used to support range operations/maintenance and training activities. New access roads (gravel) would be constructed to provide access from LZ 1 to the KD Range Complex administration area and to the existing unimproved, 4-WD utility ROW access routes, and to the designated bivouac areas (Figure 2.3-5). The existing Arizona crossing (i.e., low-water crossing with reinforced roadbed) west of the 500-yard firing line on Rifle Range Road would be maintained as part of this alternative. A new Arizona crossing would be installed to stabilize a portion of the Rifle Range Road that washes out during storm events (Figure 2.3-5).

Primary access to the Yermo Stables training area, including LZ 2, would be from the Yermo Dirt Road via Agate Road or Daggett-Yermo Road; however, construction of two new access roads would also be required. The existing gravel test track, which supports existing training activities, would also provide access to this training area (Figure 2.3-8).

The areas within MCLB Barstow are designated for military use and are controlled by the USMC. Controlled, secured access gates prevent public access to the Range Complex. However, the Yermo Stables training area is located in a publicly accessible area. To preclude public access and provide enhanced public safety, permanent fencing would be installed along the boundary of this training area and tied-in to the existing fencing along the Yermo Annex.

2.3.1.7 Construction

Construction would occur over a 24-month period. Proposed construction activities include: (1) grading and stabilizing the designated LZs, LHA/LHD site, access roads, bivouac sites, and vehicle loading/refueling areas; (2) installing the LHA/LHD landing platform; (3) constructing new 700-, 800-, and 900-yard firing lines at the KD Rifle Range; (4) upgrading the KD Rifle Range and 100-yard shotgun range; (5) raising the existing berms around the 100-yard shotgun range for safety purposes; (6) constructing new support facilities (e.g., tear gas training facility, restroom facility, range office and classroom building, ready locker, storage sheds, and pressurized propane gas storage tank); (7) installing solar and security lighting; (8) utility infrastructure modifications; and (9) installing permanent fencing at the Yermo Stables training area. Construction would involve the use of diesel- and gasoline-fueled vehicles and equipment. In general, the following equipment would be used during construction: forklift; dump trucks; scrapers; backhoes; concrete mixers; pickup trucks; loaders; cranes; compactors; electrical generators; air compressors; and miscellaneous smaller equipment (e.g., pumps). Construction staging and laydown areas would be located on previously disturbed areas (e.g., KD Range Complex parking area) within the project footprint.

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Construction activities would generate debris (e.g., steel, siding, concrete, and asphalt) that would require disposal. All materials would be disposed of in compliance with the DoD Green Procurement Program and sustainability goals (e.g., recycling approximately 50 percent of municipal trash and 40 percent of construction and demolition waste). Non-recyclable materials would be transported to an appropriate facility and disposed of in accordance with federal regulations.

For the purposes of this EA analysis, the conceptual project layout was designed to represent the maximum development footprint and level of disturbance, and all areas potentially disturbed are included within the project footprint. As the project is still in the conceptual design stage, modifications to the building sizes, configurations, and/or locations could be refined during final design. However, all design modifications would occur within the project footprint (Figure 2.2-1). Any design modifications would be reviewed and authorized by MCLB Barstow. Final design plans would be provided to the appropriate regulatory agencies for review and approval before commencement of construction.

Sustainable design principles and energy conservation measures would be integrated into the design, development, and construction of Alternative 1, in accordance with the Energy Policy Act of 2005 (Section 109), Executive Order (EO) 13693 — *Planning for Federal Sustainability in the Next Decade* (dated 19 March 2015) standards, and other applicable laws. Leadership in Energy and Environmental Design (LEED®) standards would be applied to the design of proposed range facilities and infrastructure to the extent feasible. Low-Impact Development (LID) design technologies to reduce stormwater runoff (e.g., impervious drainage features) would be constructed to the extent feasible in accordance with Unified Facilities Criteria (UFC) 3-210-10.

2.1.2 No-Action Alternative

Under the No-Action Alternative, existing training ranges and areas would not be enhanced to support combat readiness of USMC operating forces, including independent and combined ground and aviation training, at MCLB Barstow. Under the No-Action Alternative, limited ground training and live-fire training at the KD Range Complex would continue under current conditions. As discussed in Chapter 1, *Purpose and Need*, without updating the operational capabilities of existing training areas and ranges within the project footprint, including establishing general aviation areas and designated LZs and a LHA/LHD site, I MEF troops would not be provided realistic training opportunities at MCLB Barstow.

The No-Action Alternative is not considered a reasonable alternative because it does not meet the purpose and need for the proposed action. However, it does provide a measure of the baseline conditions against which the impacts of the proposed action can be compared. In this EA, the No-Action Alternative represents the baseline conditions described in Chapter 3, *Affected Environment and Environmental Consequences*.

2.4 Alternatives Considered But Not Carried Forward for Detailed Analysis

The following alternatives were considered but not carried forward for detailed analysis in this EA as they do not meet the purpose and need for the proposed action and satisfy the alternative screening factors (Section 2.1, *Reasonable Alternative Screening Factors*).

2.4.1 Alternative Locations within the DoD Southwest Range Complex and MCIWEST-MCB Camp Pendleton AO

The USMC considered enhancing any underutilized training ranges and areas at other USMC installations located within the DoD Southwest Range Complex and MCIWEST-MCB Camp Pendleton AO. For

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example, USMC training ranges within these areas include MCB Camp Pendleton, Chocolate Mountain Aerial Gunnery Range, Barry M. Goldwater Range West, and MCAGCC Twentynine Palms. Other nearby military ranges include Barry M. Goldwater Range East (U.S. Air Force), the National Training Center at Fort Irwin (U.S. Army), the Yuma Proving Ground (U.S. Army), Naval Air Facility El Centro (Navy), and the China Lake Naval Air Weapons Station (Navy).

USMC is currently conducting regional I MEF readiness training at MCB Camp Pendleton, Chocolate Mountain Aerial Gunnery Range, Barry M. Goldwater Range West, and MCAGCC Twentynine Palms. Additional MAGTF-level training at these facilities would not meet the purpose and need for enhancing existing, underutilized training ranges and areas at MCLB Barstow to support training and readiness opportunities and maximize range use and throughput. Although other nearby military ranges within the MCIWEST-MCB Camp Pendleton AO are able to fulfill most mission requirements, these ranges often experience crowded training conditions, for both ground and airspace, as well as scheduling conflicts with fixed/rotary wing training and other advanced training exercises. These conflicts limit opportunities for the types of limited-scale MAGTF integrated ground and aviation training proposed at MCLB Barstow and also limit MAGTF-level distributed training venues required to meet the CMC's mandates in the *Marine Corps Vision and Strategy 2025* and *Expeditionary Force 21* (USMC 2014; USMC 2008) (refer to Section 1.4, *Purpose and Need for the Proposed Action*).

Regarding non-USMC training ranges, these facilities receive heavy use from other military services and often have primary missions and uses that would conflict with low-flying rotary wing and tilt-rotor flight operations and landings. Furthermore, range scheduling requirements for other military services would limit USMC access to these training areas. As such, enhancing training ranges and areas at other DoD lands within the DoD Southwest Range Complex and MCIWEST-MCB Camp Pendleton AO fails to meet the purpose and need and cannot be considered a viable alternative.

2.4.2 Ground Training Alternative

The USMC considered an alternative that would only include the proposed ground training operations and range maintenance and sustainment activities. The training ranges and areas would not support general aviation areas and designated LZs or an LHA/LHD site. The proposed access route and road improvements would not occur. However, this alternative would not meet the purpose and need because it would not support limited scope MAGTF-level integrated ground and aviation training required to meet operating forces' training needs. Therefore, this alternative is not considered a viable alternative.

2.4.3 Aviation Training Alternative

An alternative was considered that would include limited-scope aviation training operations, including touch and go or pad landings, hover-holds, general navigation/tactical training, and terrain-flight within established general aviation areas and at the designated LZs and LHA/LHD site. Access roads would be constructed to support construction and maintenance activities associated with the LZs and LHA/LHD site. No ground training activities or range maintenance and sustainment activities would occur. However, this alternative would not meet the purpose and need because it would not provide opportunities for MAGTF-level integrated ground and aviation training or enhance the existing, underutilized training ranges and areas at MCLB Barstow. Therefore, this alternative is not considered a viable alternative.

2.5 Special Conservation Measures

Measures that would be incorporated into Alternative 1 to avoid, minimize, and mitigate impacts are included in the Minimization, Mitigation, Monitoring, and Reporting tracking sheet provided in

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Appendix B. These measures would be included as contract requirements on all relevant project scoping, scheduling, and planning documents.

2.6 Summary of Impacts

The environmental consequences associated with implementation of Alternative 1 and the No-Action Alternative are presented and compared in Table 2.6-1. A detailed description of the affected environment and analysis of the environmental consequences is presented in Chapter 3, *Affected Environment and Environmental Consequences*.

Table 2.6-1. Summary of Impacts

Resource Area	Alternative 1	No-Action Alternative
Airspace	NSI	NI
Air Quality	NSI	NI
Biological Resources	NSI	NI
Cultural Resources	NSI	NI
Land Use	NSI	NI
Noise	NSI	NI
Public Health and Safety	NSI	NI
Topography and Geology	NSI	NI
Transportation	NSI	NI
Utilities and Infrastructure	NSI	NI
Water Resources	NSI	NI
Notes: NSI = no significant impact; NI = no impact.		

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3 Affected Environment and Environmental Consequences

3.1 Airspace

The section addresses airspace within the Region of Influence (ROI) considered relevant to the proposed action and any effects it could have on existing airspace uses in this region. Aircraft safety at MCLB Barstow, including aircraft mishap potential and hazards from bird strikes, are discussed in Section 3.7, *Public Health and Safety*.

The FAA is responsible for managing the nation's airspace in a manner that meets the needs of military, commercial, and general aviation. Specific rules and regulations concerning airspace designation and management are stipulated in FAA Order 7400.2. The FAA has established two categories of airspace, regulatory and non-regulatory. Within these two categories, there are four types of airspace: Controlled, Special Use, Other, and Uncontrolled airspace. Controlled airspace is airspace of defined dimensions within which air traffic control service is provided to Instrument Flight Rule (IFR) flights and to Visual Flight Rules (VFR) flights in accordance with the airspace classification. Controlled airspace is categorized into five separate classes: Classes A through E (Figure 3.1-1). These classes identify airspace that is controlled, airspace supporting airport operations, and designated airways affording en route transit from place-to-place. The classes also dictate pilot qualification requirements, rules of flight that must be followed, and the type of equipment necessary to operate within that airspace. Uncontrolled airspace is designated Class G airspace and consists of airspace not designated Class A, B, C, D, or E. Air Traffic Control has no authority over operations in Class G airspace, which is used primarily by VFR civil aviation aircraft.

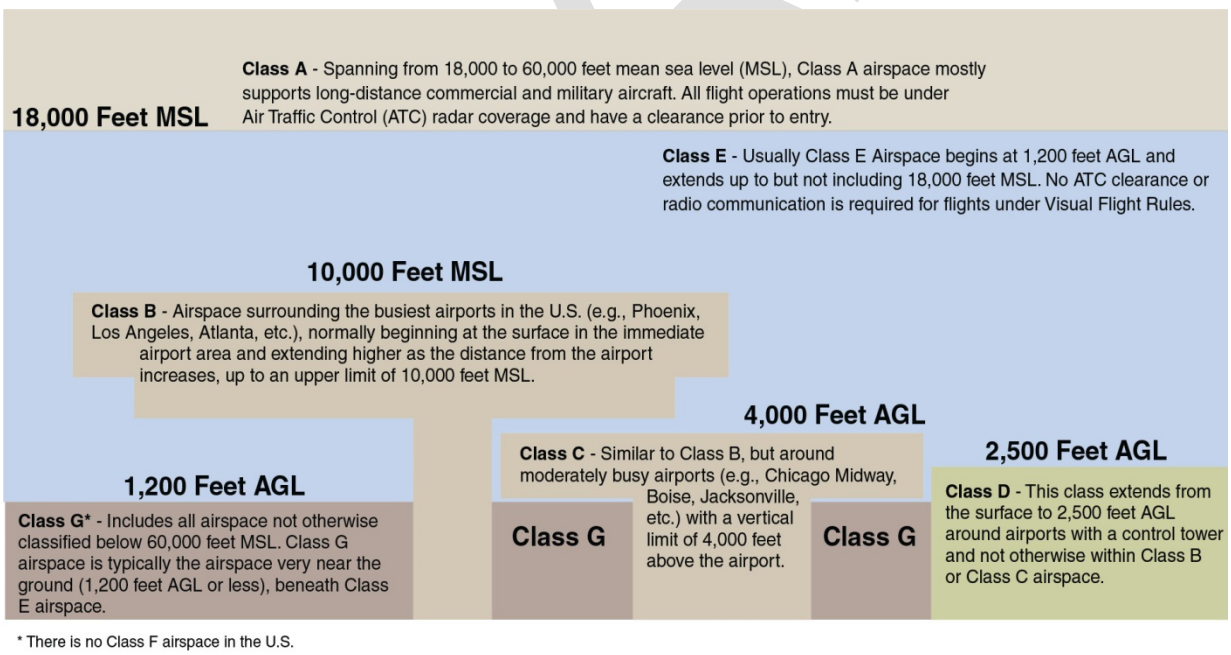

Figure 3.1-1. Cross-section of Airspace Classes and their Relationships

3.1.1 Affected Environment

The airspace ROI surrounding MCLB Barstow includes uncontrolled Class G airspace that extends from the surface up to 1,200 feet (366 meters) AGL, and Class E controlled airspace begins and extends up to, but not including, 18,000 feet (5,486 meters) above mean sea level (MSL). Class E airspace beginning at 700 feet (213 meters) above the surface surrounds the Barstow-Daggett Airport to contain the instrument approach procedures serving that airport.

The overall purpose of the Class E area is to designate transitional airspace to ensure military aircraft operations within the ROI are separated from other IFR aircraft operating throughout this region. Aircraft pilots operating under VFR can fly through Class G and E airspace without air traffic control services while following ground references and avoiding other aircraft. Higher density VFR air traffic can occur within this airspace given the limited number of general aviation aircraft at public and private airfields in the ROI.

Specific flight rules and procedures govern aircraft flights within the ROI. Military aircraft operations are regulated by FAA-mandated restrictions, military aviation operations guidance, and other safety initiatives that regulate military flight operations throughout the area. Two sets of regulations govern civil aviation aircraft operations: VFR and IFR. Flights operating under VFR are flown solely by reference to outside visual references (horizon, buildings, flora, etc.), which permit navigation, orientation, and separation from terrain and other traffic. IFR requirements are established by the FAA to govern flights under conditions in which flight by outside visual reference is not safe. Flight operations under IFR depend on flying by reference to instruments in the aircraft, and navigation is accomplished by reference to electronic signals.

Several public and private airfields are located within the ROI (SkyVector 2015). The Barstow-Daggett Airport is a public airfield with two runways that supports civil and military (California Air National Guard) aircraft operations. This airport does not have an operational control tower; however, arriving/departing IFR aircraft are under the control of the Los Angeles Air Route Traffic Control Center. An average of 100 daily aircraft operations are conducted at the Barstow-Daggett Airport, and about half of these are military operations associated with training activities at the Fort Irwin National Training Center (AirNav.com 2015). The ROI also includes heliports at the Barstow Community Hospital and the Barstow Service Center and two private airfields (i.e., Depue and Harvard airfields) (SkyVector 2015). Aircraft operations at these locations are minimal due to the limited number of aircraft typically utilizing the heliports/airfields.

Federal Victor airways (low-altitude airways) and jet routes (high-altitude airways) are located within the ROI that provide transit routes for IFR aircraft under control of the Los Angeles Air Route Traffic Control Center. Federal airways extend from 1,200 feet (366 meters) AGL up to but not including 18,000 feet (5,486 meters) MSL while the jet routes extend above 18,000 feet (5,486 meters) MSL.

Military training airspace within the ROI includes restricted areas, Military Operations Areas (MOAs), and military training routes used by the USMC and other military services for air and ground training activities. Restricted areas are established to contain hazardous air and ground-based activities, while MOAs are designated strictly for nonhazardous flight activities. The MCLB Barstow airspace does not include any Special Use Airspace (e.g., restricted areas and MOAs) (SkyVector 2015).

Overall, the manner in which this airspace is managed and the standard flight routes and operating procedures military pilots adhere to while operating within the ROI have collectively provided for the safe, compatible use of this airspace by all civil and military aircraft.

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3.1.2 Environmental Consequences

The evaluation of potential impacts on the airspace environment considers if, and to what extent, proposed aircraft operations could affect other airspace uses within the ROI. As noted in Chapter 2, *Description of Proposed Action and Alternatives*, the proposed action would be conducted in conformance with FAA-mandated restrictions and would not affect standing USMC operating procedures that govern how military flight activities are conducted within the ROI.

3.1.2.1 Alternative 1

Proposed aviation training would add approximately 1,240 annual aircraft sorties (i.e., one arrival and departure or visit) and 3,868 operations (e.g., a touch and go or pad landing) at MCLB Barstow (Table 2.3-3). Proposed aircraft training operations would include conducting touch and go or pad landings, aircrew proficiency training with external loads, troop/equipment lift, aerial delivery of troops and equipment, fast-roping hover-holds, general navigation/tactical training, night vision goggle training, and terrain-flight. All aircraft training activities would occur within general aviation, non-restricted Class G airspace and the overlying Class E airspace. Non-participating military and civilian aircraft could also operate within the airspace overlying MCLB Barstow during proposed training activities. However, current aviation safety procedures, including FAA-mandated restrictions, military aviation operations guidance, and other safety initiatives that regulate military flight operations throughout the ROI, would continue to be implemented and additional flight operations at MCLB Barstow would adhere to established safety procedures. No changes to existing airspace designations would be required to accommodate proposed aviation training. Likewise, no changes would be required to those procedures that have been implemented by the USMC and the FAA for scheduling and managing use of this airspace environment.

USMC aircraft transiting between MCAS Miramar, MCAS Camp Pendleton, or other locations and the project footprint would fly along MTRs and/or normal departure routes from an airfield and then along established routes to reach the general aviation and designated landing areas. While transitioning to MCLB Barstow from an airfield, rotary wing aircraft would fly between 1,000 to 2,000 feet (305 to 610 meters) AGL and the tilt-rotor aircraft would fly between 8,000 to 12,000 feet (2,438 to 3,658 meters) AGL. The majority of IFR air traffic operating along federal Victor airways and jet routes in the ROI would occur at higher elevations than the proposed low-altitude military aircraft operations at MCLB Barstow. Furthermore, all proposed military aircraft activities would be conducted in accordance with FAA-mandated restrictions and military aviation operations guidance.

Aircraft operations at nearby public and private airfields within the ROI would not be affected by the proposed aircraft operations. As noted previously, the transit routes flown by military aircraft in conjunction with standing USMC procedural requirements help ensure that a safe operating distance is maintained between civil and military aircraft.

Proposed aircraft training operations would be non-hazardous and would, therefore, not require activation and/or affect scheduled activities within Special Use Airspace (e.g., restricted areas and MOAs).

The proposed operations would not have significant effects on airspace uses in the ROI. Comprehensive operating procedures are employed by the USMC to reduce the potential for aircraft accidents and increase aviation safety. FAA-mandated restrictions, military aviation operations guidance, and other safety initiatives that regulate military flight operations throughout the ROI would serve to effectively and safely integrate proposed aircraft operations into the existing airspace environment. Therefore, no significant impacts on airspace would occur.

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3.1.2.2 No-Action Alternative

Under the No-Action Alternative, existing training ranges and areas would not be enhanced to support combat readiness of USMC operating forces and limited ground training and live-fire training at the KD Range Complex would continue under current conditions. Existing airspace conditions would remain as described in Section 3.1.1, *Affected Environment*. No impacts on airspace would occur.

3.2 Air Quality

The following section describes the existing air quality conditions of the project region and potential air quality impacts that would occur from the proposed action.

3.2.1 Affected Environment

Air quality at a given location can be described by the concentrations of various air pollutants in the atmosphere. The significance of a pollutant concentration is determined by comparing its concentration to an appropriate national and/or state ambient air quality standard. These standards represent allowable atmospheric concentrations that protect public health and welfare and include a reasonable margin of safety to protect the more sensitive individuals in the population. The U.S. Environmental Protection Agency (USEPA) established the National Ambient Air Quality Standards (NAAQS) to regulate the following criteria pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter less than or equal to 10 microns in diameter (PM_{10}), particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$), and lead. The California Air Resources Board (ARB) establishes the state standards called the California Ambient Air Quality Standards (CAAQS). The NAAQS represent maximum acceptable concentrations that generally may not be exceeded more than once per year, except the annual standards, which may never be exceeded. The CAAQS represent maximum acceptable pollutant concentrations that are not to be equaled or exceeded. The national and state ambient air quality standards are shown in Table 3.2-1.

Toxic air contaminants are compounds that generally have no established ambient standards but are known, or suspected, to cause short-term (acute) and/or long-term (chronic non-carcinogenic or carcinogenic) adverse health effects. The ARB designates diesel particulate matter from the combustion of diesel fuel as a toxic air contaminant.

Air emissions produced from the proposed action would affect air quality within the immediate area of MCLB Barstow and along aircraft flight routes connecting to this location within San Bernardino County. The project footprint is in the western portion of San Bernardino County and is within the Mojave Desert Air Basin (MDAB). Identifying the ROI for air quality requires knowledge of the pollutant types, source emission rates, the proximity of project emission sources to other emission sources, and local and regional meteorology. For inert pollutants (such as CO and particulates in the form of fugitive dust), the ROI generally is limited to a few miles downwind from a source. The ROI for reactive pollutants such as O_3 could extend much farther downwind than for inert pollutants. O_3 is formed in the atmosphere by photochemical reactions of previously emitted pollutants called precursors. O_3 precursors are mainly nitrogen oxides (NO_x) and photochemically reactive volatile organic compounds (VOCs). In the presence of sunlight, the maximum effect of precursor emissions on O_3 levels usually occurs several hours after they are emitted and many miles from their source.

The analysis of proposed aircraft operations is limited to emissions that would occur within the lowest 3,000 feet (914 meters) of the atmosphere, as this is the typical depth of the atmospheric mixing layer where released emissions could affect ground-level pollutant concentrations. Emissions released above the mixing layer generally would not appreciably affect ground-level air quality.

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Table 3.2-1. National and California Ambient Air Quality Standards

Pollutant	Averaging Time	National Standards[a]		California Standards[a]
		Primary[b]	Primary[b]	
Ozone (O3)	8-hour	0.075 ppm (147 µg/m³)	0.075 ppm (147 µg/m³)	0.07 ppm (137 µg/m³)
	1-hour	—	—	0.09 ppm (180 µg/m³)
Carbon monoxide (CO)	8-hour	9 ppm (10 mg/m³)	9 ppm (10 mg/m³)	9 ppm (10 mg/m³)
	1-hour	35 ppm (40 mg/m³)	35 ppm (40 mg/m³)	20 ppm (23 mg/m³)
Nitrogen dioxide (NO2)	Annual	0.053 ppm (100 µg/m³)	0.053 ppm (100 µg/m³)	0.03 ppm (57 µg/m³)
	1-hour	100 ppb	100 ppb	0.18 ppm (339 µg/m³)
Sulfur dioxide (SO2)	24-hour	—	—	0.04 ppm (105 µg/m³)
	3-hour	—	—	—
	1-hour	0.075 ppm (196 µg/m³)	0.075 ppm (196 µg/m³)	0.25 ppm (655 µg/m³)
PM10	Annual	—	—	20 µg/m³
	24-hour	150 µg/m³	150 µg/m³	50 µg/m³
PM2.5	Annual	12 µg/m³	12 µg/m³	12 µg/m³
	24-hour	35 µg/m³	35 µg/m³	—
Lead	Rolling 3-month average	0.15 µg/m³	0.15 µg/m³	—
	30-day average	—	—	1.5 µg/m³

Notes: ppm = parts per million; ppb = parts per billion; and µg/m³ = micrograms per cubic meter.
a Concentrations are expressed first in units in which they were promulgated. Equivalent units are given in parenthesis.
b Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.
c Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
Source: ARB 2013a.

3.2.1.1 Existing Air Quality

The USEPA designates all areas of the U.S. as having air quality better than (attainment) or worse than (nonattainment) the NAAQS. An area generally is in nonattainment for a pollutant if its NAAQS has been exceeded more than once per year. Former nonattainment areas that have attained the NAAQS are designated as maintenance areas. The USEPA classifies the MDAB as in severe nonattainment for O_3, moderate nonattainment for PM_{10}, and attainment for all other NAAQS (USEPA 2015a).

The ARB also designates areas of the state that are in attainment or nonattainment of the CAAQS. An area is in nonattainment for a pollutant if its CAAQS have been exceeded more than once in 3 years. The ARB currently designates the MDAB as in nonattainment for O_3, PM_{10}, and $PM_{2.5}$, and in attainment for all other CAAQS (ARB 2013b).

O_3 concentrations are highest during warmer months of the year and coincide with the period of maximum insolation. Maximum O_3 concentrations tend to be homogeneously spread throughout a region, since it often takes several hours to convert precursor emissions to O_3 in the atmosphere. O_3 precursor emissions transported from the Los Angeles metropolitan area are the main contributors to high O_3 levels in the MDAB. Inert pollutants, such as CO, tend to have the highest concentrations during the colder months of the year, when light winds and nighttime/early morning surface-based temperature inversions

inhibit atmospheric dispersion. Maximum inert pollutant concentrations are usually found near an emission source.

The arid conditions in the project region produce low soil moisture and a high potential for fugitive dust (PM_{10}/$PM_{2.5}$) emissions. Ambient PM_{10} concentrations within the project region occur from emissions of fugitive dust and the combustion of fuels in vehicles. Maximum PM_{10} impacts usually occur in combination with fugitive dust generated by ground-disturbing activities (such as the operation of vehicles on unpaved surfaces) and high-wind events.

Air emissions from current operations at MCLB Barstow occur from: (1) stationary sources that combust fuels and release VOCs from fuels storage and transfer; (2) mobile sources such as rotary wing aircraft and tactical vehicles/support equipment; and (3) fugitive dust generated by the operation of vehicles and equipment on unpaved surfaces and the landing and take-off of rotary wing aircraft. Table 3.2-2 summarizes annual emissions that occur from existing training activities at MCLB Barstow.

Table 3.2-2. Annual Emissions from Existing Training Activities at MCLB Barstow

Activity	Air Pollutant Emissions (Tons)						
	VOC	CO	NOx	SO_2	PM_{10}	$PM_{2.5}$	CO_2e
Tactical Equipment	0.01	0.05	0.13	0.00	4.14	0.64	12.56
Aircraft Transit Operations	0.00	0.02	0.10	0.01	0.07	0.07	49.86
Aircraft Range Operations	0.02	0.07	0.02	0.00	0.03	0.02	13.77
Total - Existing Operations	0.03	0.14	0.24	0.01	4.24	0.73	76.19

Notes: CO_2e data presented in metric tons.
MCLB = Marine Corps Logistics Base; CO = carbon monoxide; and VOC = volatile organic compound.

3.2.1.2 Applicable Rules and Regulations

The federal Clean Air Act (CAA) of 1970 and its subsequent amendments establish air quality regulations and the NAAQS, and delegate the enforcement of these standards to the states. The federal CAA establishes air quality planning processes and requires areas in nonattainment of a NAAQS to develop a State Implementation Plan (SIP) that details how the state will attain the standard within mandated time frames. The requirements and compliance dates for attainment are based on the severity of the nonattainment classification of the area.

In California, the ARB is responsible for enforcing both the federal and state air pollution regulations. In the MDAB, the Mojave Desert Air Quality Management District (MDAQMD) has been delegated this responsibility. The following summarizes the air quality rules and regulations that apply to the proposed action.

Federal Regulations

Section 176(c) of the federal CAA, as articulated in the *USEPA General Conformity Rule*, states that a federal agency cannot issue a permit or support an activity unless the agency determines that it will conform to the most recent USEPA-approved SIP. This means that projects using federal funds or requiring federal approval in nonattainment or maintenance areas cannot: (1) cause or contribute to new violations of an NAAQS; (2) increase the frequency or severity of any existing violation; or (3) delay timely attainment of any standard, interim emission reduction, or other milestone. Conformity determinations are required when the annual direct and indirect emissions from a federal action exceed an applicable *de minimis* threshold. Applicable *de minimis* levels vary by pollutant and the severity of nonattainment conditions. Based on the present air quality conditions of the MDAB, the proposed action

would conform to the most recent USEPA-approved SIP if its annual construction and operational emissions do not exceed 25 tons of VOCs and NO_x and 100 tons of PM_{10}.

State Regulations

The ARB is responsible for the coordination and administration of both federal and state air pollution control programs within California and for implementing the California CAA. The California CAA required the ARB to establish the CAAQS (Table 3.2-1). The CAAQS are at least as stringent as the NAAQS. The California CAA requires local air districts in the state to achieve and maintain the CAAQS by the earliest practical date. The California CAA specifies that local air districts should focus particular attention on reducing emissions from transportation and area-wide emission sources, and it gives districts the authority to regulate indirect sources of emissions.

Local Regulations

The MDAQMD is responsible for regulating stationary sources of air emissions within the MDAB. The MDAQMD has developed air quality plans designed to reduce emissions to a level that will bring the MDAB into attainment of the ambient air quality standards (MDAQMD 2015). Control measures for stationary sources proposed in the air quality plans and adopted by the MDAQMD are incorporated into the *Rules and Regulations of the MDAQMD* (MDAQMD 2015). For example, the requirements of MDAQMD Rule 403, *Fugitive Dust*, and Rule 403.2, *Fugitive Dust Control for the Mojave Desert Planning Area*, would apply to the proposed construction activities.

3.2.1.3 Greenhouse Gases

It is well-documented that the Earth's climate has fluctuated throughout its history. However, scientific evidence indicates a correlation between increasing global temperatures over the past century and the worldwide proliferation of greenhouse gas (GHG) emissions by human activity. The main source of GHGs from human activities is the combustion of fossil fuels, such as crude oil and coal. Climate change associated with global warming is predicted to produce negative environmental, economic, and social consequences across the globe.

GHGs trap heat in the atmosphere by absorbing the sun's natural energy. GHGs are released from natural processes and human activities. The most common GHGs emitted from natural processes and human activities include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Examples of GHGs created and emitted primarily through human activities include fluorinated gases and sulfur hexafluoride.

Each GHG is assigned a global warming potential (GWP). The GWP is a measure of the ability of a gas or aerosol to trap heat in the atmosphere. The GWP rating system is standardized to CO_2, which has a value of one. For example, CH_4 has a GWP of 28, which means that it has a global warming effect 28 times greater than CO_2 on an equal-mass basis (Intergovernmental Panel on Climate Change 2014), which means that CH_4 can be more detrimental to Earth's climate. To simplify GHG analyses, total GHG emissions from a source are often expressed as a CO_2 equivalent (CO_{2e}). The CO_{2e} is calculated by multiplying the emissions of each GHG by its GWP and adding the results together to produce a single, combined emission rate representing all GHGs. While CH_4 and N_2O have much higher GWPs than CO_2, CO_2 is emitted in such higher quantities that it is the overwhelming contributor to CO_{2e} from both natural processes and human activities.

Federal agencies address emissions of GHGs by reporting and meeting reductions mandated in federal laws, EOs, and agency policies. Some of these requirements include EO 13693 (*Planning for Federal Sustainability in the Next Decade*) (dated 19 March 2015) and the USEPA's *Final Mandatory Reporting*

of Greenhouse Gases Rule. Several states have promulgated laws as a means of reducing statewide levels of GHG emissions. In particular, the California Global Warming Solutions Act of 2006 (Assembly Bill 32) directs the state of California to reduce statewide GHG emissions to 1990 levels by the year 2020. Groups of states also have formed regionally based collectives (such as the Western Climate Initiative) to jointly address GHG pollutants.

The USMC takes proactive measures to reduce their overall emissions of GHGs. In an effort to reduce energy consumption, reduce dependence on petroleum, and increase the use of renewable energy resources in accordance with the goals set by EOs and the Energy Policy Act of 2005, the Marine Corps and DoD have implemented a number of renewable energy projects (e.g., photovoltaic solar systems, geothermal power, and wind generation) within the jurisdiction of MCIWEST (MCIWEST 2009; Marine Corps Expeditionary Energy Office 2011).

On 18 December 2014, the CEQ released revised draft guidance for public comment that describes how federal departments and agencies should consider the effects of GHGs and climate change in their NEPA reviews (CEQ 2014). The revised draft guidance supersedes the draft GHG and climate change guidance released by the CEQ in February 2010. This guidance explains that agencies should consider both the potential effects of a proposed action on climate change, as indicated by its estimated GHGs, and the implications of climate change for the environmental effects of a proposed action. The guidance also emphasizes that agency analyses should be commensurate with projected GHGs and climate impacts, and should employ appropriate quantitative or qualitative analytical methods to ensure useful information is developed to adequately distinguish between alternatives and mitigations. The guidance recommends that agencies consider 25,000 metric tons per year of CO_{2e} emissions as a reference point below which a quantitative analysis of GHGs is not recommended unless it is easily accomplished based on available tools and data. Similar to the 2010 guidance, the revised guidance does not propose a reference point as an indicator of a level of GHG emissions that may significantly affect the quality of the human environment.

The potential effects of proposed GHG emissions are, by nature, global and cumulative impacts because individual sources of GHG emissions are not large enough to have an appreciable effect on climate change. Therefore, the impact of proposed GHG emissions to climate change is discussed in the context of cumulative impacts, as presented in Chapter 4, *Cumulative Impacts*, of this EA.

3.2.2 Environmental Consequences

Air quality impacts from the proposed action were reviewed for significance relative to federal, state, and local air pollution standards and regulations. For the purposes of this analysis, if proposed emissions were projected not to exceed an applicable conformity *de minimis* threshold within the project region (25 tons per year of VOCs and NO_x and 100 tons per year of PM_{10}), then impacts would not be significant. If proposed emissions were projected to exceed an applicable conformity *de minimis* threshold within a project region, further analysis would be needed to determine whether impacts were significant. In such cases, if emissions conform to the approved SIP, then impacts would not be significant. In the case of a criteria pollutant for which a project region attains an NAAQS, the analysis used the USEPA Prevention of Significant Deterioration (PSD) threshold for new major sources of 250 tons per year as an indicator of significance of projected air quality impacts.

3.2.2.1 Alternative 1

Construction

Proposed construction activities include: (1) grading and stabilizing the designated LZs, LHA/LHD site, access roads, bivouac sites, and vehicle loading/refueling areas; (2) installing the LHA/LHD landing platform; (3) constructing new 700-, 800-, and 900-yard firing lines at the KD Rifle Range; (4) upgrading the KD Rifle Range and 100-yard shotgun range; (5) raising the existing berms around the 100-yard shotgun range for safety purposes; (6) constructing new support facilities (e.g., tear gas training facility, restroom facility, range office and classroom building, ready locker, storage sheds, and pressurized propane gas storage tank); (7) installing solar and security lighting; (8) performing utility infrastructure modifications; and (9) installing permanent fencing at the Yermo Stables training area. Air quality impacts from construction of Alternative 1 would occur from: (1) combustive emissions due to the use of fossil fuel-powered equipment and trucks; and (2) fugitive dust emissions from earth-moving activities and the operation of equipment and trucks on exposed soils. Construction activity data associated with Alternative 1 were used to estimate combustive and fugitive dust emissions. Appendix C-1 includes data and assumptions used to calculate emissions from these proposed activities.

Factors needed to derive source emission factors for construction activities were obtained from the EMFAC2014 model for on-road vehicles (ARB 2014a), the ARB OFFROAD Model from the California Emissions Estimator Model for off-road construction equipment (ARB 2014b; Environ 2013), and special studies on fugitive dust (USEPA 1995). The analysis assumes that implementation of Special Conservation Measure 1 (*Fugitive Dust Control for Construction*) and Special Conservation Measure 2 (*Construction Equipment Emission Control Measures*), described in Appendix B, would reduce emissions of PM_{10} and $PM_{2.5}$ associated with fugitive dust by 50 percent from uncontrolled levels.

Table 3.2-3 summarizes the annual emissions estimated for construction activities under Alternative 1. These data show that annual air emissions generated from these activities over a 24-month construction period would be below their applicable NEPA significance thresholds.

Table 3.2-3. Annual Emissions from Construction of Alternative 1

Year/Activity	Air Pollutant Emissions (Tons)						
	VOC	CO	NOx	SO2	PM10	PM2.5	CO2e
Year 2016 Construction							
KD Range Complex	0.17	0.93	3.40	0.00	1.10	0.16	435.44
LZs and LHA/LHD	0.01	0.07	0.15	0.00	0.69	0.07	16.75
Yermo Stables training area	0.00	0.02	0.04	0.00	0.14	0.01	4.26
Year 2016 Total Emissions	0.18	1.02	3.58	0.00	1.93	0.25	456.45
Year 2017 Construction							
KD Range Complex	0.04	0.23	0.45	0.00	0.71	0.09	49.38
LZs and LHA/LHD	0.01	0.08	0.19	0.00	0.69	0.07	20.20
Yermo Stables training area	0.01	0.05	0.07	0.00	0.28	0.03	6.32
Year 2017 Total Emissions	0.06	0.36	0.71	0.00	1.68	0.19	75.91
NEPA Significance Thresholds	25	250	25	250	100	250	NA
Exceed NEPA Significance Threshold?	No	No	No	No	No	No	NA

Notes: CO2e data presented in metric tons.
KD = Known Distance; LHA = Landing Helicopter Assault; LHD = Landing Helicopter Dock; LZ = landing zone; and NEPA = National Environmental Policy Act of 1969.

Proposed construction equipment would emit minor amounts of toxic air contaminants. Due to the mobile and intermittent operation of proposed diesel-powered construction equipment, proposed construction activities would generate minimal ambient impacts of toxic air contaminants in a localized area. As a result, no significant impacts on air quality would occur.

Operations

Alternative 1 operations would include ground training (e.g., tactical sustainment training and convoy training), aviation training (e.g., touch and go or pad landings, aircrew proficiency training with external loads, troop/equipment lift, and aerial delivery of troops and equipment) and range maintenance and sustainment activities (e.g., periodic road maintenance/grading, berm maintenance, periodic range sweeps to collect debris, and periodic reapplication of soil stabilizers). Air quality impacts from Alternative 1 operations would occur from: (1) the combustion of fuels by tactical vehicles/support equipment and aircraft; (2) fugitive dust generated during operation of equipment and rotary wing and tilt-rotor aircraft landings on exposed soils; and (3) ordnance usages. Operational data used to estimate emissions from proposed operations are consistent with those evaluated in the noise analysis (refer to Section 3.7, *Noise*) and include aircraft operations within 3,000 feet (914 meters) of ground level.

Factors needed to derive operational source emission rates were obtained from the sources mentioned above for proposed construction activities, previous NEPA analyses (Navy 2012), and special studies on aircraft operations (Navy Aircraft Environmental Support Office 2000–2013). Fugitive dust emissions generated from landings on exposed soils by rotary wing and tilt-rotor aircraft were estimated with methods identified in special studies conducted by the USEPA (USEPA 2006) and recent NEPA documents (USMC 2013b).

Table 3.2-4 presents an estimate of the annual operational emissions that would occur from implementation of Alternative 1. These data show that emissions from Alternative 1 operations minus existing operations would remain below any applicable conformity *de minimis* or PSD threshold for the project region. Therefore, total annual emissions from operations under Alternative 1 would not result in significant impacts on air quality.

Table 3.2-4. Annual Emissions from Proposed Operations

Activity	Air Pollutant Emissions (Tons)						
	VOC	CO	NOx	SO2	PM10	PM2.5	CO2e
Tactical Equipment	0.85	4.62	10.29	0.01	28.64	4.18	1,031
Maintenance Activities	0.11	0.63	1.03	0.00	0.06	0.06	97
Aircraft Transport Operations	0.09	1.06	3.81	0.19	1.21	1.21	1,324
Aircraft Range Operations	0.17	1.24	6.76	0.25	7.82	2.15	1,831
Ordnance Usages	0.00	0.06	0.00	-	0.01	0.00	0.04
Personnel/Equipment Transport	0.01	0.04	0.37	0.00	0.00	0.00	
Total - Proposed Operations	1.23	7.30	22.25	0.45	37.74	7.61	4,336
Total - Existing Operations	0.03	0.14	0.24	0.01	4.24	0.73	76
Proposed minus Existing Operations	1.20	7.16	22.01	0.44	33.51	6.88	4,259
NEPA Significance Thresholds	25	250	25	250	100	250	NA
Exceed NEPA Significance Threshold?	No	No	No	No	No	No	NA

Notes: CO2e data presented in metric tons.
CO = carbon monoxide; MCLB = Marine Corps Logistics Base; NA = not applicable; NEPA = National Environmental Policy Act of 1969; and VOC = volatile organic compound.

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The proposed vehicle loading and refueling area in the northeast corner of the Range East and KD Range Complex training area would be a potential source of acute fugitive dust during operations. This facility would be within about 450 feet (137 meters) of I-40 and fugitive dust generated within this area could substantially impact this transportation corridor when winds blow from the project footprint to I-40. Implementation of Special Conservation Measure 3 (*Fugitive Dust Control Measures for Operations*), described in Appendix B, would minimize the generation of fugitive dust emissions during operations within the vehicle loading and refueling area and the impact of these emissions to I-40. Therefore, fugitive dust emissions from proposed operations would not result in significant impacts on air quality.

A Record of Non-Applicability for CAA General Conformity requirements has been prepared for Alternative 1 (refer to Appendix C-2 for details).

3.2.2.2 No-Action Alternative

Under the No-Action Alternative, existing training ranges and areas would not be enhanced to support combat readiness of USMC operating forces and limited ground training and live-fire marksmanship training at the KD Range Complex would continue under current conditions. Existing air quality conditions would remain as described in Section 3.2.1, *Affected Environment*. No impacts on air quality would occur.

3.3 Biological Resources

The following section describes vegetation, general wildlife species, special status species, and ephemeral desert washes within the ROI and provides analyses of the potential effects on these resources from the proposed action.

Biological resources are grouped and analyzed in this EA as follows:

- *Vegetation* includes the most prominent vegetation and landforms encountered in the ROI;
- *Wildlife* includes the characteristic animal species that occur in the ROI;
- *Special status species* include plants or animals that are federally listed as threatened or endangered, proposed for listing as threatened or endangered, or are candidates for such listing under the federal Endangered Species Act (ESA), most notably the Agassiz's desert tortoise (*Gopherus agassizii*). Also included in this category are species protected by the federal Bald and Golden Eagle Protection Act, Migratory Bird Treaty Act (MBTA), and EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*. Other special status species include those considered sensitive by the Bureau of Land Management (BLM), California Department of Fish and Wildlife (CDFW), and California Native Plant Society (CNPS), and managed under the MCLB Barstow Integrated Natural Resources Management Plan (INRMP; MCLB Barstow 2005). Sensitive habitats include those that support endangered, threatened, or sensitive species and, therefore, are important to the conservation of these species;
- *Wetlands*, as defined under Clean Water Act (CWA) regulations (33 CFR 328), were evaluated in the field in October 2013, April 2014, December 2014, and April 2015. No wetlands were identified within the project footprint during the 2013-2015 surveys; and
- *Waters of the U.S.* are defined as areas under the U.S. Army Corps of Engineers (USACE's) jurisdiction pursuant to Section 404 of the CWA and are generally defined by the ordinary high water mark (OHWM). The USACE's jurisdiction can extend beyond the OHWM to the limit of adjacent wetlands, when present. Wetlands can also occur within waters of the U.S. Ephemeral surface water drainages (i.e., desert washes) supporting OHWMs within MCLB Barstow are not considered waters of the U.S. because the lower Mojave River downstream of MCLB Barstow

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appears to function as an isolated, intrastate system that lacks the presence of a traditional navigable water (TNW). Therefore, the following analysis assumes, subject to verification by the USACE, that the desert washes within the project footprint are non-jurisdictional.

3.3.1 Affected Environment

The ROI for biological resources is defined as areas wherein biological resources could be directly or indirectly affected due to ground disturbance during construction, ground and aviation training, and range maintenance and sustainment activities. For the purposes of the proposed action, this includes the project footprint and adjacent areas.

3.3.1.1 Data Sources

The following data sources were used to support the biological resources analysis:

- Biological Resources Survey Report (Leidos 2015a) (refer to Appendix D-1 for details);
- Desert Tortoise Survey Reports (Gardner and Brodie 2000; Walde 2007, 2013, 2015; Endemic Environmental Services et al. 2014; and Leidos 2015b) (refer to Appendix D-2 for details);
- Jurisdictional Determination Report (Leidos 2015c) (refer to Appendix D-3 for details);
- MCLB Barstow INRMP (MCLB Barstow 2005);
- Final Revised Recovery Plan for the Mojave Desert Tortoise (USFWS 2011);
- Status of the Desert Tortoise – Rangewide Status of Desert Tortoise (USFWS 2008, 2011); and
- California Natural Diversity Database (CNDDB) and CNPS Rare Plant Ranking System.

3.3.1.2 Vegetation

Vegetation at MCLB Barstow is typical for the Mojave desert region, which is sparse shrublands. In general, vegetation in the Range West and Range East and KD Range Complex training areas is dominated by Creosote bush – white bursage scrub. The Yermo Stables training area has Creosote bush-white bursage scrub, Allscale scrub, California joint fir scrub, Scale broom scrub, Desert willow woodland, and desert wash habitats.

Range West Training Area

The terrain in the Range West training area is undulating with a rocky substrate and desert pavement on the flat areas and ridges. The spatial distribution of shrubs varies depending on location in the training area. Spatial distribution of shrubs can be attributed to a variety of factors, such as elevation, precipitation, temperature, slope aspect, topographic position and substrate (Franklin 1998). In the flat areas of the Range West training area plants occur in clumps or are widely spaced (up to 15 feet [3 meters] apart). Creosote bush *Larrea tridentata*) and white bursage (*Ambrosia dumosa*) shrubs are dominant throughout the training area, and purple heather (*Krameria erecta*), Englemann's hedgehog cacti (*Echinocereus englemannii*), branched pencil cholla (*Cylindropuntia ramosissima*), and sweetbush (*Bebbia juncea*) are less common. Native spring and fall annual species common in the understory include sandmat spurge (*Chamaesyce micromera*), chinch weed (*Pectis papposa* var. *papposa*), pebble pincushion (*Chaenactis carphoclinia* var. *carphoclinia)*, cryptantha (*Crypthantha* spp.), buckwheat (*Eriogonum* spp.), and snake's head (*Malacothrix coulteri*), and less common are fringed spurge (*C. setiloba*), fringed amaranth (*Amaranthus fimbriatus*), and six weeks grama (*Bouteloua* spp.). Non-native schimus (*Schismus* sp.) is common in many areas throughout the training area. The western and

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eastern ends of the Range West training area have steep slopes that terminate into a large gently sloping alluvial fan crossed by various desert washes. On the steeper rocky slopes shrub density is approximately 1,250 shrubs/hectare (Leidos 2015a). In the basins of the desert washes vegetation is sparse and shrubs become more densely distributed (approximately 1,500 shrubs/hectare), especially along the banks. Cheesebush, box thorn (*Lycium* spp.), spiny senna (*Senna armata*), Mojave indigo bush (*Psorothamnus arborescens*), catclaw (*Senegalia greggii*), and sandpaper bush (*Petalonyx thurberi* subsp. *thurberi*) are mainly restricted to the desert washes (Figure 3.3-1).

Range East and KD Range Complex Training Area

The Range East and KD Range Complex training area has a similar distribution and composition of plant species to the Range West training area (Figure 3.3-2). The KD Range Complex has developed areas (e.g., KD Rifle Range, KD Pistol Range, 100-yard shotgun range, Rifle Range Road, and KD Range Complex administrative area), which are surrounded by vegetation that has been disturbed as a result of the development and ongoing use. The terrain is generally flat with exception of the man-made berms in the KD Rifle Range, KD Pistol Range, and 100-yard shotgun range. Throughout the training area there are numerous shallow sandy, cobbly desert washes that slope to the north.

Range Main Supply Route Training Area

The Range Main Supply Route training area is intermittently disturbed and sparsely vegetated with creosote bush – white bursage scrub habitat (Figure 3.3-3). The two existing unimproved, utility ROW access routes within this training area are sandy with vegetation concentrated along the border and occasionally growing in the roads. There are several buried gas pipelines on the edges of the existing utility access routes. In some areas, the buried pipelines have created berms that have altered the natural drainage patterns. The terrain is gently sloping and the substrate is sandy with rocks and cobbles throughout the training area. Various areas have eroded and portions of the existing utility access routes have washed away exposing many pipelines. Shrubs are sparsely distributed with creosote bush and white bursage dominant. There is also a strip of habitat that extends the length of the Range Main Supply Route training area that mainly supports a disturbed vegetation community.

Yermo Stables Training Area

The northern portion of the Yermo Stables training area is flat and the southern portion of the site has numerous undulating sandy mounds and includes the floodplain of the Mojave River. Allscale (*Atriplex polycarpa*) and creosote bush are the dominant shrubs in upland areas away from the Mojave River with desert willow (*Chilopsis linearis*), scale broom (*Lepidospartum squamatum*), and desert tea (*Ephedra californica*) dominant in low areas on the Mojave River floodplain. Sparsely disturbed shrubs include box thorn (*Lycium* spp.), cheesbush, sandpaper bush, and climbing milkweed (*Funastrum hirtellum*) (Figure 3.3-4).

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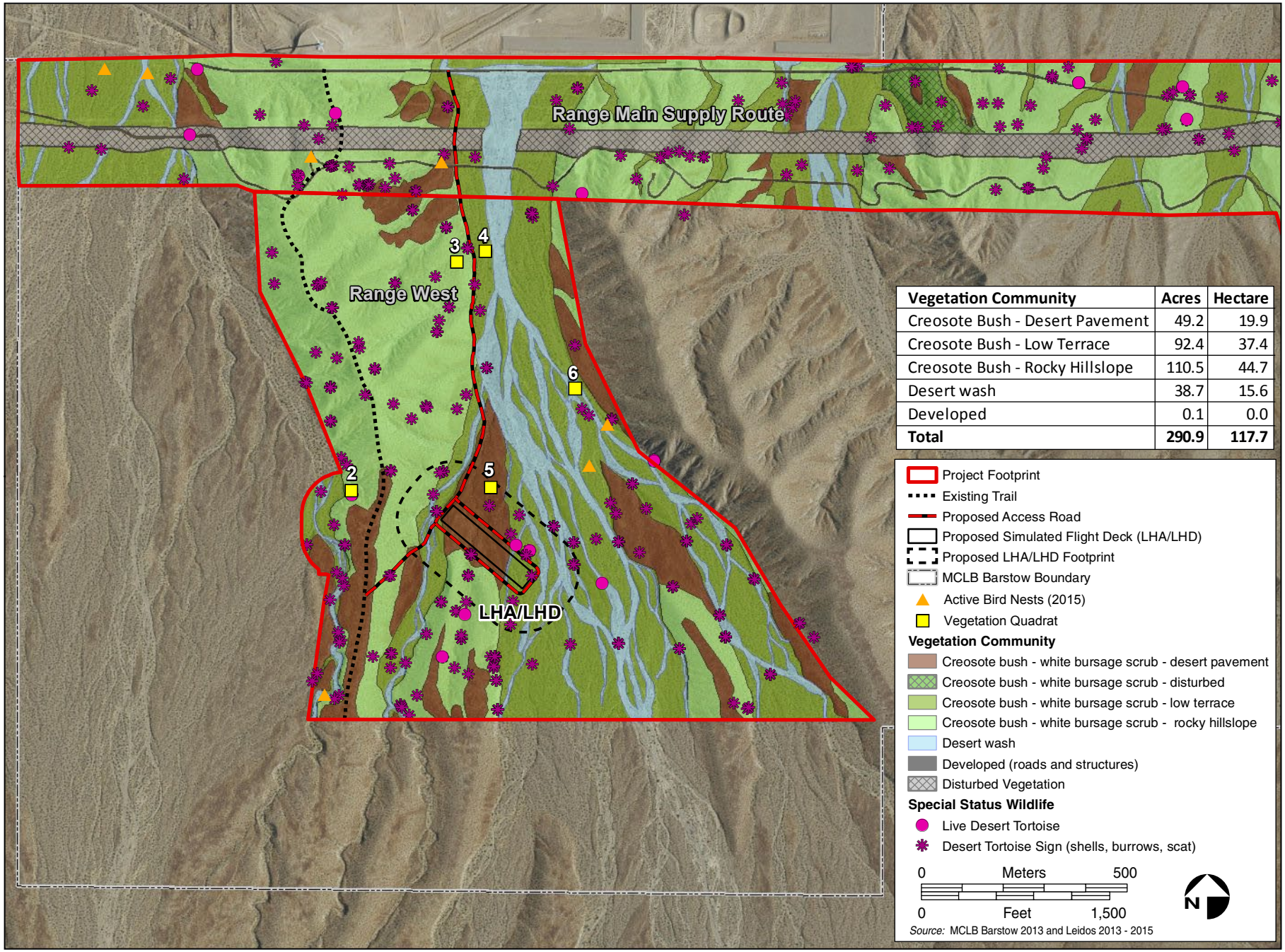
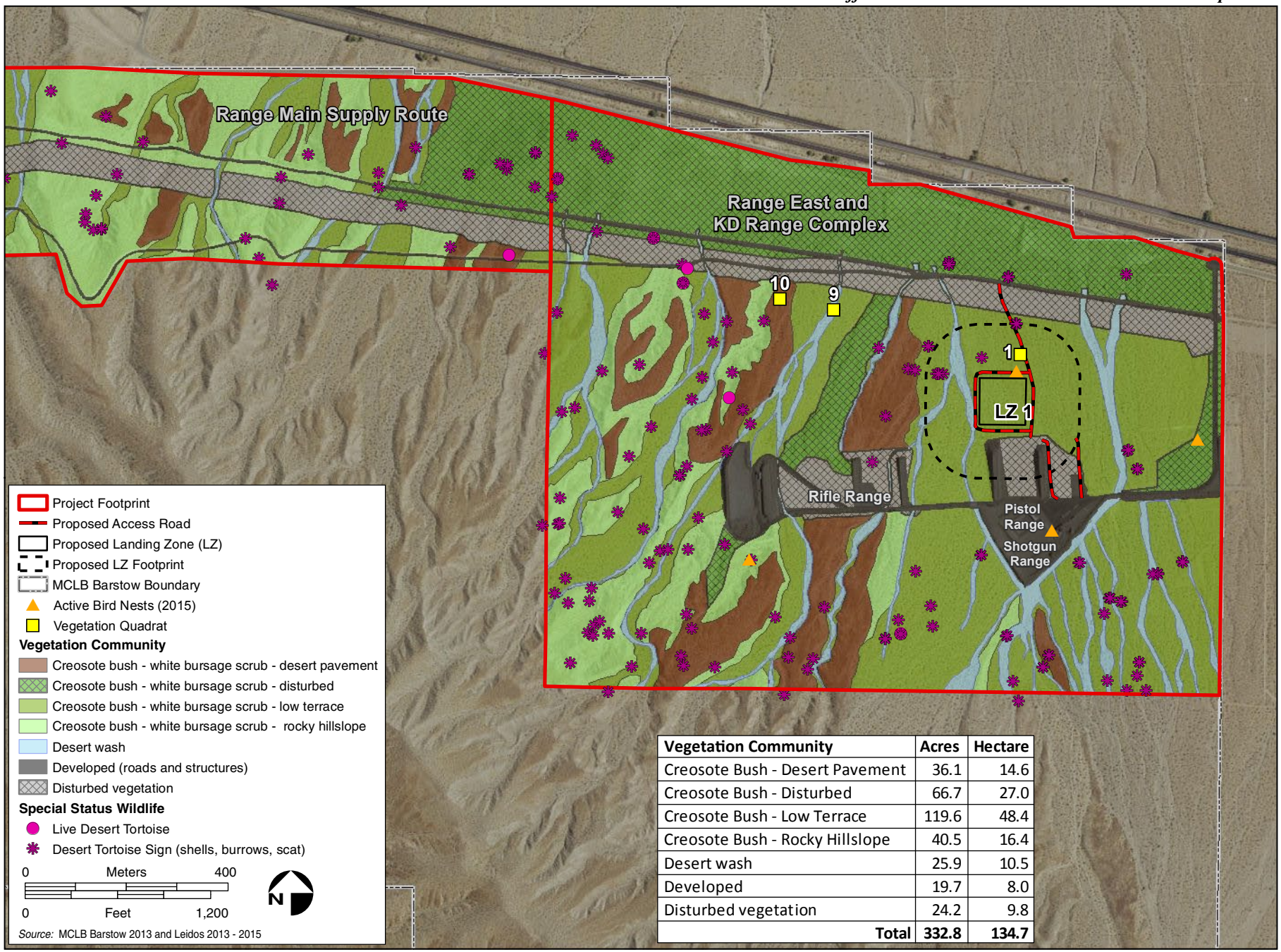


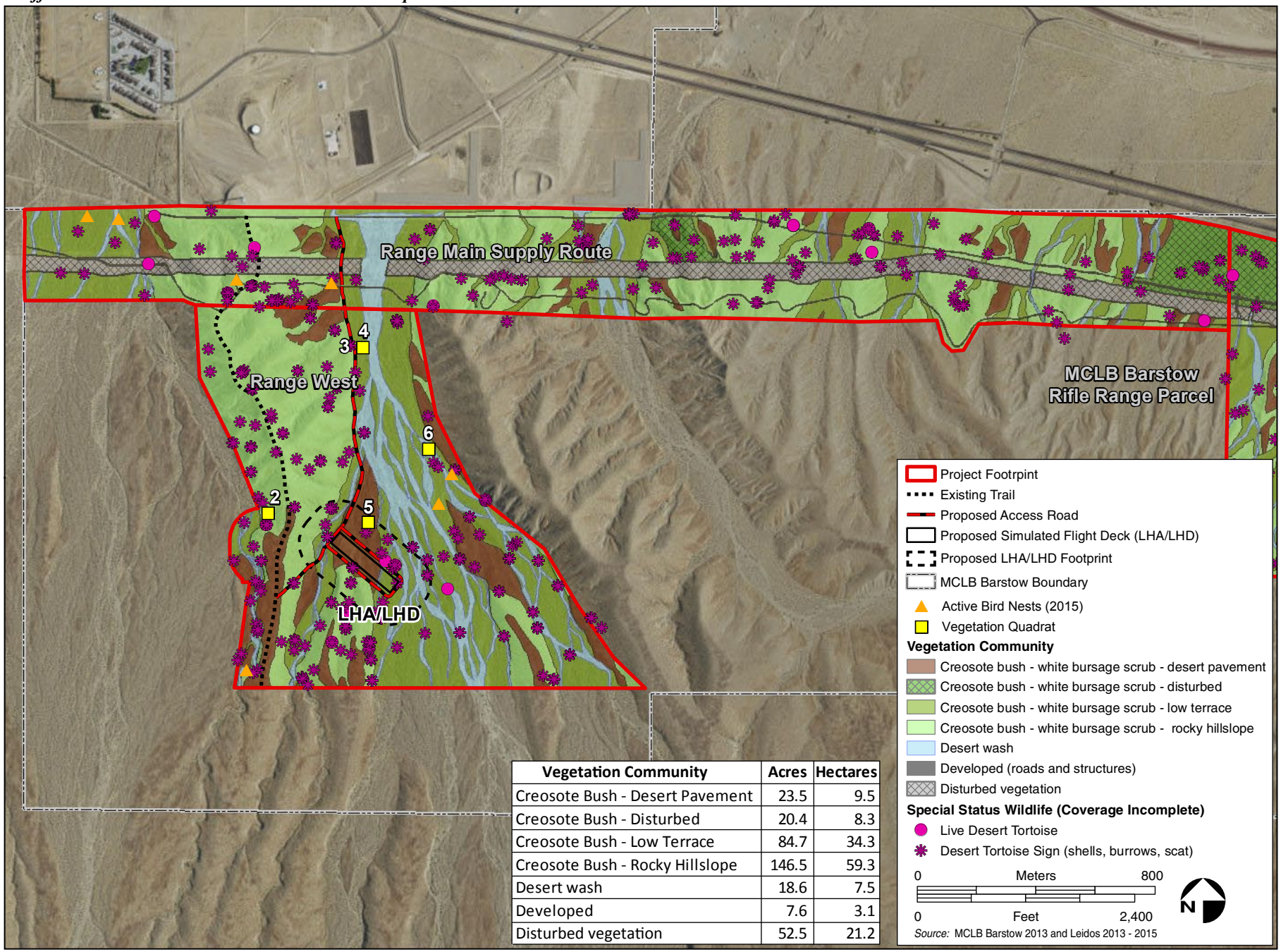
Vegetation Community	Acres	Hectare
Creosote Bush - Desert Pavement	49.2	19.9
Creosote Bush - Low Terrace	92.4	37.4
Creosote Bush - Rocky Hillslope	110.5	44.7
Desert wash	38.7	15.6
Developed	0.1	0.0
Total	**290.9**	**117.7**

Figure 3.3-1. Vegetation and Special Staus Wildlife Known to Occur in the Range West Training Area



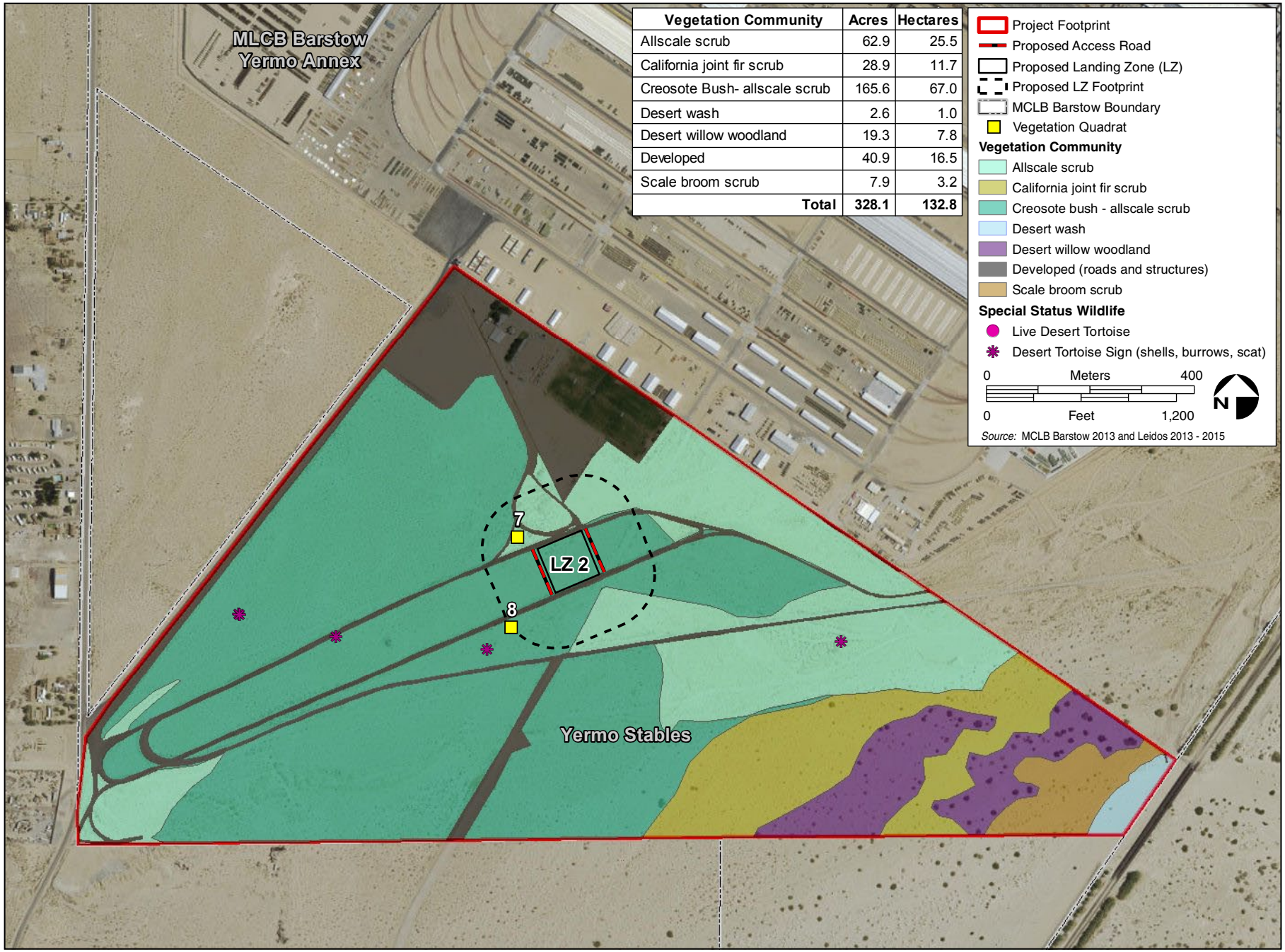
Vegetation Community	Acres	Hectare
Creosote Bush - Desert Pavement	36.1	14.6
Creosote Bush - Disturbed	66.7	27.0
Creosote Bush - Low Terrace	119.6	48.4
Creosote Bush - Rocky Hillslope	40.5	16.4
Desert wash	25.9	10.5
Developed	19.7	8.0
Disturbed vegetation	24.2	9.8
Total	**332.8**	**134.7**

Figure 3.3-2. Vegetation and Special Staus Wildlife Known to Occur in the Range East and the KD Range Complex Training Area



Vegetation Community	Acres	Hectares
Creosote Bush - Desert Pavement	23.5	9.5
Creosote Bush - Disturbed	20.4	8.3
Creosote Bush - Low Terrace	84.7	34.3
Creosote Bush - Rocky Hillslope	146.5	59.3
Desert wash	18.6	7.5
Developed	7.6	3.1
Disturbed vegetation	52.5	21.2

Figure 3.3-3. Vegetation and Special Staus Wildlife Known to Occur in the Range Main Supply Route Training Area



Vegetation Community	Acres	Hectares
Allscale scrub	62.9	25.5
California joint fir scrub	28.9	11.7
Creosote Bush- allscale scrub	165.6	67.0
Desert wash	2.6	1.0
Desert willow woodland	19.3	7.8
Developed	40.9	16.5
Scale broom scrub	7.9	3.2
Total	**328.1**	**132.8**

Figure 3.3-4. Vegetation and Special Staus Wildlife Known to Occur in the Yermo Stables Training Area

3.3.1.3 Plant Communities

The vegetation communities and classifications described in this EA follow *A Manual of California Vegetation* (Sawyer et al. 2009). An alternative category defined by Leidos was assigned to those areas that could not be described according to the Sawyer et al. (2009) classification system. This additional classification system was based on topographic features and disturbance patterns, and used similar techniques and categories as *Vegetation Mapping at the Barry M. Goldwater Range, Marine Corps Air Station, Arizona* (Malusa 2012), which incorporates topographic and landscape features when defining vegetation categories. Scientific nomenclature for plants follows *The Jepson Manual: Vascular Plants of California, Second Edition* (Baldwin et al. 2012).

Vegetation within the project footprint directly relates to the terrain or landforms present, which fall into three basic categories: (1) rocky slopes and ridges; (2) large desert washes; and (3) alluvial terraces with runnels (small channels) and minor desert washes. These landform categories differ in soil characteristics that are directly related to the amount of water available to plants and the degree of flash flooding, which together affect plant survival and the establishment of species. The project footprint includes three major cover types: (1) shrublands, which include Creosote bush – white bursage scrub (low terrace, desert pavement, and rocky hillslopes), Allscale scrub, Desert wash, California joint fir scrub, Scale broom scrub and disturbed vegetation; (2) woodlands, which include desert willow woodlands; and (3) developed communities (Table 3.3-1). In addition, disturbed forms of Creosote bush – white bursage scrub is present in the project footprint. Ten different cover types occur in the project footprint, and a general description of each is provided in subsequent sections. Table 3.3-1 lists the vegetation communities and associated acreages within the project footprint.

Table 3.3-1. Vegetation Communities within the Project Footprint

Cover Type*	Total Acres	Total Hectares	Percent of Project Footprint
Shrubland Communities			
Creosote bush–white bursage scrub			
Low terrace	296.7	120.1	22.7
Desert pavement	108.8	44.0	8.3
Rocky Hillslopes	297.6	120.4	22.8
Disturbed Creosote bush–white bursage	87.2	35.3	6.7
Creosote bush–allscale scrub	165.6	67.0	12.7
Allscale scrub	62.9	25.5	4.8
Desert wash	85.8	34.7	6.6
California joint fir scrub	28.9	11.7	2.2
Scale broom scrub	8.4	3.4	0.6
Disturbed vegetation	76.7	31.0	5.9
Woodland Communities			
Desert willow woodland	18.8	7.6	1.4
Developed Communities			
Developed	68.3	27.6	5.2
Total	1305.8	58.4	100
Notes: * = Sawyer et al. 2009.			

Shrubland Communities

Creosote bush – white bursage scrub. Creosote bush and white bursage are co-dominant with other shrubs not exceeding the cover of these two species. Other shrubs present include cheesebush, Mojave indigo bush (*Psorothamnus arborescens*), box thorn (*Lycium* spp.), ephedra (*Ephedra* spp.), purple heather (*Krameria erecta*), Mojave yucca (*Yucca schidigera*), and catclaw (*Senegalia greggii*). Creosote

bush – white bursage scrub is the most dominant habitat type and is present throughout the Range East and KD Range Complex and Range West training areas. Due to the extensive area this community represents it was subdivided based on topographic features, including low terrace, desert pavement, rocky hillslopes and desert washes.

- Creosote bush – white bursage low terrace

  This cover type occurs at the base of the slopes and is generally flat with shrubs dominant that are sparsely distributed with an average of 509 per acre (206 per hectare) (Table 3.3-2). Annuals are common in the understory.

Table 3.3-2. Vegetation Characteristics in Creosote Bush –White Bursage Habitats within the Project Footprint

Habitat Type	Shrub Density (acres) (± SE)	Creosote Shrub Height feet (± SE)	Creosote Shrub Width feet (± SE)	Number of Annual Plants/acre (± SE)	Number of Shrubs/acre (± SE)
Creosote bush – white bursage low terrace	509 (35.7)	4.9 (0.3)	7.1 (0.78)	47 (17)	60 (6)
Creosote bush - desert pavement	334 (29.2)	3.5 (0.28)	4.1 (0.21)	83 (19)	43 (0.9)
Creosote bush – white bursage rocky hillslopes	621 (150.1)	3.4 (0.18)	1.6 (0.09)	90 (15)	4 (1.2)
Creosote bush- white bursage desert Wash	395 (7.8)	4.5 (0.23)	6.8 (1.02)	72 (19)	90 (0.6)
Notes: Data presented as mean (± SE). SE = Standard Error. *Source*: Leidos 2015a.					

- Creosote bush - desert pavement

  This cover type is defined as the areas where desert pavement occurs and is typically on the upper terraces between small channels with a sparse vegetation cover with shrubs distributed at an average of 334 per acre (135 per hectare). Annuals are also sparsely distributed in these areas. Desert pavement within the project footprint differs in the degree to which it has been subject to weathering and some is very dark whereas others are lighter in color. On very weathered surfaces, typically isolated from overflow, well-varnished desert pavement consists of tightly packed stones and rocks. Other areas that have been exposed to overflow or disturbance are lighter in color and rocks are less tightly packed.

- Creosote bush – white bursage rocky hillslopes

  This cover type occurs on rocky slopes (over 20 percent). These areas are rocky with sparsely distributed shrubs with an average shrub density of 621 per acre (251 per hectare) and annual plants in the rock crevices.

- Creosote bush – white bursage desert washes

  Typically desert washes or small channels occur at the base of the hillslopes. This cover type has an average shrub density of 395 per acre (160 per hectare) with the highest shrub species richness of the creosote bush cover types.

Disturbed Creosote bush – white bursage scrub. This alliance is not included as a classification in Sawyer et al. (2009), but was assigned to areas that are more disturbed than creosote bush – white bursage scrub. Species composition is the same but forbs and bare ground are more abundant. Disturbed Creosote bush – white bursage scrub alliance is present within the Range Main Supply Route training area, which includes

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sandy dirt access routes with some vegetation growing through and Creosote bush – white bursage scrub along the borders.

Allscale scrub. Allscale is dominant in this community with creosote bush sparsely distributed. Other shrubs less frequent in occurrence include white bursage, cheesebush, and rabbit thorn (*Lycium pallidum* var. *oligospermum*). Allscale scrub is prevalent in the Yermo Stables training area.

Desert wash. Desert washes occur in the Range Complex and Yermo Stables training area. The desert washes on the Range Complex flow to the north and eventually to the Mojave River. Vegetation within the active flow channels is sparse and the areas along the banks, which are less frequently flooded, support a variety of shrub species including cheese bush, spiny senna, Mojave indigo bush, catclaw, desert thorn, purple heather, and sandpaper bush. Dominant shrub species vary amongst the washes (based on width, slope, time between flooding events, and volume of flood waters). The transition from desert wash to creosote bush - white bursage low terrace (described above) is fairly abrupt.

Desert wash in the Yermo Stables training area includes the Mojave River. At MCLB Barstow the Mojave River is ephemeral with flow only occurring during large storm events. There is no vegetation within the active flow channel. The low floodplain supports large shrubs, most of which are on sandy hummocks (i.e., low mounds or ridges) that form as a result of periodic high velocity flows.

California joint fir scrub. California joint fir scrub is dominated by desert tea (also known as California joint-fir) with allscale scrub less common. Associated species include alkali heliotrope, (*Heliotropium curassavicum*), sandpaper bush, red-root cryptantha (*Cryptantha micrantha* var. *micrantha*), and schismus. Desert tea and other associated shrubs occur in clumps about 3 to 4 feet (0.9 to 1.2 meters) tall, and 2 to 3 feet (0.6 to 0.9 meters) wide. California joint fir scrub occurs in the Yermo Stables training area in the low terrace of the Mojave River.

Scale broom scrub. Scale broom is dominant on hummocks on the Mojave River floodplain with schismus, red-root cryptantha, golden sun cup (*Chylismia brevipes),* sand dropseed (*Sporobolus cryptandrus*), Russian thistle, and red brome (*Bromus madritensis* ssp. *rubens*) present. Scale broom scrub occurs in the Yermo Stables training area adjacent to the Mojave River.

Disturbed vegetation. Disturbed vegetation occurs along the buried gas pipelines adjacent to the existing unimproved, utility ROW access routes within the Range Main Supply Route training area and in the KD Range Complex (e.g., KD Rifle Range, KD Pistol Range, and 100-yard shotgun range). Although the pipeline corridor was revegetated after disturbance, a scar remains with vegetation different from the surrounding natural vegetation communities. Schismus is common to dominant in many area with plants, (likely from seed that were planted as part of the revegetation), including desert marigold (*Baleya multiradiata*), fourwing salt bush (*Atriplex canescens*), and brittlebush (*Encelia farinosa*) scattered throughout the area. During the 2015 surveys, numerous dead shrubs were observed within the disturbed vegetation along the pipeline corridor. In the KD Range Complex, disturbed vegetation occurs adjacent to developed areas with cheesebush dominant.

Woodland Communities

Desert willow woodland. Desert willow (*Chilopsis linearis*) and salt cedar (*Tamarix ramosissima*) are the two dominant plant species in this community. Plants occur as large shrubs or small, multi-branch trees on hummocks with one or both species present. The size of the hummocks ranges from 10 to 50 feet (3 to 15 meters) wide. Desert willow woodland occurs in the Yermo Stables training area where it is confined to the low terrace of the Mojave River.

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Developed Communities

Developed. There is no Sawyer et al. (2009) equivalent to Developed. This category was assigned to all areas that have been constructed or physically altered such as urban structures or other developed land (e.g., semi-permanent structures and gravel roads). Developed habitat occurs in the Range East and KD Range Complex training area (i.e., KD Rifle Range, KD Pistol Range, 100-yard shotgun range, Rifle Range Road, and KD Range Complex administrative area) and in the Yermo Stables training area (i.e., old gravel test track). Vegetation is generally sparse on the developed lands either as a result of repeated disturbance and/or maintenance activities.

3.3.1.4 Non-Native Plant Species

Invasive, non-native plant species were observed in the project footprint. Species including saltcedar, Sahara mustard (*Brassica tournefortii*), schismus (*Schismus* sp.), red brome (*Bromus madritensis* ssp. *rubens*), London rocket (*Sisymbrium irio*), and Russian thistle (also known as tumbleweed [*Salsola tragus*]), were observed in the project footprint. Saltcedar, Sahara mustard and red brome are listed in the California Invasive Plant Council's (CalIPC) Invasive Plant Inventory with a "High" rating of invasiveness (i.e., species that have severe impacts on ecological processes, plant and animal communities, and vegetation structure). London rocket has a "Moderate" rating of invasiveness (i.e. these species have substantial and apparent—but generally not severe—ecological impacts on physical processes, plant and animal communities, and vegetation structure). Russian thistle and schismus are also on the CalIPC Invasive Plant Inventory with a "Limited" rating of invasiveness (i.e., ecological impacts are minor on a state-wide level, they have a low to moderate rate of invasiveness, and distribution is generally limited, although may be locally persistent or problematic) (CalIPC 2006). Overall, with the exception of schismus, invasive species were found in scattered, isolated occurrences within the natural communities and were typically more abundant in or near disturbed communities.

Saltcedar is generally a small tree or shrub that is often found where surface or subsurface water is available most of the year. Saltcedar can be prolific and when it occurs in dense numbers, it is known to cause dramatic changes in the geomorphology, groundwater availability, soil chemistry, fire frequency, plant community composition, and native wildlife diversity (Bossard et al. 2000). Saltcedar is present at one location in the Range East and KD Range Complex training area (i.e., KD Range Complex parking area). It is also common along the southeastern portion of the Yermo Stables training area, adjacent to the Mojave River, where it occurs as individuals and small clumps intermixed with desert willow.

Sahara mustard is an annual herb that is 4 to 40 inches (10 to 100 centimeters) tall and is especially common in areas with wind-blown sediments and is becoming increasingly frequent in the Mojave and Sonoran deserts and south coastal California. During rains, a sticky coat forms over the seeds that enable them to attach to passing animals or vehicles, allowing the plant to spread over long distances. Where Sahara mustard is abundant, it can increase fuel loads and alter fire regimes, which in turn results in a change of plant community as the species can survive fires and re-establish in burn areas (Bossard et al. 2000). In the project footprint, Sahara mustard was sparse, occurring as individual plants or small clumps with scatted plants. It was observed towards the eastern and western ends of the Range Main Supply Route, within a few desert washes in the Range Complex, and in the Yermo Stables training area adjacent to Yermo Dirt Road and the berm on the southern boundary.

Red brome is a fairly widespread annual grass that invades disturbed areas, roadsides, and natural areas, where it can increase fire frequency and convert habitat to annual grassland (CalIPC 2006). Red brome was present but sparse within the project footprint.

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London rocket is a winter annual forb/herb, which can be found in abandoned fields, roadsides, and orchards. A few scattered plants were present in the Range Main Supply Route training area and one dense patch of London rocket occurs on the western portion of the Yermo Stables training area adjacent to the berm.

Russian thistle is a large, bushy summer annual found throughout California that occurs in deserts, along roadsides, and in disturbed areas. After it dries, the plants are easily transported by wind where they impede traffic or can collect along fences or other barriers and create fire hazards (CalIPC 2006). Within the project footprint, this species was frequently observed within disturbed areas in the Yermo Stables training area.

Schismus (*Schismus arabicus* or *S. barbatus*) is a non-native annual grass species observed throughout the project footprint. Schismus has replaced native annual grasses in arid and semi-arid regions of California and also may compete with other annual species for limited nutrients in shrublands (Bossard et al. 2000). Schismus was sparse to common throughout the project footprint, occurring in both open areas and under shrubs in the Range East and KD Range Complex, Range West, Range Main Supply Route, and Yermo Stables training areas.

Cheat grass (*Bromus tectorum*) was observed in a few locations and has previously been reported in the Range Complex and Yermo Annex (MCLB Barstow 2005). Cheat grass is a widely distributed invasive plant and invades interior scrub, woodlands, grasslands, and desert shrub communities. Cheat grass displaces native vegetation and dense stands can interfere with the establishment of native perennial species. In the project footprint, cheat grass was observed in a few isolated locations that generally consisted of a few to several plants in the Range West and Range Main Supply Route training areas.

The project footprint is within the Mojave Weed Management Area, which has a list of target weed species to focus control efforts. Of the species included on the Mojave Weed Management Area list, red brome, Russian thistle, Sahara mustard, and saltcedar have been documented to occur on MCLB Barstow (MCLB Barstow 2005). None of the plants on the California Department of Food and Agriculture or the Federal Noxious Weed List (USDA 2012, Leidos 2015a) were found or are expected to occur in the project footprint.

3.3.1.5 General Wildlife

As a consequence of the harsh climatic extremes, limited habitat resources, and regional geographic barriers in the Mojave Desert, wildlife have adapted to the environment and provide an important function in the desert ecosystem. The project footprint lacks surface or open water sources for wildlife, with the exception of ephemeral pools that develop after seasonal storm events, and water that accumulates in tinajas (natural bedrock depressions) or in the Mojave River. Several wildlife species and/or their sign were observed during the 2013 – 2015 surveys. Rodent and small mammal sign was frequently noted throughout the project footprint and included the white-tailed antelope squirrel (*Ammospermophilus leucurus*), Merriam's kangaroo rat (*Dipodomys merriami*), desert woodrat (*Neotoma lepida*), black-tailed jack rabbit (*Lepus californicus*), and desert cottontail (*Sylvilagus audubonii*). A coyote (*Canis latrans*) was observed in the Range West training area and sign of bobcats (*Felis rufus*) and kit fox (*Vulpes macrotis*) were also documented.

Reptile species observed in the project footprint include side-blotched lizards (*Uta stansburiana*), Great Basin whiptails (*Aspidoscelis tigris tigris*), zebra tail (*Callisaurus draconoides*), desert horned lizard (*Phrynosoma platyrhinos*), desert spiny lizard (*Sceloporus magister*), and Northern desert iguana (*Dipsosaurus dorsalis dorsalis*). Snakes observed included gopher snake (*Pituophis catenifer*), western patch-nosed snake (*Salvadora hexalepis*), and coachwhip (*Masticophis flagellum*). Rattlesnakes

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(*Crotalus* spp.), especially sidewinders (*C. cerastes*), Mojave rattlesnake (*C. scutulatus*) and Southwestern speckled rattlesnake (*C. mitchellii pyrrhus*) were noted in the project footprint.

Twenty six bird species were observed during the surveys, common species included the common raven (*Corvus corax*), white crown sparrow (*Zonotrichia leucophrys*), sage sparrow (*Amphispiza belli*), verdin (*Auriparus flaviceps*), blue gray gnatcatcher (*Polioptila caerulea*), Black-throated sparrow (*Amphispiza bilineata*), loggerhead shrike (*Lanius ludovicianus*), and horned lark (*Eremophila alpestris*). Active nests of various birds including loggerhead shrike, red-tailed hawk (*Buteo jamaicensis*), blue-gray gnatcatcher, cactus wren (*Campylorhynchus brunneicapillus*), Scott's oriole (*Icterus parisorum*), common raven, Ash-throated flycatcher (*Myiarchus cinerascens*), rock wren (*Salpinctes obsoletus),* and mourning dove (*Zenaida macroura*) were observed in the project footprint. MCLB Barstow provides habitat for many neotropical migratory species, moving between California and countries to the south as part of their life cycle, and use habitats in between breeding areas and wintering areas for stopovers, feeding and resting (MCLB Barstow 2005).

3.3.1.6 Special Status Species

For the purposes of this assessment, special status species are those that are federally listed as threatened or endangered, proposed for listing as threatened or endangered, or are candidates for such listing under the ESA. Also included in this category are species protected by the Bald and Golden Eagle Protection Act, the MBTA, and EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*. Other special status species include those considered sensitive by BLM, CDFW, CNPS, and managed under the MCLB Barstow INRMP. Sensitive habitats include those that support endangered, threatened, or sensitive species and, therefore, are important to the conservation of these species. No federally or state-listed plant species were observed in the project footprint and; therefore, are not discussed further (refer to Appendix D-1 for details).

Federally Listed Species

Four federally listed threatened or endangered or candidate species were initially identified during informal consultation with the USFWS under Section 7 of the ESA as having the potential to occur in the vicinity of MCLB Barstow and therefore could occur within the project footprint (Leidos 2015a). These species are:

- Agassiz's desert tortoise (*Gopherus agassizii*), threatened; critical habitat;
- Southwestern willow flycatcher (*Empidonax traillii extimus*), endangered;
- Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), candidate; and
- Least Bell's vireo (*Vireo bellii pusillus*), endangered.

The project footprint was evaluated for the potential to support habitat for sensitive wildlife species that could occur in the region. Due to lack of suitable habitat and survey results, three federally listed or candidate species (i.e., southwestern willow flycatcher, western yellow- billed cuckoo, and least bell's vireo) were not carried forward for detailed analysis in this assessment. The only federally listed wildlife species (also listed as threatened in California and as a BLM special status species) documented in the project footprint is Agassiz's desert tortoise (*Gopherus agassizii*) (Table 3.3-3) (Gardner 2000; Lovio 2006; Walde 2007; USGS 2011; Leidos 2014; Leidos 2015b). Due to the known occurrence of desert tortoise within the project footprint, the USMC will consult with the USFWS under Section 7 of the ESA.

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Table 3.3-3. Federally Listed Threatened and Endangered Plant and Animal Species Known to Occur or Potentially Occur in the Project Vicinity

Species	Status Federal/State	Habitat/Occurrence in Project Footprint	Potential to Occur in the Project Vicinity/Species Carried Forward for Analysis
Agassiz's desert tortoise *Gopherus agassizii*	FT-CH/ST	Agassiz's desert tortoise occurs on rocky slopes in desert scrub to semi-desert grassland, as well as along desert washes, and extends into creosote bush terraces and rocky slopes. This species generally occurs in areas where soil is suitable for digging burrows and may be found in habitats ranging from flat areas to steep slopes of up to 40 percent. This species is known to occur throughout MCLB Barstow and is considered present; suitable habitat exists throughout the project footprint. Desert tortoises and desert tortoise signs were documented during 2013, 2014 and 2015 surveys. The southern portions of the project footprint in the Range Complex are adjacent to desert tortoise critical habitat.	Present/Yes
Southwestern willow flycatcher *Empidonax traillii extimus*	FE-CH/SE	Nests only in dense riparian vegetation associated with streams, rivers, lakes, springs, and other watercourses and wetlands. No suitable habitat present in project footprint thus the species is unlikely to occur there.	Low/No
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	FC/SE	Open woodland with clearings and thick, scrubby under-growth along watercourses. In California, large tracts (in excess of 49 acres [20 hectares]) of deciduous riparian woodland - generally absent from heavily forested and urban areas. No suitable habitat present in project footprint thus the species is unlikely to occur there.	Low/No
Least Bell's vireo *Vireo bellii pusillus*	FE-CH/SE	Riparian habitats including scrub and thickets in coastal southern California. Typically breeds in willow riparian forest supporting a dense, shrubby understory of mulefat (*Baccharis salicifolius*) and other mesic species. Breeds 15 March – 31 August, prefers to nest in a dense shrub layer between 2 to 10 feet (0.6 and 3 meters) from the ground. No suitable habitat present in project footprint thus the species is unlikely to occur there.	Low/No

Status:
Federal Status (determined by USFWS):
- FT Federally Listed Threatened
- FE Federally Listed Endangered
- CH Critical Habitat
- FC Candidate for Federal Listing

State Status (determined by CDFW):
- ST California State-Listed Threatened
- SE California State-Listed Endangered

Agassiz's desert tortoise (Gopherus agassizii)

On 4 August 1989, the USFWS published an emergency ruling listing for the Mojave population of the desert tortoise as endangered (54 FR 42270), and on 2 April 1990, this population was listed as threatened (55 FR 12178). On 8 February 1994, the USFWS designated approximately 6.45 million acres (2.6 million hectares) of critical habitat for the Mojave population of the desert tortoise in portions of California, Nevada, Arizona, and Utah (59 FR 5820–5846). DNA, geographic, and behavioral differences between desert tortoises east and west of the Colorado River, resulted in recognition of two species of desert

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tortoises: desert tortoises north and west of the Colorado River are recognized as Agassiz's desert tortoise (*Gopherus agassizii*); and tortoises south and east of the Colorado River are recognized as Morafka's desert tortoise (*Gopherus morafkai*) (Murphy et al. 2011). For specific details on the desert tortoise listing, range, life history, and critical habitat, see the USFWS *Federal Register* 55(63):12178–12191 (USFWS 1990), *Determination of Critical Habitat for the Mojave Population of the Desert Tortoise* (USFWS 1994 [59 FR 5820]). A Final Recovery Plan for the desert tortoise was published in June 1994 (USFWS 1994) and in 2011 a *Final Revised Recovery Plan for the Mojave Population of the Desert Tortoise* was published (USFWS 2011). The Plan identifies six recovery units and recommended the establishment of 14 Desert Wildlife Management Areas within the recovery units. MCLB Barstow is situated within the Western Mojave Desert Recovery Unit and is a part of the Ord-Rodman Desert Wildlife Management Area (USFWS 1994). There are approximately 541 acres (219 hectares) of desert tortoise critical habitat on MCLB Barstow, situated along the southern boundary of the Range Complex. The project footprint is not located within designated desert tortoise critical habitat, but the southern boundary of the project footprint in the Range Complex abuts critical habitat (Figure 3.3-5).

The desert tortoise is an herbivorous reptile found throughout the Sonoran and Mojave Deserts. The species occupies a variety of habitats from flats to rocky slopes, and is associated with the creosote bush scrub plant community at lower elevations and juniper woodland ecotones at higher elevations (USFWS 2011). Seasonal, annual, and geographic variations in rainfall affect the physiology, behavior, and ecology of desert tortoises (Henen et al. 1998). The desert tortoise spends much of the year underground in burrows to avoid extreme temperatures during summer and winter. The tortoise is active above ground during the spring, summer, and fall when daytime temperatures are below 90 °F (32 °C). Tortoises in the Mojave Desert region are most active in spring (April to May) and fall (September to October). The emergence of tortoises generally coincides with healthy growth of annual plants, which for the western Mojave Desert often occurs in spring, following fall and winter precipitation. Tortoises primarily eat annual forbs but will also forage on perennials (grasses and cacti), and will eat non-native species such as red-stem filaree (*Erodium cicutarium*) and schismus (Leidos 2015b). Desert tortoises derive much of their water requirements from the vegetation they eat and can go for extended periods without drinking.

The size of desert tortoise home ranges varies with location, year, and resource availability. Annual home ranges are highly variable both between and within populations (Franks et al. 2011; USFWS 2011) and range from 2.4 to 219 acres (1 to 89 hectares) (Franks et al. 2011; USFWS 2011). In the Mojave Desert, males moved farther per day, sometimes twice the distance of females (Franks et al. 2011). During productive years, desert tortoise show increased movement and increased home range size whereas during drought years they appear to restrict activity and spend more time in burrows. Desert tortoises have demonstrated a high degree of site fidelity and are hypothesized to have homing abilities, suggesting some degree of spatial awareness, but neither the mechanism nor the extent of these behaviors is well known (Hinderlie et al. 2015). Desert tortoises can live for more than 50 years and do not reach reproductive maturity until 14 to 20 years of age.

The decline of the desert tortoise is thought to be a result of a complex interaction of threats. Disease, along with urbanization, human access, military operations, and illegal use of off-road vehicles have been suggested to be the most serious threats to the desert tortoise (Darst et al. 2013). Predation by the common raven, feral/domestic dog, and coyote is also a threat, especially to juvenile tortoises. Several diseases and fungal infections have been identified in desert tortoise (USFWS 2008). Upper respiratory tract disease, cutaneous dyskeratosis or shell disease, and herpesvirus are the more frequently observed diseases (Jacobson et al.1991, Berry 1997). Upper respiratory tract disease is suspected to have caused huge declines in some desert tortoise populations in recent decades (Berry 1997). A variety of studies near MCLB Barstow have shown that the closer the proximity a desert tortoises is to human populations and human disturbances the higher incidence of disease in tortoises (Berry et al. 2015; Berry et al. 2006).

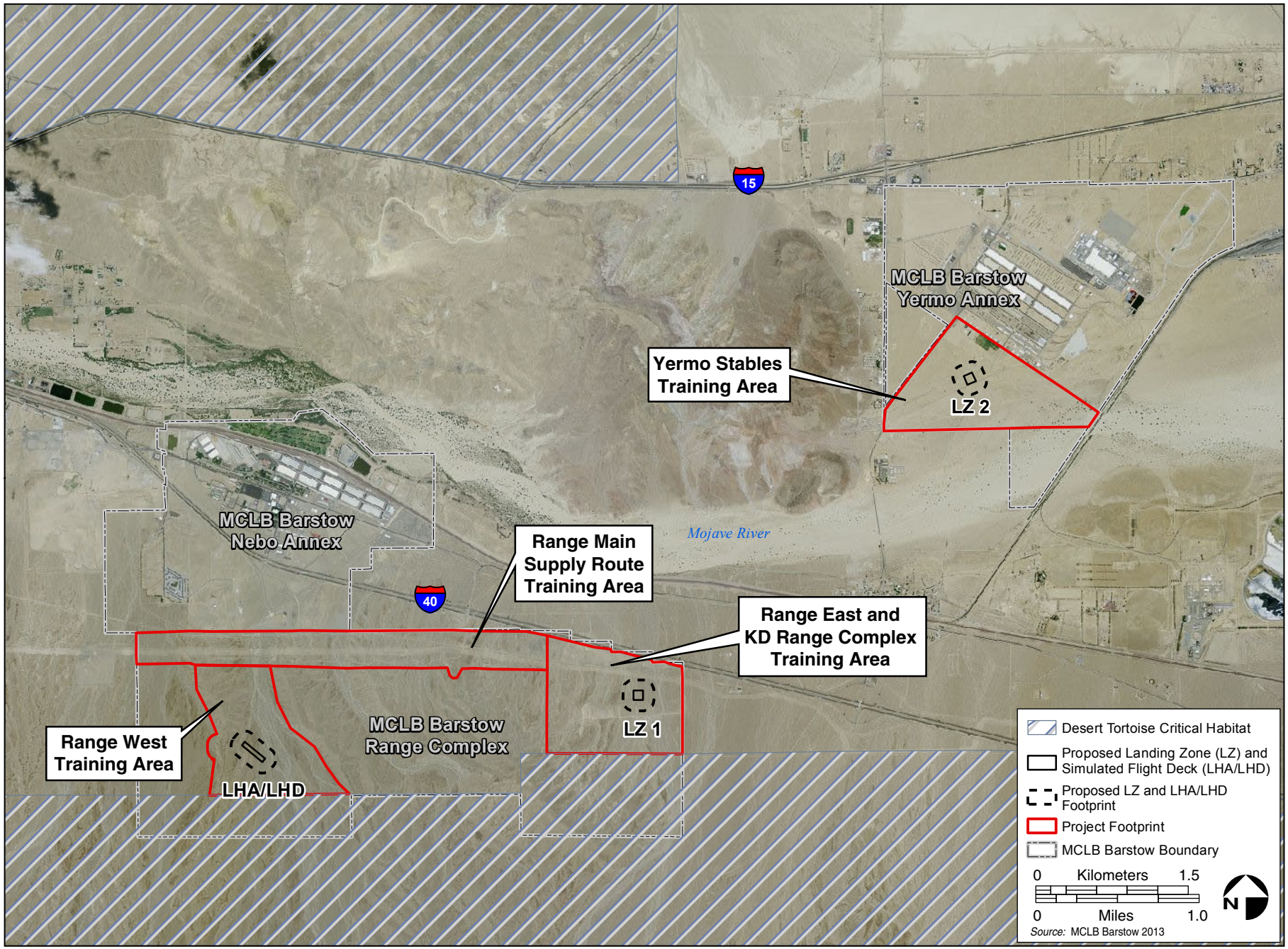

Figure 3.3-5. Location of Desert Tortoise Critical Habitat in the Project Vicinity

Unpaved roads and off-road vehicle and human activities have caused a substantial loss, degradation, and fragmentation of desert tortoise habitat (USFWS 2008). Vehicle travel and human activity on unpaved roads increases the risk of crushing a tortoise or burrow, can damage native vegetation, facilitate the establishment and spread of non-native vegetation, result in the loss and compaction of soil, generate increased particulate matter emissions, and likely result in direct desert tortoise mortality (Berry 1990; USFWS 2011\). Nafus et al. (2013) examined the abundance of Agassiz's desert tortoise near roads and found that relative abundance of tortoise sign was greatest along roads with low traffic volume (i.e., greater than 1 vehicle/day) compared to roads with intermediate (30–60 vehicles/day) and high (320–1100 vehicles/day) traffic volumes (Nafus et al. 2013). Additionally, tortoise sign was lower in proximity to roads with highest traffic volumes and increased with distances over 656 feet (200 meters) from roads.

Translocation is one strategy used to manage declining populations. Hinderlie et al. (2015) tracked eighty tortoises that were displaced distances of 0, 1.24, 3.1, and 5 miles (0, 2, 5, and 8 kilometers) from their source location. Forty four percent of the tortoises translocated 1.24 miles (2 kilometers) returned home and one tortoise translocated within 3.1 miles (5 kilometers) returned home. No tortoises translocated within 5 miles (8 kilometers) returned home. However, the understanding of effects of translocating tortoises is very limited and answers to key questions such as the distance a tortoise can be moved, the long-term survival of translocated tortoises, and the contribution of translocated tortoises on local gene pools remains unknown. Knowing the long-term consequences, other behavioral responses to translocation, and the impact these responses may have on individual survival rates of translocated individuals is essential to improve the likelihood of success of translocation as an impact reduction strategy (Hinderlie et al. 2015).

Details of desert tortoise life history and ecology, including knowledge of desert tortoise movements, home range, and activity patterns are still under investigation for the Mojave Desert (Franks et al. 2011). On MCLB Barstow Agassiz's desert tortoises are known to occur and have been documented since 1992. Studies have been conducted that focus on desert tortoise presence absence surveys (e.g., Walde 2007, 2013; Vernadero Group 2015), habitat use and utilization of steep slopes (Gardner 2000), and seasonal comparisons of desert tortoise sign (burrows, carcasses and live tortoises) on permanent research plots (Walde 2013). These surveys have documented a continued decline of the desert tortoise population on MCLB Barstow (Figure 3.3-6). Similar trends of declining population are being observed for the Ord-Rodman Tortoise Conservation Area of the western Mojave Desert recovery unit, with an average decrease in population of about -8 percent per year from 2004 to 2014 (USFWS 2015a).

On 21 to 24 October 2013, 27 April to 1 May 2015, and 26 to 30 May 2015, protocol-level surveys for Agassiz's desert tortoise were conducted within the project footprint (totaling approximately 1,306 acres [528 hectares]) (Leidos 2014, Leidos 2015b). Surveys were performed in accordance with the USFWS *2010 Field Season Pre-project Field Survey Protocol for Potential Desert Tortoise Habitats (Protocol)* (USFWS 2010). The surveys were conducted to determine the presence or absence of desert tortoises and their signs (e.g., burrows, scat, tracks, shell fragments, carcasses, or live tortoises). Table 3.3-4 provides a summary of the desert tortoise signs and survey results for 2015.

Agassiz's desert tortoise sign (carcasses, shell remains, scat, burrows, egg shell fragments, and live tortoises) was observed throughout the project footprint. The Range East and KD Range Complex, Range West, Range Main Supply Route, and Yermo Stables training areas showed evidence of desert tortoise, though presence of desert tortoise on the Range Complex was more recent than the Yermo Stables training area (Figures 3.3-1, 3.3-2, 3.3-3 and 3.3-4). A total of 13 live tortoises (12 adults and 1 juvenile), 112 carcasses, 228 burrows, and 27 scat were observed during the 2015 surveys (Leidos 2015b). A single observation of reproduction (egg-shell fragments) was observed and a juvenile was observed, but no neonate (i.e., hatchling) tortoises were observed. Reproduction in the project footprint is present.

Table 3.3-4. Desert Tortoise Survey Results

Sign Type/Training Area	Sign Class				
Burrows	Class 1 Currently active with tortoise or recent tortoise sign	Class 2 Good condition, definitely tortoise but no evidence of recent use	Class 3 Deteriorated condition but is definitely tortoise	Class 4 Deteriorated condition, possibly tortoise (no other corroborating sign)	Class 5 Good condition, possibly tortoise (no other corroborating sign)
Range West	40	20	13	1	3
Range East and KD Range Complex	22	23	12	4	4
Range Main Supply Route	39	23	14	1	4
Yermo Stables	0	1	1	1	0
Total	101	67	40	7	11
Scat	Class 1 Wet or moist but not from rain or dew or dried but with obvious odor	Class 2 Dry, dark brown, has a glaze, and some odor	Class 3 Dry, has no glaze or odor, is slightly bleached, is light brown, and plant fibers are tightly packed	Class 4 Dry, has no glaze or odor, is somewhat bleached, is light brown to pale yellow, plant fibers are not tightly packed, and has a scaly appearance	Class 5 Dry, has no glaze or odor, is bleached, is white, and consists only of plant fibers
Range West	0	3	8	0	0
Range East and KD Range Complex	1	0	2	0	0
Range Main Supply Route	1	2	4	3	3
Yermo Stables	0	0	0	0	0
Total	2	5	14	3	3
Carcass/Shell Remains	Class 1 Fresh or putrid	Class 2 Fresh or putrid, is of normal color and the scutes adhere to the bone	Class 3 Scutes are peeling from the bone	Class 4 Shell bone is falling apart and the growth rings on the scutes are peeling	Class 5 Disarticulated and scattered
Range West	1	1	12	9	20
Range East and KD Range Complex	0	2	12	4	26
Range Main Supply Route	0	0	10	5	9
Yermo Stables	0	0	0	0	0
Total	2	3	34	18	55
Live tortoise					
Range West	2	--	--	--	--
Range East and KD Range Complex	5	--	--	--	--
Range Main Supply Route	6	--	--	--	--
Yermo Stables	0	--	--	--	--
Total	13	--	--	--	--
Notes: Leidos 2015b provides additional details on desert tortoise occurrence and sign.					

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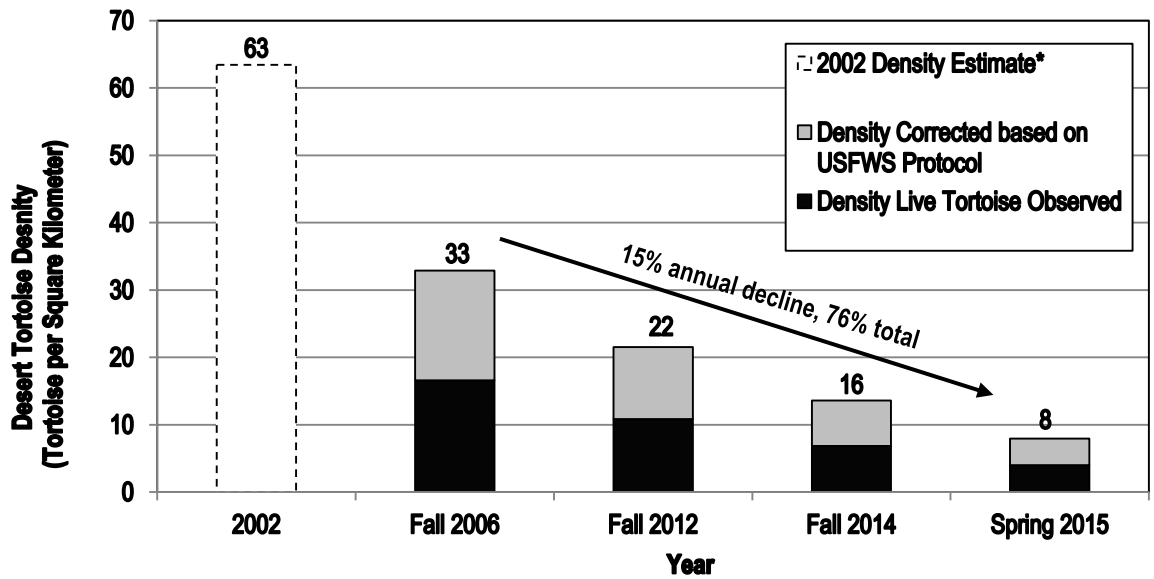
All live tortoises appeared to be healthy except one live tortoise (of undetermined sex) had an irregular shell with a deep depression on the rear right costal scute (Leidos 2015b). Forty-four percent (101) of the burrows documented were class 1, which are currently active with tortoise or recent tortoise sign and thirty percent (67) were class 2, which are definitely tortoise but no evidence of recent use. Less than one percent (11) of the burrows were noted as class 5, which are good condition, possibly tortoise. These results suggest the majority of desert tortoise burrows observed during the surveys were recent and active.



**The 2002 population estimate was based on the 2006 mark/recapture survey adding in the observed carcasses that were estimated to be less than 4 years old.*
** Graph created from data in sources Walde 2007, 2013, Vernadero Group 2015 [in prep].*

Figure 3.3-6. Desert Tortoise Density on Long Term Research Plots at MCLB Barstow

Within the project footprint, desert tortoises occur in a variety of habitats (Table 3.3-5). The project footprint consists of suitable substrate for burrow construction, areas of high forage quality, and numerous washes offering increased plant diversity and topographic variation. Most of the live tortoise and sign were observed in Creosote bush-white bursage scrub habitats (Table 3.3-5). The highest density of sign occurred in Creosote bush-white bursage scrub-rocky hillslope habitats followed by desert washes. Recent evidence of tortoises (burrows class 1 or class 2) was also noted within disturbed vegetation and in developed areas on man-made berms (Leidos 2015b). In the project footprint, tortoise burrows are primarily located under or adjacent to shrubs but are also found under rocks, in the banks of gullies and desert washes, especially on rocky hillsides. Gullies and desert washes often expose the resistant caliche layer found several feet below the surface in desert soils. Tortoise burrows were sometimes found underneath the resistant caliche (calcium carbonate) layer.

Based on the USFWS Protocol calculation method (USFWS 2010), 25.8 tortoises (greater than 6.3 inches [16 centimeters] in size) were estimated to occupy the project footprint in 2015 (Table 3.3-6). Habitat suitability within the project footprint is excellent in the Range West, Range East and KD Range Complex, and Range Main Supply Route training areas and low in the Yermo Stables training area.

Table 3.3-5. Desert Tortoise Occurrence and Associated Habitat within the Project Footprint

Vegetation Community	Live Tortoise	Burrows	Scat	Carcass/Shell remains	Total
Creosote bush – white bursage scrub-					
Rocky Hillslope	6	121	12	30	169
Low Terrace	2	38	3	45	88
Desert Pavement	1	13	1	20	35
Desert wash	0	20	3	14	37
Disturbed Creosote bush – white bursage scrub	2	20	3	1	26
Disturbed vegetation	2	9	4	2	17
Developed	0	3	1	0	4
Creosote Bush- allscale scrub	0	2	0	0	2
Allscale Scrub	0	1	0	0	1
California joint fir scrub	0	0	0	0	0
Desert willow woodland	0	0	0	0	0
Scale broom scrub	0	0	0	0	0
Total	13	227	27	112	379
Source: Leidos 2015b.					

Table 3.3-6. Estimated Desert Tortoise Density Based on 2013 and 2015 Surveys

Year	Live Tortoise	Project Footprint (acres)	Project Footprint (km^2)	Density Live Tortoise/km^2 Observed	Density Live Tortoises /km^2 Corrected[1]	Total Estimated Desert Tortoise in Project Footprint[1]
Fall 2013	4	422	1.7	2.3	4.6	7.9
Spring 2015	13	977	4.0	3.3	6.5	25.8
Notes: [1] Based on USFWS Protocol (USFWS 2010). *Source*: Leidos 2014; 2015b.						

Other Special Status Species

One special status plant species, the dentate blazing star (*Mentzelia tridentata)*, and two special status wildlife species, the burrowing owl *(Athene cunicularia)* and loggerhead shrike (*Lanius ludovicianus)* have been documented within the project footprint. A willow flycatcher has also been documented on MCLB Barstow; however, it was not verified to be the southwestern willow flycatcher *(Empidonax traillii extimus)*, a special status species. Willow flycatchers, including the southwestern willow flycatcher are not expected to occur within the project footprint due to lack of suitable habitat. There are nine additional special status plant species and three special status wildlife species that have the potential to occur within the project footprint (Table 3.3-7) (MCLB Barstow 2005; Leidos 2015a). Raptors, such as the prairie falcon, may forage or fly over the project footprint.

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Table 3.3-7. Special Status Plant and Wildlife Species Known to Occur or Potentially Occur in the Project Vicinity

Species	Status Fed/State/ CRPR	Habitat	Notes	Potential for Occurrence in Project Footprint
Abronia villosa var. aurita Chaparral sand verbena	--/--/1B.1	Annual herb that occurs in chaparral, coastal scrub, desert dunes; on sandy soils; 246 - 5,249 feet (75 - 1,600 meters). Blooms January –September.	Record of occurrence northwest of Barstow in 1976. No recent records from San Bernardino County. Species not observed during 2013 - 2015 surveys and is unlikely to occur in the project footprint.	Low to medium
Astragalus jaegerianus Lane mountain milkvetch	FE/--/1B.1	Perennial herb that occurs in creosote bush scrub, Joshua tree woodlands, washes and roadcuts, in sand or gravel; 2,953 – 3,937 feet (900 – 1,200 meters). Blooms April – June.	Known from small populations adjacent to and on Fort Irwin. The project footprint is above elevational range for this species. Species not observed during 2013 – 2015 surveys and it is unlikely to occur in the project footprint.	Low
Castela emoryi Crucifixion thorn	--/--/2.3	Thorny, deciduous shrub that occurs on playa, creosote bush scrub, Mojavean desert scrub, Sonoran desert scrub; 295 - 2,198 feet (90 - 670 meters). Blooms June – July.	Known to occur within 5 miles (8 kilometers) of the project footprint. Suitable habitat is present in the Range Complex and Yermo Stables training area but species was not found during 2013 - 2015 surveys.	Medium
Chorizanthe spinosa Mojave spineflower	--/--/4.2	Annual herb that occurs in creosote bush scrub and shadscale scrub in sand or gravel; 1,960 – 4,265 feet (600 – 1,300 meters). Blooms March – July.	Suitable habitat is present in the project footprint but not observed during 2013 -2015 surveys.	Medium
Cryptantha clokeyi Prickly cryptantha	--/--/1B.2	Annual herb that occurs in creosote bush scrub on rocky to gravelly slopes, ridge crests and desert woodlands; 2,789 – 5,413 feet (850 – 1,650m). Blooms April.	Suitable habitat is present in the Range Complex and Yermo Stables training area but not observed during 2013 -2015 surveys.	Medium
Cymopterus deserticola Desert spring parsley	--/--/1B.2	Perennial herb that occurs in creosote bush scrub and Joshua tree woodlands on sand soils; 2,297 – 4,921 feet (700 – 1,500 meters). Blooms March – May.	Suitable habitat is present in the Range Complex and Yermo Stables training area and but species not observed during 2013 – 2015 surveys.	Medium
Eriophyllum mohavense Barstow woolly sunflower	--/--/1B.2	Annual herb that occurs in desert chenopod scrub, Mojavean desert scrub and desert playas; on open silty or sandy areas; 1,640 – 2,953 feet (500 - 900 meters). Blooms April – May.	Known to occur within 5 miles (8 kilometers) of the project footprint. Suitable habitat is present in the Range Complex and Yermo Stables training area. Species not observed during 2013 -2015 surveys.	High
Menodora spinescens var. mohavensis Mojave menodora	--/--/1B.2	Deciduous shrub that occurs in Mojavean desert scrub, Andesite gravel, rocky hillsides and canyons; 2,264 – 6,562 feet (690 - 2,000 meters). Blooms April – May.	Known to occur within 5 miles (8 kilometers) of the project footprint. Suitable habitat is present in Range Complex but species not found during 2013 -2015 surveys.	Medium
Mentzelia tricuspis Spinyhair blazingstar	--/--/2.1	Annual herb that occurs in in Mojavean desert scrub, creosote bush scrub, Andesite gravel, rocky hillsides and canyons; 492 – 4,200 feet (150 – 1,280 meters). Blooms March – May.	Known to occur within 5 miles (8 kilometers) of the project footprint. Suitable habitat is present in the Range Complex. Species not observed during 2013 - 2015 surveys.	Medium to high
Mentzelia tridentata Dentate (creamy) blazing star	--/--/1B.3	Annual herb that occurs in Mojavean desert scrub, gravelly, rocky and sandy soil; 2,297 – 3,806 feet (700 – 1,160 meters). Blooms March – June.	Known to occur within 5 miles (8 kilometers) of the project footprint and recently observed west of Range East and KD Range Complex outside the project footprint. Suitable habitat is present in the Range Complex. Species not observed during 2013-2015 surveys.	Medium to high

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Table 3.3-7. Special Status Plant and Wildlife Species Known to Occur or Potentially Occur in the Project Vicinity

Species	Status Fed/State/ CRPR	Habitat	Notes	Potential for Occurrence in Project Footprint
Mimulus mohavensis Mojave monkeyflower	--/--/1B.2	Annual herb that occurs in Mojavean desert scrub, creosote bush scrub and Joshua tree woodlands, sandy or gravelly often in washes; 1,969 -3,937 feet (600 – 1,200 meters). Blooms April – June.	Known to occur within 5 miles (8 kilometers) of the project footprint. Suitable habitat is present in the Range Complex. Not observed during 2013-2015 surveys.	High
Pediomelum castoreum Beaver dam breadroot	--/--/1B.2	Perennial herb that occurs in creosote bush scrub, Joshua tree woodlands, sandy, washes and roadcuts; 0 - 5,003 feet (0 – 1,525 meters). Blooms April – May.	Known to occur within 5 miles (8 kilometers) of the project footprint. Suitable habitat is present in the Range Complex but species not observed during 2013 - 2015 surveys.	Medium
Phacelia parishii Parish's phacelia	--/--/1B.1	Annual herb that occurs on playas in creosote bush scrub, alkali sink; 1,772 - 3,937 feet (540 - 1,200 meters). Blooms April – May.	Known to occur within 5 miles (8 kilometers) of the project footprint. Suitable habitat (playas) not present thus is unlikely to occur in the project footprint.	Low
Mammals				
Antrozous pallidus Pallid bat	--/CSSC	Low elevation <6,000 feet (1,829 meters) rocky arid deserts, grasslands and canyon lands, higher elevation >7,000 feet (2,133 meters) coniferous forests. Roosts in rock crevices and basal tree hollows as well as in man-made structures. Mating: October-February, Parturition: April-July, Weaning: August.	May occasionally forage; roost sites not known and unlikely to occur within the project footprint.	Low
Corynorhinus townsendii Townsend's big- eared bat	--/CSSC	Found throughout California from sea level to 10,827 feet (3,300 meters). Occurs in a wide variety of habitats. Associated habitats include, coniferous forest, mixed mesophytic forests, deserts, native prairies, riparian communities, active agricultural areas and coastal habitats. Requires caves, mines, tunnels, buildings, or other human-made structures for roosting. Most mating occurs from November-February, births occur in May and June. Maternity roosts are warm areas found in caves, mines, tunnels, and buildings. Small clusters or groups (<100 individuals) of females and young form the maternity colony.	Move to hibernacula sites and stay from October to April. Known to occur north of the Yermo Stables training area about 3.5 miles (5.6 kilometers) in the Calico Mountains, where many old mines are present. May occasionally forage; roost sites not known and unlikely to occur within project footprint.	Low
Eumops perotis Western mastiff bat	--/CSSC	Uncommon resident in coastal ranges from Monterey County southward through southern California. Occurs in many open, semi-arid to arid habitats, including conifer and deciduous woodlands, coastal scrub, annual and perennial grasslands, palm oases, chaparral, desert scrub, and urban. In California, parturition may occur from early April through August or September but dates vary more for this species than for any other bat in the U.S. Nursery roosts described as tight rock or building crevices at least 35 inches (90 centimeters) deep and 2 inches (5 centimeters) wide.	May occasionally forage; roost sites not known and unlikely to occur within project footprint.	Low

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Table 3.3-7. Special Status Plant and Wildlife Species Known to Occur or Potentially Occur in the Project Vicinity

Species	Status Fed/State/ CRPR	Habitat	Notes	Potential for Occurrence in Project Footprint
Xerospermophilus mohavensis Mohave ground squirrel	--/ST	Occupies all desert scrub habitats in the western Mojave Desert including Joshua tree woodlands, creosote scrub, saltbush scrub and Mojave mixed woody scrub. Generally inhabits flat to moderate terrain. Primarily feeds on leaves and seed of forbs and shrubs from February to July and then begins period of estivation (summer inactivity). Breeding occurs after hibernation (winter dormancy) around February.	The Mohave ground squirrel was mapped about 3 miles (4.8 kilometers) southwest of the Range Complex and 3 miles (4.8 kilometers) southeast of the Yermo Stables training area.	Medium to high
Birds				
Athene cunicularia *Burrowing owl*	--/CSSC	Distributed throughout most of California in grasslands, shrub-steppes grasslands, savannas and open areas such as agricultural lands or vacant lots near human habitation. Burrows are usually in areas with a low, open cover that can provide good horizontal visibility. Nests are in abandoned burrows, such as those dug by prairie dogs, ground squirrels, foxes, and woodchucks. Nesting begins in spring, burrows are used for breeding nesting and brooding.	Previously documented on MCLB Barstow. Suitable habitat is present in the Range Complex and Yermo Stables training area. Several burrowing owl sightings were also recorded south of Barstow and approximately 2 miles (3.2 kilometers) from the Nebo Annex.	High
Empidonax traillii extimus Southwestern willow flycatcher	FE-CH/SE[1]	Nests only in dense riparian vegetation associated with streams, rivers, lakes, springs, and other watercourses and wetlands. In California, this bird breeds from near sea level on the Santa Margarita River to 2,640 feet (805 meters) at the South Fork Kern River and 3,000 feet (914 meters) at upper San Luis Rey River. Arrives on the breeding grounds between early May and early June. Successful breeders depart from breeding territories as early as mid-August, and fledglings probably leave the breeding area a week or two after adults, but few details are known.	Previously documented on MCLB Barstow in the Nebo Annex. Unlikely to occur in the project footprint because suitable riparian habitat is not present.	Low
Falco mexicanus Prairie falcon	--/CSSC BLM-S	Occupy a variety of habitats mainly treeless terrain that includes prairies, deserts, riverine escarpments, canyons, foothills, and mountains in relatively arid and semiarid shrublands and grassland habitats. Generally forage in open areas with low vegetation. Breeding begins about 2 years old and occurs from mid- February to mid-September with peak activity from early May to early August. Most nests in California have northern exposures.	Prairie falcons have been noted in the project vicinity and may visit MCLB Barstow to hunt for prey. Potential breeding sites have not been observed in the project footprint.	Medium to high

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Table 3.3-7. Special Status Plant and Wildlife Species Known to Occur or Potentially Occur in the Project Vicinity

Species	Status Fed/State/ CRPR	Habitat	Notes	Potential for Occurrence in Project Footprint
Icteria verens Yellow-breasted chat	--/CSSC	A migrant and summer resident primarily from late March to September. Occurs in riparian habitats with a well-developed shrub layer and an open canopy. Nests along the borders of streams, creeks, sloughs and rivers. Breeds from late April through early August.	Unlikely to occur in the project footprint because suitable riparian habitat is not present.	Low
Lanius ludovicianus Loggerhead shrike	--/CSSC BLM-S	Loggerhead shrike occurs in grasslands and open habitat with scattered shrubs and trees.	This species was observed on numerous occasions during 2013 – 2015 surveys. Active nests were documented in the project footprint.	High
Toxostoma lecontei Le Conte's thrasher	--/CSSC	Occurs primarily in sparsely vegetated desert flats, dunes, alluvial fans or gentle rolling hills with desert scrub, alkali desert scrub, and desert succulent shrub habitats. Often occurs in habitats with a high proportion of saltbush or shadscale species (*Atriplex spp.)* and /or cholla cactus (*Opuntia spp*.); also occurs in Joshua tree habitat with scattered shrubs. Territory defended most actively from early December–early February, with breeding occurring from February – June and peaks from mid-March–mid April.	Le Conte's thrasher has been recorded in Barstow within 4 miles (6.4 kilometers) of the Nebo Annex and just east of the Yermo Stables training area along the Mojave River.	Medium to high
Vireo bellii pusillus Least Bell's vireo	FE/SE	Occurs in dense willow-dominated riparian habitats with lush understory vegetation, nesting in the understory and using taller trees for foraging and singing perches. First eggs are laid in April.	Suitable habitat is not present within the project footprint thus is unlikely to occur.	Low
Amphibians				
Anaxyrus californicus Arroyo toad	FE-CH/CSSC	Ranges west of the desert in coastal area washes, arroyos, sandy riverbanks, riparian areas with willows, sycamores, oaks, cottonwoods. Extremely specialized habitat needs, including exposed sandy stream sides with stable terraces for overwinter and forage sites. Streams not necessarily perennial but do require a relatively long period of flow and occur from sea level to 4,400 feet (1,341 meters). Mating and egg-laying takes place from March to July at the quiet margins of shallow streams or pools free of predatory fishes with sandy or gravel bottoms without silt.	Arroyo toad uses low gradient riverine and adjacent floodplain habitats primarily. Suitable habitat is not present, thus is unlikely to occur in the project footprint	Low
Reptiles				
Gopherus agassizii Desert tortoise	FT-CH/ST	Rocky slopes in desert scrub to semi-desert grassland, as well as along washes, and extending into creosote bush flats. Generally occurs in areas where soil is friable (brittle) to dig burrows. Has been documented on rocky slopes of up to 40 percent. Breeds March – May.	Known to occur on the Nebo Annex, Range Complex, and the Yermo Stables training area. Desert tortoise sign documented in the project footprint during 2013 – 2015 surveys.	High

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Table 3.3-7. Special Status Plant and Wildlife Species Known to Occur or Potentially Occur in the Project Vicinity

Species	Status Fed/State/ CRPR	Habitat	Notes	Potential for Occurrence in Project Footprint
Fish				
Siphateles bicolor mohavensis Mohave Tui chub	FE/SE	Mohave Tui chub is mainly associated with deep pools and slough-like areas of the Mojave River. Spawning occurs when water warms in March or April. Fish spawn in mass over vegetation.	Suitable habitat not present and unlikely to occur within the project footprint.	Low

Status:

Federal Status (determined by U. S. Fish and Wildlife Service):

FE Federally Listed Endangered
FT Federally Listed Threatened
FP Federally Proposed for Listing
FC Federal Candidate for listing as threatened or endangered
CH USFWS-designated critical habitat occurs in the region.

California State Status (determined by California Department of Fish and Wildlife):

SE California State Listed Endangered
ST California State Listed Threatened
SR California State Listed Rare

California Rare Plant Rank (CNPS/CDFW):

List 1B: Plants rare, threatened, or endangered in California and elsewhere.
List 2: Plants rare, threatened, or endangered in California but more common elsewhere.
List 3: Plant about which we need more information- (A review list).
List 4: Plants of limited distribution (A watch list).

Threat Ranks:

0.1-Seriously threatened in California
0.2-Fairly threatened in California
0.3-Not very threatened in California

Notes:

The state of California considers any subspecies of willow flycatcher (*Empidonax traillii*) to be endangered

Sources:

MCLB Barstow 2005; CDFW 2011, 2015; Baldwin et al. 2012; CalFlora 2015; CNPS 2015

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Migratory Bird Treaty Act Species

The MBTA is an international agreement among the U.S., Canada, and Mexico that protects designated species of birds. Specifically, the MBTA controls the taking of these birds, their nests, eggs, parts, or products. Virtually all birds are protected under the MBTA, with only a few exceptions, such as the California quail (*Callipepla californica*). A complete list of all species of all migratory birds protected by the MBTA is in the Federal Register (50 CFR 10.13). EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, directs federal agencies to take actions to further implement the MBTA. A Memorandum of Understanding between the DoD and the USFWS was developed under EO 13186 to promote the conservation of migratory birds. Active nests of various migratory birds including loggerhead shrike, red-tailed hawk, blue-gray gnatcatcher, cactus wren, Scott's oriole, common raven, ash-throated flycatcher, rock wren, and mourning dove were observed in the project footprint.

3.3.1.7 Wetlands and Other Waters of the U.S.

Wetlands and other waters are protected under a number of laws and regulations. At the federal level, the Federal Water Pollution Control Act of 1972, more commonly referred to as the CWA (33 USC 1344), is the primary law regulating wetlands and surface waters. One purpose of the CWA is to regulate the discharge of dredged or fill material into waters of the U.S., including wetlands. Waters of the U.S. include navigable waters, interstate waters, territorial seas, and other waters that may be used in interstate or foreign commerce. To classify wetlands for the purposes of the CWA, a three-parameter approach is used that includes the presence of hydrophytic (water-loving) vegetation, wetland hydrology, and hydric soils (soils formed during saturation/inundation). All three parameters must be present, under normal circumstances, for an area to be designated as a jurisdictional wetland under the CWA.

Section 404 of the CWA establishes a regulatory program which provides that discharge of dredged or fill material cannot be permitted if a practicable alternative exists that is less damaging to the aquatic environment or if the nation's waters would be significantly degraded. The Section 404 permit program is run by the USACE with oversight by the USEPA.

Regional Water Quality Control Boards (RWQCBs) were established under the CWA to oversee water quality. In compliance with Section 401 of the CWA, the RWQCBs also issue water quality certifications for activities that may result in a discharge to waters of the U.S. This is most frequently required in conjunction with a Section 404 permit request.

Wetlands

Wetlands are defined under CWA regulations (33 *CFR* 328) as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

Three parameters are used in the field to delineate jurisdictional wetlands: wetland hydrology (inundation or soil saturation during at least 5 percent of the growing season, which is 18 days in southern California); hydric soils (soils classified as hydric or that exhibit characteristics of a reducing environment); and hydrophytic vegetation (more than 50 percent of dominant plants are adapted to anaerobic soil conditions).

A jurisdictional determination survey of the project footprint was conducted on 1 to 4 October 2013, 21 to 23 April 2014, 9 to 11 December 2014, and 20 to 23 April 2015. No potentially jurisdictional wetlands are located within the project footprint.

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Waters of the U.S.

Regulatory Guidance

Waters of the U.S. refers to areas under the USACE's jurisdiction pursuant to Section 404 of the CWA and are generally delineated in the field by the presence of an OHWM. However, guidance on the technical question of legal jurisdiction has changed recently. In May 2015, the Final Clean Water Rule was established by the USEPA and USACE (USEPA and USACE 2015). The final rule revises the existing definition of "waters of the United States," consistent with the CWA, science, the agency's technical expertise and experience, and Supreme Court decisions. The final rule establishes categories of waters that are jurisdictional and other categories that are excluded, as well as categories of waters that require a case-specific significant nexus evaluation to determine if they are waters of the U.S. and covered by the CWA.

The agencies define waters of the U.S. for all sections of the CWA to include TNWs, interstate waters, the territorial seas, impoundments of jurisdictional waters, covered tributaries, and covered adjacent waters. All waters that meet the definition of tributary are waters of the U.S. by rule, because tributaries and the ecological functions they provide, alone or in combination with other tributaries in the watershed, significantly affect the chemical, physical, and biological integrity of TNWs, interstate waters, and the territorial seas. Adjacent and neighboring waters included as waters of the U.S. include waters/wetlands within 1,500 feet (305 meters) of an OHWM (USEPA and USACE 2015). Waters in these categories are jurisdictional waters of the U.S. by rule; no additional analysis is required. This eliminates the need to make a case-specific significant nexus determination for covered tributaries or covered adjacent waters because the agencies determined that these waters have a significant nexus to jurisdictional waters. The agencies emphasize that the finding of jurisdiction for these covered tributaries and covered adjacent waters was not based on the mere connection of a water body to downstream users, but rather a determination that the nexus, alone or in combination with other of these covered tributaries or covered adjacent waters in the watershed, is significant (USEPA and USACE 2015).

In addition, the rule specifies that waters located within the 100-year floodplain of a TNW, interstate water, or the territorial seas, and waters located within 4,000 feet (1,219 meters) from the OHWM of TNWs, interstate waters, the territorial seas, impoundments, or covered tributaries may be found to have a significant nexus on a case-specific basis (USEPA and USACE 2015). Based on the Final Clean Water Rule, any channel with OHWM that is a tributary to a TNW has a significant nexus. They further clarify that if there is a break in the tributary but the upstream areas have bed and banks with OHWM, it would still be considered a tributary.

MCLB Barstow lies within the Mojave River watershed. The Mojave River spans over 120 miles (193 kilometers) from its headwaters in the San Bernardino Mountains to its terminus near Baker, California. Most of the Mojave River is ephemeral with flow only occurring after large storm events; however, some sections where bedrock forces the water to the surface are perennial during some years (e.g., the Narrows and Afton Canyon). Water flowing from the Mojave River into Soda Dry Lake and Silver Dry Lake ultimately evaporates with no outlet to the ocean. Therefore, the Mojave River and its tributaries are intrastate waters (e.g., not connected outside of the state) and isolated. A review of the streamflow data at two U.S. Geological Survey (USGS) gaging stations downstream of Barstow indicated that it has minimal capacity and susceptibility to be navigated by water craft and does not appear to meet the criteria for a TNW (Leidos 2015c). The USACE also has determined that the terminus of the Mojave River at Soda Dry Lake is not a TNW (Soda Mountain Solar Project, SPL-2010-01042-SLP, USACE 2013). The USACE has also recently determined that washes in closed basin watersheds adjacent or nearby the Mojave River Watershed are isolated, intrastate, and not TNW and, therefore, not under their jurisdiction (USACE 2015).

Based on the available evidence and recent jurisdictional determinations by the USACE in the project vicinity, the lower Mojave River adjacent to and downstream of MCLB Barstow appears to function as an isolated, intrastate system that lacks the presence of a TNW. Therefore, the analysis in this EA assumes, subject to verification by the USACE, that the desert washes within the project footprint are non-jurisdictional.

There are numerous unnamed ephemeral desert washes and gullies within the project footprint. A jurisdictional determination survey of the project footprint was conducted on 1 to 4 October 2013, 21 to 23 April 2014, 9 to 11 December 2014, and 20 to 23 April 2015. Several ephemeral surface water drainages supporting OHWMs are located within the project footprint. During the surveys, the floodplain and channels were surveyed throughout the project footprint to develop an understanding of the site characteristics. Cross-sections were selected that were perpendicular to channels that represented overall site characteristics. The hydrogeomorphic surfaces for each transect were mapped and data were taken on the evidence of water flow, sediment texture, and vegetation. Using aerial photography and the field data collected for the OHWM, desert washes were mapped within the project footprint (Leidos 2015c, Appendix D-3). Refer to Section 3.12, *Water Resources*, for additional details on surface water resources.

3.3.2 Environmental Consequences

Several types of impacts on biological resources could result from implementation of the proposed action, including permanent and temporary impacts, as well as direct and indirect impacts. The definitions of the four types of impacts to biological resources are described below.

- *Direct Impact*. Any alteration, disturbance, or destruction of biological resources (specifically through vegetation/habitat removal) that would result from project-related activities and occur at the same time and place as the action is considered a direct effect.
- *Indirect Impact*. As a result of project-related activities, biological resources may also be impacted in an indirect manner. Indirect impacts are defined as those impacts that are caused by, or would result from, a proposed action and are later in time, but are still reasonably certain to occur.
- *Temporary Impact*. Any impact to biological resources that is considered reversible can be viewed as temporary. Examples include the generation of fugitive dust during construction or the removal of plant communities for construction activities and subsequent revegetation of the affected area.
- *Permanent Impact*. Any impacts that result in the irreversible removal of biological resources are considered permanent. Examples include construction of a building or permanent road on an area containing biological resources.

Initial assessment of potential impacts on biological resources (e.g., vegetation, general wildlife, special status species, and habitats) was conducted by overlying the area of impacts on geographic information system (GIS) resource data obtained during the 2013-2015 surveys. The assessment of impacts on occupied desert tortoise habitat included a 350-foot (107-meter) buffer around the proposed LZs and LHA/LHD site and a 50-foot (15-meter) buffer around existing trails and proposed access roads. Occupied desert tortoise habitat was defined as all areas where desert tortoise sign (live tortoise, recently occupied burrows, scat, intact carcasses [class 1, 2 or 3], and tracks) was present. Desert tortoise density (i.e., the number of tortoises per unit area) was calculated based on protocol survey results and the estimated tortoise numbers calculated using the USFWS-approved methodology (Table 3.3-8; USFWS 2010). The GIS-based impact calculations provide a worst-case, conservative estimate of the potential impacts on biological resources within the project footprint. The analysis assumes that vegetation

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disturbance associated with military operations would be greatest in the proposed high-intensity training areas (Category 1).

Table 3.3-8. Desert Tortoise Density Estimates Within the Project Footprint

	Area (acres)	Area (square kilometers)	Tortoise Density per Square Kilometer	Total Estimated Desert Tortoise
Range Complex[1]	977	4.0	6.5	25.8
Yermo Stables Training Area	329	1.3	0	0

Notes: [1]The Range Complex includes the Range West training area, Range East and KD Range Complex training area, and Range Main Supply Route training area.
Source: Leidos 2015b.

3.3.2.1 Alternative 1

Vegetation

Construction

Proposed construction activities would result in impacts to vegetation. Ground disturbing activities would include: (1) grading and stabilizing the designated LZs, LHA/LHD site, access roads, bivouac sites, and vehicle loading/refueling areas; (2) installing the LHA/LHD landing platform; (3) constructing new 700-, 800-, and 900-yard firing lines at the KD Rifle Range; (4) upgrading the KD Rifle Range and 100-yard shotgun range; (5) raising the existing berms around the 100-yard shotgun range for safety purposes; (6) constructing new support facilities (e.g., tear gas facility, restroom facility, offices, lockers and storage sheds and tanks); (7) installing solar and security lighting; (8) utility infrastructure modifications; and (9) installing permanent fencing at the Yermo Stables training area. Alternative 1 would result in direct and indirect as well as temporary and permanent impacts to vegetation within the high-intensity training areas (Category 1) of the project footprint (Table 3.3-9).

Approximately 260.5 acres (105.4.6 hectares) of vegetation (i.e., 162.7 acres [65.8 hectares] on the Range Complex and 97.8 acres [39.6 hectares] in the Yermo Stables training area) would be permanently impacted during construction and subsequent operations. Vegetation in most of these areas would be destroyed and if any vegetation persists it would be in a somewhat diminished and disturbed state. Indirect impacts to vegetation would occur adjacent to high-intensity training areas (Category 1), which could result in alterations to the vegetation community structure and function.

Operations

GROUND TRAINING AND RANGE MAINTENANCE AND SUSTAINMENT

Proposed ground disturbing activities during operations would consist of: (1) construction and demolition of berms; (2) trenching to dig fighting positions and tank ditches; (3) convoy operations; (4) erecting temporary structures (e.g., tents, portable toilets, and showers/laundry facilities); (5) establishing personnel and equipment decontamination areas; (6) clearing and constructing road/trail obstructions; and (7) range maintenance activities.

Table 3.3-9. Alternative 1 – Vegetation Communities Potentially Disturbed

Vegetation Community	High-Intensity Training Area (Category 1) (acres)				Moderate-Intensity Training Area (Category 2) (acres)				Low-Intensity Training Area (Category 3) (acres)			
	Range East and KD Range Complex	Range West	Range Main Supply Route	Yermo Stables	Range East and KD Range Complex	Range West	Range Main Supply Route	Yermo Stables	Range East and KD Range Complex	Range West	Range Main Supply Route	Yermo Stables
Shrubland Communities												
Creosote bush – white bursage scrub				62.6	-	-	-	63.0	-	-	-	39.2
Low terrace	27.0	12.5	13.6	-	61.9	75.4	10.5	-	30.7	4.6	60.6	-
Desert pavement	0.5	13.5	2.7	-	17.0	25.4	1.9	-	18.6	10.3	19.0	-
Rocky Hillslopes	0.6	14.7	33.7	-	4.7	27.5	2.5	-	35.3	68.3	110.3	-
Disturbed Creosote bush – white bursage	10.3	-	3.1	-	18.4	-	-	-	38.0	-	17.4	-
Allscale scrub	-	-	-	35.2	-	-	-	21.8	-	-	-	5.9
Desert wash	3.4	3.8	3.3	-	14.5	32.6	6.0	-	8.0	2.3	9.4	2.6
Desert willow woodland	-	-	-	-	-	-	-	-	-	-	-	19.3
California joint fir scrub	-	-	-	-	-	-	-	-	-	-	-	28.9
Scale broom scrub	-	-	-	-	-	-	-	-	-	-	-	7.9
Disturbed vegetation	16.2	-	3.8	-	3.0	-	3.9	-	5.0	-	44.8	-
Total Acres	57.9	44.4	60.1	97.8	119.6	160.9	24.8	84.9	135.6	85.5	261.3	103.7

Direct and indirect impacts would occur to vegetation caused by ongoing operations in the proposed moderate-intensity (Category 2) and low-intensity (Category 3) training areas. Long-term vehicle traffic and training activities as well as range maintenance and sustainment activities would disturb existing vegetation communities and could prevent vegetation from re-establishing and, over time, alter the community structure and function. Vegetation in these areas is expected to persist, although likely in a somewhat diminished and disturbed state. Indirect impacts associated with ground training (e.g., convoy training, refueling operations, and tactical training) in the moderate-intensity and low-intensity training areas would be localized and result in moderate levels of vegetation disturbance within and adjacent to these areas. Ground training activities would also result in localized effects on vegetation adjacent to existing trails and proposed access roads. Ground training (e.g. off-road vehicles and foot traffic) would have the potential to damage native vegetation, facilitate the establishment and spread of non-native vegetation, and would result in the loss and compaction of soil that would likely affect vegetation communities.

Ground operations would also result in indirect, long-term, adverse impacts to existing vegetation communities through the potential introduction and spread of invasive non-native plant species. Areas where ground surfaces would be disturbed and/or existing native vegetation and soils could be damaged or destroyed would have the potential to provide suitable habitat for the establishment and spread of invasive non-natives. In addition, ongoing military ground training activities could also introduce invasive plant species by carrying seed on clothing, footwear, equipment, and/or vehicles. Invasive plants decrease the overall quality of habitat by out-competing native species, contributing to reduced diversity and structure, and reduced habitat functions and values. An increase in invasive plants also has the potential to increase the threat of wildfires. Although infrequent in desert areas, wildfires could also disturb shrublands, reducing overall shrub density and eliminating or greatly reducing the cover of fire-intolerant species and providing suitable habitat for invasive species. Many of the dominant desert plant

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species, including creosote bush, are slow to recover from fire, and larger fires could fragment vegetation, and recurrent fires could reduce the abundance and diversity of native forbs. Based on the type of proposed training activities, establishment of designated refueling areas, and the low level of available fuel, the potential for ground training activities to cause fire is considered low.

AVIATION TRAINING

Aviation training would result in the disturbance of loose surface debris and soil caused by downdraft and outwash from moving rotors (i.e., rotor wash) in the vicinity of takeoffs, landings, and near-surface hovering. The effects from rotor wash range from windblown vegetation to broken branches and scouring of soils to the extent that small shrubs and annuals can be uprooted. Rotor wash would result in dust and debris being scattered and becoming airborne in the immediate vicinity of the aircraft eventually settling on plants and soil. The extent of dust disturbance would depend on a variety of factors, including local soil characteristics, topography, presence of vegetation, and weather conditions. Dust deposits may affect essential plant processes, including photosynthesis, respiration, and transpiration; dust could also allow the penetration of phytotoxic gaseous pollutants or pathogens to nearby vegetation and may cause increased incidence of plant pests and diseases (Farmer 1993).

Aircraft operations at the designated LZs would have a low probability of directly affecting vegetation because these areas would be graded, leveled, and stabilized to reduce impacts from dust and debris. The LHA/LHD site would be constructed as a landing platform with a temporary modular structure that would resemble an amphibious assault ship deck. Proposed site improvements and ongoing training would make it difficult for vegetation to establish within the vicinity of the designated landing areas. However, plants could be damaged by aviation activities outside the LZs and LHA/LHD site within the general aviation areas.

Aviation training outside the designated LZs and LHA/LHD site would have the potential to damage native vegetation and result in the loss and compaction of soil that would likely affect vegetation communities where aircraft operations occur. Aircraft operations would also result in indirect, long-term adverse impacts to existing vegetation communities through the increased risk for the potential introduction and spread of invasive non-native plant species. Areas where ground surfaces would be disturbed and/or existing native vegetation and soils are damaged or destroyed would have the potential to provide suitable habitat for the establishment and spread of invasive non-natives. An increase in invasive plants also has the potential to increase the threat of wildfires. However, based on the type of proposed aviation training activities, establishment of designated landing areas, and the low level of available fuel, the potential for aviation operations to cause fire is considered low.

The potential for establishment or spread of invasive plants would be minimized with implementation of Special Conservation Measure 4 (*Invasive Plant Species Control*) and potential direct and indirect impacts to vegetation would be reduced with implementation of Special Conservation Measure 5 (*Restoration of Disturbed Habitats*), described in Appendix B. Therefore, no significant impacts on vegetation would occur.

General Wildlife

Construction

Alternative 1 would result in direct, permanent (i.e., removal of habitat caused by construction) and temporary (i.e., generation of dust and noise during construction) impacts to wildlife within the project footprint. Proposed construction would cause mortality of common, less-mobile wildlife species including reptiles, and small mammals; destruction of the burrows of small mammals and reptiles; and disturbance

of existing vegetation within the project footprint that provides habitat for wildlife. Direct impacts from construction activities would be greatest during active periods for specific wildlife species. Effects related to dust and noise would diminish with distance from the construction area. The most likely wildlife response to construction activities would be avoidance (flushing) of the area during the activity.

Operations

GROUND TRAINING AND RANGE MAINTENANCE AND SUSTAINMENT

Alternative 1 would result in direct, permanent (i.e., removal of habitat caused by ground operations) and temporary (i.e., generation of dust and noise during operations) impacts to wildlife within the project footprint. Direct effects of ground operations (i.e., ground training and range maintenance and sustainment activities) include mortality, destruction of burrows, and habitat disturbance as described above. In addition, Alternative 1 would result in permanent and temporary impacts to wildlife in the project vicinity due to increased noise, dust, and human activity. Proposed ground training and the use of munitions during training would potentially induce a startle response by wildlife and cause possible injury from being trampled or uncontrolled flight. Operations could cause wildlife to increase their expenditure of energy during critical periods, decrease the amount of time spent on life functions such as seeking food or mates, temporarily mask auditory signals from other animals, and put nests in the immediate vicinity of training activities at risk for abandonment and depredation (Manci *et al.* 1988; MCIWEST 2009). Direct impacts from ground operations are greatest when the military personnel or vehicles are within close proximity to occupied habitats. The most likely wildlife response to ground training and range maintenance and sustainment activities would be avoidance (flushing) of the area during the activity.

AVIATION TRAINING

Alternative 1 would result in direct, permanent (i.e. proposed aircraft operations) and temporary (i.e., generation of dust and noise during aviation operations) impacts to wildlife within the project footprint. Proposed aircraft activities would potentially induce a startle response by wildlife and cause possible injury from being trampled or uncontrolled flight. As described above, aviation operations could cause stress to wildlife, mask calls, and increase the risk of nest abandonment. Approximately 44 percent (429 acres [174 hectares]) of wildlife habitat in the Range Complex and 78 percent (255 acres [103 hectares]) of wildlife habitat in the Yermo Stables training area support suitable landing areas. The area directly under the aircraft would experience substantially greater impacts due to focused downwash, engine exhaust heat, and landing gear. Direct impacts from tactical landings would be greatest when the aircraft is within close proximity to occupied habitats, such as during take-offs/landings and hovering. Effects related to dust generation and wind velocities from aircraft operations (i.e., rotor wash) would diminish substantially beyond 100 feet (30 meters) from the aircraft (Bell Boeing 2008). The most likely wildlife response to tactical landing activities would be avoidance (flushing) of the area during the activity. Wildlife densities in the high-intensity training areas (Category 1), which include the designated LZs and the LHA/LHD site, would be low due to the lack of vegetation; however, wildlife densities in moderate-intensity (Category 2) and low-intensity (Category 3) training areas are expected to be greater due to increased vegetation and suitable habitat.

Implementation of Special Conservation Measure 5 (*Restoration of Disturbed Habitats*), described in Appendix B, would reduce effects on wildlife habitat in disturbed areas. Implementation of Special Conservation Measure 6 (*Vehicle Speed Limit Restrictions*) would limit vehicle speeds, which would minimize impacts to wildlife. The number of individual animals that could be lost due to proposed activities would be based on the general wildlife species present during the proposed activity. The overall quality of wildlife habitat in the project vicinity is high and would provide habitat for mobile species to relocate to another area on an as-needed basis. Therefore, no significant impacts on wildlife would occur.

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Special Status Species

Agassiz's desert tortoise

The Range West training area, Range East and KD Range Complex training area, and the Range Main Supply Route training area are located within portions of the Range Complex (Figure 2.3-1). The project footprint is approximately 40 percent (977 acres [395 hectares]) of the Range Complex (2,460 acres [996 hectares]) on MCLB Barstow. The Range Complex supports high quality desert tortoise habitat. Desert tortoise sign was identified in the Yermo Stables training area; however, there was no evidence of recent use by desert tortoise (Leidos 2015b). According to 2015 USFWS protocol surveys and estimated calculations using the USFWS (2010) methodology, 25.8 tortoises are estimated to occur within the project footprint (Table 3.3-9; Leidos 2015b). The project footprint supports juvenile desert tortoise and eggs; estimating densities of juvenile desert tortoises is difficult because of low detection probabilities due to their small size and cryptic nature (USFWS 2015b). Tortoise density within the project footprint (0.03 tortoises per acre [6.5 tortoises per square kilometer]) (Leidos 2015b) is similar to tortoise density (estimated at 0.03 tortoises per acre [7.9 tortoises per square kilometer]) outside the project footprint (Vernadero Group 2015 [in prep]).

CONSTRUCTION

Potential direct impacts to desert tortoise would occur during construction of the proposed LZs, LHA/LHD site, access roads, bivouac sites, and vehicle loading/refueling areas. Permanent impacts would be greatest in all designated high-intensity training areas (Category 1) where complete removal of habitat would occur (Figure 2.3-9 and 2.3-10). Impacts would include habitat degradation caused by vegetation removal, mortality or impacts from conflicts with vehicles and the associated damage or destruction of burrows that could have eggs, juveniles, or adult tortoises. Vehicular traffic on existing trails/access roads during construction activities could kill or injure tortoises. Tortoises that are removed to avoid harm in a construction area and/or from existing trails and access roads may be affected directly by physical stress of the handling and relocation (such as loss of bodily fluid), and, if moved beyond its home range, by associated stresses, such as lack of knowledge of cover site locations, burrows, and foraging areas.

The potential for mortality or injury would be highest when proposed construction activities occur during the peak season for desert tortoise activity (i.e., when tortoises are most likely to be above-ground). Potential mortality or injury to desert tortoises is likely to be proportional to the densities of desert tortoises at designated areas. The likelihood of direct impacts to desert tortoise during construction would decrease with distance from the areas of activity. On the Range Complex, proposed construction activities would occur on approximately 96 acres (38.7 hectares) and would have the potential to harass an estimated 2.5 tortoises. Construction activities would result in the permanent loss of 75 acres (30.3 hectares) of potential desert tortoise habitat (Table 3.3-10).

Table 3.3-10. Construction Impacts to Desert Tortoise

Activity	Area Affected (acres)	Desert Tortoise Harassed[1] by Construction	Desert Tortoise Affected by Permanent Habitat Removal
Existing Habitat Disturbed by Construction	96	2.5	0.0
Existing Habitat Permanently Removed by Construction	75	0.0	2.0
Notes: [1]Tortoises found within construction footprints would be relocated, which would result in harassment.			

Potential effects on desert tortoise at the Yermo Stables training area would be low compared to those at the Range Complex. Desert tortoise sign was identified in the Yermo Stables training area; however, there

was no evidence of recent use by desert tortoise. Potential impacts to habitat would be high in construction areas. Individual desert tortoises are unlikely to be affected because of the very low density or absence at the present time. Given the low quality of habitat in the Yermo Stables training area and very low to negligible tortoise population density, the potential for injury or mortality is low and no degradation of high quality desert tortoise habitat would occur. It is unlikely that any take would result from construction activities in the Yermo Stables training area.

OPERATIONS

Ground Training and Range Maintenance and Sustainment Activities

Proposed ground operations, including operations of tactical vehicles on and off-road, as well as range maintenance and sustainment activities are expected to result in direct impacts to Agassiz's desert tortoise and occupied habitat for this species within the Range Complex.

Within the Range Complex, direct impacts to desert tortoise during operations would be greatest in the designated high-intensity training areas (Category 1) where complete removal of habitat would occur. Impacts would also occur to a lesser degree in the moderate-intensity (Category 2) and low-intensity (Category 3) (Figures 2.3-9 and 2.3-10). Potential impacts would include habitat degradation, mortality or injury, and damage or destruction of burrows as described above under construction. As noted above, the likelihood of direct impacts to desert tortoise from operations (i.e., ground training and range maintenance and sustainment activities) would decrease with distance from the areas of activity.

Proposed ground training activities, which involve foot mobile patrols and vehicular traffic on and off existing trails/access roads, could increase the risk of harassing, killing, or injuring a tortoise and/or crushing a burrow (Table 3.3-11).

Ground training activities would have the potential to damage native vegetation, facilitate the establishment and spread of non-native vegetation, result in the loss and compaction of soil, generate increased particulate matter emissions, and likely effect desert tortoise habitat both in the project footprint and adjacent areas (Berry 1990; USFWS 2011). The removal of native plants makes finding shelter and food more difficult, increases exposure for individual tortoises, which could become more vulnerable to predation (particularly by predators attracted to human activity such as common ravens or coyotes). In addition, an increase in invasive plant species establishment could permanently modify existing plant communities and provide additional fuel that could pose a risk for wildfires. Desert tortoise movement patterns in the Mojave Desert vary, and home ranges have been noted to vary from 2.4 to 219 acres (1 to 89 hectares) (Franks et al. 2011; USFWS 2011). Individuals that occur within the project footprint may naturally move beyond the project boundaries and individuals and habitat adjacent to the project footprint could be indirectly affected by Alternative 1.

Table 3.3-11. Operations Impacts to Desert Tortoise (Range Complex)

Activity	Harassments	Kills
Ground Operations Impacts (per year)		
Tactical vehicle usage on roads	3.5	0.7
Range maintenance vehicles on road	1.9	0.4
Tactical vehicle dispersal off-road	9.2	0.9
Aircraft Operations Impacts (per year)		
Tactical landings (stop and go)	6.9	0.2
Total Operations Impact (per year)	21.5	2.2

Potential ground training impacts to desert tortoise were analyzed using tortoise density and the estimated on- and off-road vehicle area travelled on the Range Complex with a correction factor based on the percentage of the year tortoises spend in burrows, which was based on radio telemetry data. Radio telemetry data from MCLB Barstow suggests that desert tortoises are inside of their burrows, caliche cave, or rock shelters about 55 percent of the time from March to September (Gardner 2000). During the colder half of the year (October to February) it is assumed that tortoises are in their burrows 100 percent of the time. Therefore, annually, desert tortoises are estimated to be in burrows 75 percent of the time and above ground 25 percent of the time. The estimated vehicle miles travelled were converted to the total area covered by vehicles using the estimated average width of the vehicles that would be used during training and the average number of vehicles in a convoy (refer to Appendix D-4 for details). The total area covered by vehicle convoys was divided by the acres per desert tortoise then multiplied by the percent of the time that desert tortoises are above ground. It was assumed, since the roads on the Range Complex are dirt with a low traffic volume, there would be an equal probability for a tortoise to occur on a dirt road as in other habitats. Desert tortoise density, the area traveled by vehicles annually, and the percent of the year tortoises spend in burrows was used to estimate the number of annual vehicle tortoise encounters. Harassment was estimated to occur in 25 percent of the encounters and the crushing of tortoise was estimated to occur in 5 percent of the encounters based on an average vehicle driver's ability to detect a roadway hazard (Underwood et al. 2013). Overall, Alternative 1 includes approximately 23,800 miles (38,294 kilometers) of tactical vehicle travel on roads in the Range Complex which has the potential to harass 3.5 tortoises per year and crush 0.7 tortoises per year (Table 3.3-11). Alternative 1 also includes approximately 2,800 miles (4,505 kilometers) travelled for range maintenance and sustainment activities which have the potential to harass 1.9 tortoises per year and crush 0.4 tortoises per year (Table 3.3-11).

Impacts from off-road tactical vehicle usage were estimated using a similar approach to that used for on-road vehicles. The total vehicle miles travelled were converted to the area covered by vehicles using an average width of the tactical vehicles. No correction was made for the percent of time a tortoise is in a burrow because for off-road vehicle dispersal, desert tortoises would not be protected when they are in a burrow and would likely be crushed if run over by a vehicle. Collapsing of empty burrows, which was estimated based on the density of tortoise burrows (0.2 burrow per acre) observed during the 2015 surveys, was considered to be harassment (Leidos 2015b). Overall, it is estimated that Alternative 1 would include approximately 200 vehicles being dispersed off-road into tactical positions for training purposes per year. Off-road vehicle dispersal has the potential to harass 9.2 tortoises per year mainly due to the collapsing of burrows, and crush approximately 0.9 tortoise per year.

Designated desert tortoise critical habitat located adjacent to the project footprint could also be indirectly affected by proposed activities, including increased human activity and operations, within the Range Complex. An increase in noise and dust caused by proposed operations within the Range Complex could affect tortoises within nearby critical habitat. Additionally, long-term degradation of critical habitat could occur through the potential introduction and spread of invasive non-native plant species from the Range Complex into critical habitat. If a desert tortoise were to move from critical habitat to the project footprint it could also be directly impacted by operational activities.

Aviation Training

Aircraft operations associated with Alternative 1 at the designated LZs would have a low probability of directly affecting tortoises because these areas would be graded, leveled, and stabilized to reduce impacts from dust and debris. The LHA/LHD site would be constructed as a landing platform with a temporary modular structure that would resemble an amphibious assault ship deck. Proposed site improvements would make it difficult to burrow within the vicinity of the designated landing areas.

Aircraft operations outside the designated LZs and LHA/LHD site would have a higher potential of directly affecting tortoises. Burrows could be collapsed or damaged by aviation activities within the general aviation areas. Potential aviation impacts to desert tortoise were analyzed using tortoise density, time spent in burrows (as described above in Ground Training and Range Maintenance and Sustainment Activities), and the estimated area affected by aircraft during tactical landings (MCIWEST 2015). When desert tortoises are in borrows, caliche caves, or rock shelters, downwash impacts are expected to be minimal (except when directly under the aircraft). Based on an approach/takeoff downwash footprint, approximately 2.58 acres (1.1 hectare) would be affected by downwash during each tactical landing (MCIWEST 2015). The area directly under the aircraft (a 40-foot by 85-foot [12-meter by 26-meter] rectangle covering 0.07805 acre [0.03158 hectare]) would experience substantially greater impacts due to focused downwash, engine exhaust heat, and landing gear. To estimate the number of desert tortoise affected (harassed or killed) per tactical landing, the area affected by downwash was divided by the tortoise density and the likelihood of a tortoise being in a burrow (refer to Appendix D-4 for additional details). It is assumed that if the tortoise is in the burrow directly beneath an aircraft (75 percent of time), it may be harassed but not likely killed. Thus each tactical landing is estimated to harass 0.002 tortoises (each landing would affect 2.58 acres [1.04 hectares] per landing) and injure or kill 0.001 tortoises (each landing estimated to affect 0.07805 acre [0.03158 hectare] per landing). Approximately 44 percent (429 acres [173.6 hectares]) of the Range Complex (outside the designated LZs and LHA/LHD site) is suitable for tactical landings. Thus the proposed 438 annual tactical landings have the potential to harass 6.9 tortoises and injure/kill 0.2 tortoises per year (Table 3.3-11).

Desert tortoise may be also impacted by dust and noise generated from aircraft operations. Increased noise, dust, and aircraft activity would be localized and temporary, but could occur frequently with up to 3,868 individual aircraft operations (e.g., a touch and go or pad landing) per year. This frequency amounts to between 10 and 15 landings per day, which would be spread out over the project footprint so that individual tortoises would be exposed considerably less frequently. Dust generation due to aircraft operations at the designated LZs and LHA/LHD site would have a minor adverse impact on plant productivity, but could result in a minor reduction in available forage and cover. Noise could elicit temporary behavioral responses by tortoises or could possibly affect hearing thresholds. It is likely that desert tortoises would be subjected to some physical damage and stress from these impacts. Desert tortoise would be expected to resume normal activities following departure of the aircraft from the immediate area of the tortoise.

Proposed tactical aircraft operations in the general aviation areas would affect desert tortoise habitat by diminishing or removing vegetation in the vicinity of the landing area and potentially prevent vegetation from re-establishing, thus altering the community structure and function. Indirect impacts could occur through degradation of desert tortoise habitat, with potential damage to food plants, disturbance to soils, compaction of soils, which could impede burrowing, and potential replacement of native vegetation by non-native invasive plants.

Proposed aviation activities could cause indirect permanent and temporary impacts to desert tortoise critical habitat located adjacent to the project footprint. An increase in noise and dust could affect tortoises within critical habitat as described above under Ground Training and Range Maintenance and Sustainment Activities.

Effects Summary

Overall Alternative 1 would result in the removal of 163 acres (66 hectares) of desert tortoise habitat due to the enhancement of training areas and the high intensity of use surrounding those training areas (Table 3.3-12). An additional 305 acres (123 hectares) of desert tortoise habitat would be degraded by off-road vehicle dispersal and tactical landings in moderate-intensity training areas. The remaining habitat would

be subject to low intensity training, with 73 acres (30 hectares) impacted due to occasional foot mobile training and tactical landings and 410 acres (166 hectares) impacted by only foot mobile training.

Table 3.3-12. Long-term Operations Impacts to Desert Tortoise Habitat

Activity	Habitat Effect	Range Complex (acres)	Yermo Stables (acres)[1]
High-Intensity Training Area (Category 1)	High-intensity use would likely result in the complete loss of habitat over time.	163	98
Moderate-Intensity Training Area (Category 2)	Off-road vehicle dispersal and tactical landings would result in the moderate degradation of habitat over time but not loss.	305	85
Low-Intensity Training Area (Category 3) – Suitable for Tactical Landings	Tactical landings and foot mobile training would result in a low level of habitat degradation over time.	73	93
Low-Intensity Training Area (Category 3) – Not Suitable for Tactical Landings	Foot mobile training would result in minimal degradation of habitat over time.	410	11
Notes: [1]Desert tortoise sign was identified in the Yermo Stables training area; however, there was no evidence of recent use by desert tortoise (Leidos 2015b).			

The combined effects of proposed ground training, aircraft operations, and range maintenance and sustainment activities would likely reduce the desert tortoise population in the project footprint over time. Using the annual take estimates discussed above (Table 3.3-11) and adjusting the tortoise density each year while assuming no reproduction or migration, the tortoises within the project footprint would have a mortality of approximately nine percent per year (refer to Appendix D-4 for additional details).

Alternative 1 would include implementation of Special Conservation Measure 6 (*Vehicle Speed Limit Restrictions)*, Special Conservation Measure 7 (*MCLB Barstow Tortoise Management Representative*), Special Conservation Measure 8 (*Tortoise Education Program*), Special Conservation Measure 9 (*Vehicle Inspections)*, Special Conservation Measure *10 (Clearance Surveys during Construction)*, Special Conservation Measure 11 *(Tortoise Monitoring during Construction, Training, and Range Maintenance and Sustainment Activities)*, Special Conservation Measure 12 *(Pet Prohibitions)*, Special Conservation Measure 13 (*Waste Management*), Special Conservation Measure 14 (*MCLB Barstow Desert Tortoise Conservation Plan*), Special Conservation Measure 15 (*Annual Desert Tortoise Surveys and Reporting)*, Special Conservation Measure 16 *(Notify USFWS of any Take of Desert Tortoise)*, Special Conservation Measure 17 (*Delineation of Desert Tortoise Critical Habitat*), Special Conservation Measure 18 *(Predator Management)*, and Special Conservation Measure 19 (*Wildfire Prevention*), as described in Appendix B. These impact avoidance, minimization, and species conservation measures, as modified and possibly augmented during Section 7 ESA consultation for Alternative 1 and outlined in the Biological Opinion issued by USFWS, would be implemented to ensure the take and direct and indirect impacts to the desert tortoise are minimized.

Consultation

Proposed activities associated with Alternative 1 would be subject to consultation with the USFWS under Section 7 of the ESA. In 1993, the USFWS issued a Biological Opinion (1-8-93-F-16) to address operations and maintenance activities south of I-40 at MCLB Barstow. The 1993 Biological Opinion permits the following take: two desert tortoise per year in the form of direct mortality due to crushing by vehicles or other proposed activities; two desert tortoises in the form of direct mortality resulting from increased predation of desert tortoise; and ten desert tortoises through harassment associated with excavation of active burrows or movement of desert tortoises found above ground which must be moved to avoid harm. Following the 1993 Biological Opinion, a 1997 Biological Opinion (1-8-97-F-20R) was issued for maintenance and upgrades of firearm ranges and construction of a desert tortoise fence. The

1997 Biological Opinion permits take of one tortoise injured/killed and 15 tortoises in the form of harassment. In 2003, a Biological Opinion (1-8-03-F-26) was issued for installation of the perimeter fence that permits take of one desert tortoise and harassment of up to five tortoises. No take has been reported and/or identified in recent years, and there is no evidence that the current take has exceeded the 1993, 1997, or 2003 allowances. Because Alternative 1 is not covered under the existing Biological Opinions, a separate Biological Assessment is being prepared. Implementation of Special Conservation Measures 6 - 19, described in Appendix B, is proposed to minimize the estimated take associated with Alternative 1.

Other Special Status Species

Impacts to other special status species (i.e., dentate blazing star, burrowing owl, and loggerhead shrike) would be similar to those described above for general wildlife and the desert tortoise. Implementation of Special Conservation Measure 4 (*Invasive Plant Species Control)***,** Special Conservation Measure 5 (*Restoration of Disturbed Habitats),* Special Conservation Measure 6 *(Vehicle Speed Limit Restrictions*), Special Conservation Measure 10 *(Clearance Surveys during Construction and Range Maintenance and Sustainment Activities),* and Special Conservation Measure 20 (*Seasonal Avoidance for MBTA-protected Bird Species*), described in Appendix B, would minimize impacts to other special status species. Therefore, no significant impacts to other special status species would occur.

Migratory Bird Treaty Act Species

The project footprint supports suitable habitat for migratory bird species. Alternative 1 would result in the permanent alteration of approximately 85 acres (34 hectares) of vegetation within the project footprint. Due to the small amount of area that would be disturbed (i.e., less than one percent of the total project footprint) and the large amount of suitable habitat in the project vicinity, MBTA species would be expected to utilize suitable habitat adjacent to the project footprint. As discussed previously, increased noise and dust during construction and operations (i.e., ground and aviation training and range maintenance and sustainment activities) could temporarily affect the suitability of habitat within and adjacent to the project footprint, which would reduce the nesting success of MBTA species during the breeding season. Implementation of Special Conservation Measure 20 (*Seasonal Avoidance for MBTA-protected Bird Species),* described in Appendix B, would ensure that all proposed activities occur outside the breeding season for nesting birds protected under the MBTA. Therefore, no significant impacts on MBTA species would occur.

Permanent, direct impacts to MBTA species as a result of bird aircraft strikes have the potential to occur in the project footprint. However, bird-aircraft strikes occur infrequently and are primarily associated with take-offs and landings at airfields. There have been no documented bird aircraft trikes at MCLB Barstow. Low-level aircraft operations in the project footprint would be consistent with existing operations at MCLB Barstow. Potential impacts on MBTA species associated with the rare incidence of aircraft strikes are negligible.

Wetlands and Other Waters of the U.S.

No wetlands or other water bodies were recorded within the project footprint. Several ephemeral desert washes are located within the project footprint, but are not assumed to be jurisdictional waters of the U.S because they lack nexus with TNWs. However, final determinations regarding jurisdiction would be subject to verification and approval by the USACE. Therefore, no significant impacts on wetlands or waters of the U.S would occur.

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3.3.2.2 No-Action Alternative

Under the No-Action Alternative, existing training ranges and areas would not be enhanced to support combat readiness of USMC operating forces and limited ground training and live-fire marksmanship training at the KD Range Complex would continue under current conditions. Existing biological resource conditions would remain as described in Section 3.3.1, *Affected Environment*, and the potential disturbance to biological resources would be avoided. No impacts on biological resources would occur.

3.4 Cultural Resources

Cultural resources are comprised of districts, buildings, sites, structures, areas of traditional use, or objects with historical, architectural, archaeological, cultural, or scientific importance. They include archaeological resources (both prehistoric and historic), historic architectural resources (physical properties, structures, or built items), and traditional cultural resources (those important to living Native Americans for religious, spiritual, ancestral, or traditional reasons).

Historic properties are defined in the federal regulations outlining Section 106 of the National Historic Preservation Act (NHPA) of 1966 [54 USC §300101 *et seq.*], as amended, 36 *CFR* 800, as prehistoric and historic sites, buildings, structures, districts, or objects listed or eligible for listing on the National Register of Historic Places (NRHP), as well as artifacts, records, and remains related to such properties. Compliance with Section 106 of the NHPA, which directs federal agencies to take into account the effect of a federal undertaking on a historic property, is outlined in the Advisory Council on Historic Preservation's regulations, *Protection of Historic Properties* (36 *CFR* Part 800). A traditional cultural property can be defined generally as one that is eligible for inclusion in the NRHP because of its association with cultural practices or beliefs of a living community that are rooted in that community's history and are important in maintaining the continuing cultural identity of the community.

To be eligible for the NRHP, a property must possess integrity of location, design, setting, workmanship, feeling, and association, and meet the criteria for evaluation in at least one area of significance as defined by the *Secretary of the Interior's Standards for Evaluation* (36 *CFR* 60):

a. associated with events that have made a significant contribution to the broad patterns of American history; or

b. associated with the lives of persons significant in our past; or

c. embody the distinctive characteristic of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic value, or that represent a significant or distinguishable entity whose components may lack individual distinction; or

d. have yielded, or may likely yield, information important in prehistory or history.

Once the NRHP-eligibility of the properties has been determined, the federal agency must assess the effects that the undertaking or proposed action may have on any historic properties. MCLB Barstow will seek concurrence from the State Historic Preservation Officer (SHPO) on the determinations of eligibility for resources located within the project footprint and findings of effect from the proposed action. MCLB Barstow has initiated consultation with the SHPO in compliance with Section 106 of the NHPA. (Note to reviewers: This text will need to be updated if SHPO consultation has not been initiated prior to release of the Public Draft EA.)

The DoD's American Indian and Alaska Native Policy (1999) provides guidance for interacting and working with federally recognized American Indian governments. DoD policy requires that Bases provide timely notice to, and consult with, tribal governments before taking any actions that may have the

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potential to significantly affect protected tribal resources, tribal rights, or American Indian lands. Through consultation with federally recognized tribes who assert ancestral ties to the area, the federal agency attempts to identify any traditional cultural properties and sacred sites that may be affected by the undertaking. MCLB Barstow has initiated consultation with the following federally recognized tribes in compliance with the DoD Policy, as well as EO 13007, *Indian Sacred Sites*; EO 13175, *Consultation and Coordination with Indian Tribal Governments*; American Indian Religious Freedom Act; Presidential Memorandum on Government-to-Government Relations with Native American Tribal Governments; Section 106 of the NHPA; and NEPA: (Note to reviewers: This text will need to be updated if tribal consultation has not been initiated prior to release of the Public Draft EA.)

- Chemehuevi Reservation;
- Colorado River Indian Tribe;
- Fort Mojave Indian Tribe;
- Morongo Band of Mission Indians;
- Ramona Band of Cahuilla Mission Indians; and
- San Manuel Band of Mission Indians.

In addition, following guidance provided by California's Native American Heritage Commission, MCLB Barstow has included two American Indian groups that are not federally recognized:

- San Fernando Band of Mission Indians; and
- Serrano Nation of Mission Indians.

3.4.1 Affected Environment

The affected environment for cultural resources is based on the establishment of the area of potential effects (APE) of an undertaking. An APE is defined in 36 *CFR* 800.16(d) as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist." The APE, and therefore the affected environment, for the proposed action includes the project footprint that encompasses areas potentially disturbed during construction (i.e., establishing designated LZs, a LHA/LHD site, and access routes, KD Range Complex upgrades, new support facilities, and utility infrastructure modifications); ground and aviation training; and range maintenance and sustainment activities.

3.4.1.1 Prehistoric and Historic Setting

Prehistory

The most prominent chronological frameworks for the Mojave Desert are those proposed by Warren (1980) and Bettinger and Taylor (1974). Warren's (1984) terminology provides the general framework in the following discussion.

The earliest accepted period of human occupation in the Mojave Desert, termed Lake Mojave, is tentatively dated from about 12,000 to 7,000 before present (B.P.) (Warren 1984). In southern California, this period has also been termed San Dieguito or Playa (Rogers 1939). The Lake Mojave cultural complex was originally distinguished at a series of sites along the shorelines of ancient Lake Mojave, which encompassed modern Soda Lake and Silver Lake (Byrd and Pallette 1994). Absolute dates on stratified

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occupation horizons from this time period are rare, and the onset and termination of this period are uncertain.

Overall, sites of this time period are relatively infrequent and they may represent only brief occupations. They are characterized by a well-developed lithic industry with long-stemmed points (typically termed Silver Lake and Mojave points), large bifaces, crescents in simple lunate and more eccentric forms, large flake and core scrapers, choppers, scraper-planes, and hammerstones. Microcrystalline raw material is common, although other raw materials were also utilized (Byrd and Pallette 1994).

The Pinto period (5,000 to 2,000 B.P.) is defined largely on the presence of slightly shouldered, stemmed points with indented bases that are often lumped under the term Pinto (Warren 1984). Associated with these points are leaf-shaped bifaces, various unifacial tools including thick scrapers, and core-cobble tools. Pinto period sites are relatively few in number and are typically surface manifestations or lack well-developed middens (Warren 1984; Byrd and Pallette 1994). The settlement pattern is interpreted as highly mobile with most sites considered to be temporary, seasonal camps (Byrd and Pallette 1994). Pinto culture sites have been found on high terraces near former shorelines of sinks and along extinct rivers (Warren 1984).

The Gypsum period (2,000 B.P. to Anno Domini [A.D.] 500) is marked by intensified occupation of the Mojave Desert along with new technological developments, a broadening subsistence base, and the development of new socioeconomic ties with the California coast and the Southwest (Byrd and Pallette 1994). The hunting of large mammals appears to have been a significant part of the Gypsum subsistence pattern, although smaller faunal remains are also represented. Medium to large stemmed and notched points characterize the early part of the Gypsum period, indicating the continued use of the spear thrower. Milling bases and manos are common during the Gypsum period, indicating the increased reliance on hard seeds. The appearance of mortars and pestles has been interpreted as indicating the onset of mesquite bean exploitation (Warren 1984). The Gypsum settlement pattern includes large, intensively occupied sites located on the valley floors. Rogers (1939) suggested that these sites may represent permanent habitation sites, or at least areas that were repeatedly reoccupied over many years. The Gypsum period also saw the broader use of the landscape with canyon and upland areas being exploited. Late in the period, the occurrence of pit houses in the eastern Mojave Desert and the introduction of ceramics, along with shell beads and ornaments, suggest greater connection with the Southwest and California coast by Gypsum period peoples.

The Saratoga Springs period (A.D. 500 to 1200) is characterized by cultural divergence and increased regional variance within the Mojave Desert (Byrd and Pallette 1994). External influence and probably occupation by the Anasazi from the Virgin area and Patayan from the Colorado River has been hypothesized. Metates, manos, mortars, pestles, ceramics, and a variety of ornamental and ritual objects represent the cultural inventory. Rose Spring and Cottonwood Triangular series projectile points were used with the bow and arrow. Reliance on the exploitation of plants and small animals increased during this period. Tools became more specialized and were manufactured from a narrow range of locally available lithic resources (McGuire and Hall 1988). The presence of large village sites is first documented during this period (Byrd and Pallette 1994). The settlement pattern appears to shift from circulating to radiating in these areas, with temporary camps and processing stations situated around major habitation locations (McGuire and Hall 1988).

During the Late Prehistoric and Protohistoric periods, variation in the spatial distribution of ceramic types is the primary archaeological evidence used to distinguish spheres of influence within the Mojave Desert. Patayan influence appears early and continuously during the Protohistoric period, while Anasazi occupation was more restricted and short-lived (Byrd and Pallette 1994). Paiute Owens Valley brownware ceramics are most common north of the Mojave River, while Colorado buffwares are most common south

of the Mojave River (Byrd and Pallette 1994). Shell beads found in the Mojave Desert are evidence of trade with the southern California coast, and a trade route along the Mojave River Valley was well established.

History

The first Europeans arrived in the region in 1772, when Pedro Fages, commander of the Spanish forces in California, entered the area.

In the 1860s, a drought in parts of California caused cattlemen to move to the Mojave River Valley in order to feed their herds. To protect travelers and the ranchers from Indian attack, the U.S. Army established Camp Cady on the Mojave River, about 15 miles (24 kilometers) downstream from Daggett. This site was chosen for its abundant water supply (USDA 1986). The encampment was named for Major Albemarle Cady, 6th Infantry, then in command of Fort Yuma. For 3 months the Dragoons quartered themselves in temporary shelters of brush and mud or dugouts similar to those used later by the region's miners. The makeshift quarters were finally replaced by permanent structures built by the U.S. Army: Camp Cady, a 300-square yard (251-square meter) parade ground, with buildings arranged along three of its sides. The buildings were constructed of adobe, floored and shingle roofed, plastered outside, and plastered and whitewashed inside. The officers' quarters were the only structure with ceilings. Camp Cady served as the Base for a whole series of camps, redoubts, and forts along the Old Government Road to Fort Mojave and the Salt Lake Road, with campaigns waged against the Paiutes and Shoshones. Camp Cady was abandoned on 24 April 1871 (Hart 2013).

Gold, silver, and borax mines in the Mojave Desert and gold mining in the San Bernardino Mountains stimulated travel and settlement in the area from the middle to the end of the 19th century.

In 1882, the Southern Pacific Railroad started a line from the town of Mojave east to the Colorado River (USDA 1986). In 1885, the Santa Fe Railroad built a rail line north from San Diego through Cajon Pass and along the Mojave River. It joined the Atlantic and Pacific Railroad at a point 9 miles (14.5 kilometers) west of Daggett. The completion of this line stimulated activity in the Mojave Valley and influenced the establishment of Barstow, Victorville, and other settlements along the line (USDA 1986).

Waterman Junction was an intersection on the Santa Fe line. Originally, this location had been called Fishpond, but it was renamed Waterman Junction in honor of the governor of California, who owned a nearby silver mine (Hart 1987). It was renamed Barstow in 1886 after William Barstow Strong, president of the Santa Fe Railroad at the time (Leadabrand 1966).

The first traces of silver in the Calico Hills area were supposed to have been discovered by a man named Lee in 1875 (Leadabrand 1966). In 1880, a man named Porter, who operated a mill near Barstow, relocated some silver claims to the area (Leadabrand 1966). In 1881, Lowrey Silver made some discoveries on Calico Mountain and on 6 April 1881, S.C. Warden, Hues Thomas, John C. King, and others (possibly Frank Mecham and "Doc" Yaeger) founded the Silver King mine and the camp of Calico was established (Leadabrand 1966). The Silver King would go on to earn the title "the biggest and richest mine in California" (Leadabrand 1966). The California Division of Mines estimated that between $13 million and $20 million of silver was mined in Calico (Leadabrand 1966).

In 1882, a station on the railroad was located and named Calico, even though it was 7 miles (11 kilometers) away. This station was renamed Daggett in 1883 (Leadabrand 1966). Daggett became an important transportation and supply center for the mines. In 1905, the San Pedro, Los Angeles, and Salt Lake Railroad was constructed from Riverside to Daggett and then to Salt Lake City. This line was

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later purchased by the Union Pacific Railroad, and Yermo became a division point (USDA 1986). In 1883, borax was discovered east of Calico along a ravine that earned the name Mule Canyon after the 20-mule teams that would haul the borax to the railroad siding 12 miles (19 kilometers) away at Daggett (Leadabrand 1966). Also in 1883, a large fire swept through Calico destroying most of the buildings, but by 1884, the town had rebuilt and the community reached its peak population of 2,500 (Leadabrand 1966).

By the spring of 1882, there were 100 people living along Main Street in Calico. In 1888, a narrow-gauge railroad was built from a mill near Daggett past the site of Calico into the hills to the Waterloo Mine. Calico was served by the railroad (Leadabrand 1966). In 1892, the price of silver dropped and the railroad suspended operations. It operated again around 1899, but by 1903 the tracks had been removed. After 1903, only sporadic mining continued in the Calico area. Walter Knott, of Knott's Berry Farm fame, acquired the original property of the townsite at Calico from the Zenda Mining Company in 1951. Because of his strong family ties to the place, he began to restore Calico to its original frontier character (Leadabrand 1966). At present, Calico is a ghost town and a tourist attraction.

Military History

MCLB Barstow was constructed as a Navy Depot in 1942 (Willey et al. 2005). The USMC inherited the Base when it was turned over by the Navy in 1942 (Bricker 2012). The land had been purchased from its original owner, a sheepherder's wife, with the stipulation of having perpetual care given to her husband's gravesite on Base (Bricker 2012).

Barstow's geographic location at the junction of two transcontinental railroads and three major highways, as well as available land for expansion, made the Base the key USMC logistics center for West Coast operations (William Manley Consulting 1999). During the Cold War era, MCLB Barstow supplied, stored, maintained, and repaired equipment and vehicles for the USMC and other DoD organizations in the western U.S. and the Pacific (William Manley Consulting 1999). During the Vietnam War, MCLB Barstow supplied more than 70 percent of the supplies shipped to the Marines in Vietnam (William Manley Consulting 1999).

Most of the buildings and structures on MCLB Barstow were constructed between 1946 and 1989 for the Base mission of procuring, maintaining, repairing, storing, and distributing supplies in support of the USMC and other DoD installations west of the Mississippi and around the Pacific (William Manley Consulting 1999). MCLB Barstow contains the largest, single-story building in the USMC. This structure, Production Plant Barstow, Marine Maintenance Command (formerly known as Maintenance Center Barstow), is 440,000 square feet (40,877 square meters) (Bricker 2012). It has more than 300 product lines dedicated to repairing and overhauling ground equipment used by the USMC (Bricker 2012). On 28 December 2012, MCLB Barstow marked its 70th anniversary (Bricker 2012).

3.4.1.2 Cultural Resources within the Project Footprint

A records and literature search was conducted at the San Bernardino Archaeological Information Center of the California Historical Resources Information System at the San Bernardino County Museum on 17 September 2013 in support of the proposed action. This records search included a review of all available maps, reports, and site forms within a 1-mile (1.6-kilometer) radius of the APE. The record search was used to identify previous archaeological investigations and recorded cultural resources within 1 mile (1.6-kilometers) radius of the APE.

Thirty-three archaeological investigations have been conducted within 1 mile (1.6 kilometers) of the APE. Of the 33 previous studies, 6 studies occurred within the APE. These studies include: William Manley

Consulting (1996; 1999); Berryman and Bull (2003); Willey et al. (2005); Heidelberg (2009); and Daniels et al. (2011). In addition to the previous studies, Leidos surveyed previously unsurveyed portions of the APE in 2014 and 2015 (Leidos 2015d).

Archaeological Resources

Sixty-six previously recorded prehistoric or historic archaeological sites occur within a 1-mile (1.6-kilometer) radius of the APE. Of these cultural resources, 17 previously recorded sites are located within the APE. In addition to the previously recorded 17 archaeological sites, Leidos (2015d) recorded 26 archaeological sites and 116 isolated artifacts in the APE (refer to Appendix E for details). Four archaeological sites within the APE are considered to be potentially eligible for listing on the NRHP, including CA-SBR-73 (Rattlesnake Rock petroglyph site), MCLB-SITE-7 (rock ring), CA-SBR-8319 (sleeping circles), and CA-SBR-11840 (prehistoric rock ring). The Rattlesnake Rock petroglyph site also has been designated as a California Point of Historical Interest (No. 40), despite vandalism and location on an active training range. The remaining archaeological sites and isolates are considered to be not eligible for listing on the NRHP, pending SHPO concurrence (Leidos 2015d). MCLB Barstow is seeking concurrence from the California SHPO on the above determinations of eligibility.

Historic Buildings and Structures

There are no recorded historic buildings or structures located in or immediately adjacent to the APE.

Traditional Cultural Resources

There are no known traditional cultural recourses within or adjacent to the APE. However, it is possible that some of the previously identified archaeological resources within the APE are properties of traditional religious and cultural importance to American Indian groups. In compliance with Section 106, EO 13007, EO 13175, and the Presidential Memorandum on Government to Government Relations, MCLB Barstow continues to consult with interested tribal governments.

3.4.2 Environmental Consequences

The regulations implementing Section 106 of the NHPA require that federal agencies take into account the effects (impacts) of their undertakings (proposed actions) on historic properties (cultural resources that are eligible for nomination to the NRHP). Impacts on cultural resources are considered significant if a historic property, as defined under 36 *CFR* 60.4, would be physically damaged or altered, would be isolated from the context considered significant, or would be affected by project elements that would be out of character with the significant property or its setting.

3.4.2.1 Alternative 1

Proposed construction and operations activities could affect historic properties within the APE. In the Range West training area, potentially NRHP-eligible sites CA-SBR-11840 (a prehistoric rock ring) and MCLB-SITE-7 (rock ring) are located near an existing trail that would be improved to provide access to the LHA/LHD site and the southern project boundary. Site CA-SBR-11840 is also located within the LHA/LHD footprint and approach/departure flight path. Alternative 1 would also increase the level of operational activities (i.e., aviation and ground training and range maintenance and sustainment activities) within the proximity to these NRHP-eligible sites. However, implementation of Special Conservation Measure 21 (*NRHP-eligible Site Buffer Zone*), described in Appendix B, would require clearly defined limits of construction, ground training, aircraft operations, and range maintenance and sustainment activities to avoid impacts to potentially eligible archaeological resources within the APE.

In the Range East and KD Range Complex training area, NRHP-eligible site CA-SBR-8319 (a sleeping circle) is located near LZ-1 and the KD Range Complex. No construction is proposed within or adjacent to Site CA-SBR-8319 and this site is not located within the LZ-1 footprint and approach/departure flight paths or proposed bivouac areas. Implementation of Special Conservation Measure 21 (*NRHP-eligible Site Buffer Zone*), described in Appendix B, would avoid impacts to potentially eligible archaeological resources within the APE.

NRHP-eligible site CA-SBR-73 (Rattlesnake Rock Petroglyph Site) is located within the Yermo Stables training area, near an existing gravel test track, outside of the LZ 2 footprint and approach/departure flight paths. Implementation of Special Conservation Measure 21 (*NRHP-eligible Site Buffer Zone*), described in Appendix B, would require establishing a buffer zone beyond the existing fence that protects the site to avoid inadvertent impacts associated with increased activity in the surrounding area.

Although the APE has been intensively surveyed to identify historic properties, it is possible that subsurface archaeological material may be encountered during ground disturbing activities. Potential impacts to possible post-review discoveries would be minimized because MCLB Barstow would manage these resources in accordance with the NHPA and other federal laws and regulations, Marine Corps and DoD regulations, instructions, and orders, and DoD American Indian and Alaska Native Policy. MCLB Barstow would also follow the procedures stipulated in the MCLB Barstow Integrated Cultural Resources Management Plan (ICRMP) (Standard Operating Procedures) (MCLB Barstow 2011). Therefore, no impact on cultural resources would occur.

MCLB Barstow is seeking concurrence from the California SHPO on the above determinations of eligibility.

3.4.2.2 No-Action Alternative

Under the No-Action Alternative, existing training ranges and areas would not be enhanced to support combat readiness of USMC operating forces and limited ground training and live-fire training at the KD Range Complex would continue under current conditions. Existing cultural resources conditions would remain as described in Section 3.4.1, *Affected Environment*, and the potential disturbance to cultural resources would be avoided. All cultural resources within the APE would continue to be managed in accordance with the MCLB Barstow ICRMP and applicable federal laws, regulations, DoD policy, and Navy instructions. No impacts on cultural resources would occur.

3.5 Land Use

3.5.1 Affected Environment

3.5.1.1 Existing Land Uses

MCLB Barstow encompasses 5,567 acres (2,253 hectares) and is situated within the DoD Southwest Range Complex and MCIWEST-MCB Camp Pendleton AO. The key function and activity at MCLB Barstow is to receive, store, distribute, maintain, and repair military supplies and equipment and conduct training for mission-related and combat tasks. As one of only three logistics Bases operated by the USMC, MCLB Barstow serves an important role as a primary west coast Marine Corps Logistics and Maintenance Center. Its mission is twofold: to procure, maintain, store, and distribute supplies and equipment as needed; and to repair and rebuild USMC and other DoD equipment. Secondarily, MCLB Barstow is responsible for the technical training of Marines, including developing and maintaining their skills and job efficiency. Training at MCLB Barstow generally consists of annual marksmanship and tactical combat training, which occurs on a periodic basis based on training demands.

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MCLB Barstow is separated into three primary (functional) use areas (Figure 1.1.2): one range area (a live-fire KD Range Complex) and two cantonment areas (Nebo Annex and Yermo Annex). The project footprint is approximately 1,306 acres (528 hectares) and with the exception of the developed areas in the KD Range Complex, consists of mostly undeveloped, training and maneuvering areas in the Range Complex (i.e., Range West, Range East and KD Range Complex, and Range Main Supply Route training areas) and Yermo Annex (i.e., Yermo Stables training area).

The KD Range Complex is located southeast of the Nebo Annex and supports operations and training land uses. Rifle marksmanship training and sniper rifle proficiency training occur at the KD Rifle Range, pistol marksmanship training occurs at the KD Pistol Range, and shotgun and pistol training also occurs at the 100-yard shotgun range (Figure 2.3-5). The KD Range Complex also provides ancillary facilities, including a temporary tear gas training facility, target storage building (Building 252), pit operations building (Building 254), range office and classroom building (Building 249), shop building (Building 243), storage sheds, and support infrastructure (e.g., parking area, temporary portable restrooms, and bleachers). Units conducting live-fire marksmanship training at the KD Range Complex preclude concurrent use of the other training areas within the Range Complex. However, when the KD Rifle Range, KD Pistol Range, and 100-yard shotgun range are not active, the Range Complex supports various components of individual and unit-level training (i.e., land navigation, patrolling, and command/logistical support).

The Nebo Annex is located northwest of the Range Complex and functions as the MCLB Barstow headquarters. Primary land uses at the Nebo Annex include storage, housing and community support, utility functions, administration, operations and training, medical/dental clinics, maintenance/production, and open space (MCLB Barstow 2006).

The Yermo Annex is located east of the Nebo Annex and is primarily a storage and industrial complex. It also supports U.S. Army deployments for National Training Center rotations with a railhead and temporary billeting for soldiers supporting these operations. Primary land uses at the Yermo Annex include storage, maintenance/production, operations and training, housing and community support, utility functions, and open space (MCLB Barstow 2006).

3.5.1.2 Surrounding Land Uses

The areas adjacent to the project footprint include military and industrial land uses, undeveloped land, recreational areas, and low-density residential. The Desert View military housing area is located in the Nebo Annex 0.25 mile (0.4 kilometer) northwest of the Range Complex and community support facilities are located immediately north of the Yermo Stables training area (MCLB Barstow 2006). The Town of Daggett is located approximately 1 mile (1.6 kilometers) southwest of the Yermo Annex and the Town of Yermo is located approximately 1 mile (1.6 kilometers) northeast of the Yermo Annex. Scattered residential structures and a recreational vehicle park are located west of Daggett-Yermo Road and north of I-40.

3.5.1.3 Land Use Management Plans

Legal requirements and plans pertinent to land use and development within the project vicinity are described below.

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Marine Corps Installation West-Marine Corps Base Camp Pendleton Regional Range Complex Management Plan

The MCIWEST-MCB Camp Pendleton Regional RCMP provides planning guidance for USMC ranges, training areas, and airspace within the MCIWEST-MCB Camp Pendleton AO and other-Service range complexes and non-military lands used to support USMC training. The MCIWEST-MCB Camp Pendleton AO includes MCB Camp Pendleton, MCAS Miramar, MCAS Camp Pendleton, MCAS Yuma, and MCLB Barstow. These ranges and airspace are critical to the training and readiness of Marines and support the majority of training conducted by the Marine Corps. Guidance stipulated in the RCMP ensures that the USMC has regionally integrated range capabilities, which optimize the training assets (ranges, training areas, and airspace) needed to successfully execute USMC operations.

The RCMP contains guidelines and requirements that address several priorities including: regional MAGTF training; regional range shortfalls affecting unit training requirement; airspace access and encroachment; and range management data. The RCMP includes a strategic vision for regional range planning and management, an inventory of ranges and training areas in the MCIWEST-MCB Camp Pendleton AO, and requirements to develop linkages between ranges using non-DoD lands and airspace; identifies and enhance efficiencies and training opportunities for cross-utilization of DoD ranges; and includes range maintenance and sustainment guidelines, operational range clearance program guidelines, integrated natural and cultural resource management objectives, regional stakeholder outreach guidelines, range communications standardization goals, and strategies for implementing range requirements.

MCLB Barstow Master Plan

The MCLB Barstow Master Plan provides a basis for evaluating land use impacts. The Master Plan contains overall land management guidelines based on a consideration of the location of the Base, its infrastructure, operations, and natural resources. The Master Plan assesses existing conditions (including current inconsistent land uses), documents existing needs and future expectations, and provides recommendations for future development at MCLB Barstow. Conformity with these guidelines is a key factor as to whether a specific land use is suitable for a given site or area (MCLB Barstow 2006).

3.5.2 Environmental Consequences

The land use analysis addresses the potential for the proposed action to create physical incompatibilities between adjacent land uses or activities that would result in a significant impact on the physical environment. This is accomplished through the evaluation of the extent to which surrounding land uses could be affected by the proposed action. This analysis also evaluated if noise exposure associated with proposed ground and aircraft operations would have an adverse impact on land use compatibility.

This analysis also evaluates the consistency or compliance of the proposed action with adopted plans and policies governing land use and development. Inconsistency with a land use policy or objective is only considered a significant impact if the inconsistency would result in a significant impact on the physical environment.

3.5.2.1 Alternative 1

Land Use Compatibility

Alternative 1 would update and enhance MCLB Barstow's existing training and readiness capability and capacity in accordance with the CMC's mandates in the *Marine Corps Vision and Strategy 2025* and *Expeditionary Force 21* (USMC 2014; USMC 2008) to support local and regional operational training

requirements. Through a process of modernization, training facilities would be upgraded and training lands and live-fire ranges better utilized, maintained, and managed to support maximum throughput by increasing the capability of MCLB Barstow to support greater training opportunities. Implementation of Alternative 1 would increase the intensity of training activities within the project footprint and include new training activities (e.g., aircraft operations). However, proposed activities would be compatible with existing and surrounding land uses (operations and training).

Land Use Management Plans

Alternative 1 would enhance and update the operational capabilities of existing training areas and ranges because these facilities do not adequately support the ability to conduct simultaneous training or provide the flexibility to meet evolving USMC operational requirements. Furthermore, Alternative 1 would ensure range maintenance and sustainment of open training lands and live-fire small arms ranges (i.e., KD Rifle Range, KD Pistol Range, and 100-yard shotgun range) within the project footprint. Proposed activities would optimize training assets (ranges and training areas) at MCLB Barstow, consistent with the guidelines stipulated in the MCIWEST-MCB Camp Pendleton Regional RCMP.

Alternative 1 would be sited, designed, and constructed consistent with the guidelines stipulated in the MCLB Barstow Master Plan regarding future development within the project footprint. Furthermore, no impacts to surrounding communities would occur since the proposed development would be contained within existing military designations at MCLB Barstow. Therefore, no significant impacts on land use management plans would occur.

3.5.2.2 No-Action Alternative

Under the No-Action Alternative, existing training ranges and areas would not be enhanced to support combat readiness of USMC operating forces and limited ground training and live-fire training at the KD Range Complex would continue under current conditions. Existing land use conditions would remain as described in Section 3.5.1, *Affected Environment*. Existing training opportunities would not be maximized to meet evolving USMC operational requirements. No impacts on land use would occur.

3.6 Noise

3.6.1 Noise Characteristics

Noise is commonly defined as unwanted sound. Sound is defined as pressure variations in air that the human ear can detect. The nature of sound can be characterized by its pitch or its loudness. Pitch is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. Loudness describes the amplitude of sound waves combined with the reception characteristics of the ear. Responses to noise vary widely according to the characteristics of the sound source, the distance between the noise source and the receptor, and the time of day as well as the sensitivity and expectations of the receptor. Technical acoustical terms commonly used in this section are defined in Table 3.6-1.

In addition to the concepts of pitch and loudness, several measurement scales are used to describe noise. The dB is a unit of measurement that indicates the relative amplitude (loudness) of a sound. Zero on the dB scale is based on the lowest sound pressure that a healthy, unimpaired human ear can detect. Sound levels in dB are calculated on a logarithmic basis. An increase of 10 dB represents a 10-fold increase in acoustic energy, while 20 dB is 100 times more intense, and 30 dB is 1,000 times more intense. There is also a relationship between the subjective noisiness or loudness of a sound and its level. Each 10-dB

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increase in sound level is perceived by the human ear as approximately a doubling of loudness over a wide range of amplitudes.

Table 3.6-1. Definitions of Acoustical Terms

Term	Definition
Sound	A vibratory disturbance created by a vibrating object which, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism such as the human ear or a microphone.
Noise	Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20.
Sound Pressure Level (SPL)	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The SPL is expressed in dB as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 micro Pascals). SPL is the quantity that is directly measured by a sound level meter.
Frequency, Hertz (Hz)	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sounds are below 20 Hz and ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level (dBA)	The SPL in dB as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective human reactions to noise.
Equivalent Sound Level (Leq)	The average A-weighted sound level during a stated time period. For example, Leq-workday is the average noise level during the workday (7:00 a.m. to 5:00 p.m. for the purposes of this document).
Maximum sound level (Lmax)	The highest sound level measured during a noise event.
Day-night average sound level (DNL)	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 dB to levels measured in the night between 10:00 p.m. and 7:00 a.m.
Community Noise Equivalent Level (CNEL)	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 dB to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and after addition of 10 dB to sound levels in the night between 10:00 p.m. and 7:00 a.m.
Onset-Rate Adjusted Monthly Community Noise Equivalent Level (CNELmr)	The average A-weighted noise level during the busiest month of the year. This measurement is used to calculate aircraft operations in training areas. Whereas training at an air station typically occurs along regular flight patterns and at regular intervals, operations in training areas are sporadic and use highly variable flight patterns. An 'onset rate adjustment' of up to 11 dB is applied to operations conducted at high speeds and low altitudes, which have the potential to startle listeners due to sudden onset of noise.
Peak level exceeded 15 percent of the time (PK 15[met])	Munitions noise levels are strongly influenced by meteorological conditions (e.g., winds). This measurement accounts for weather-influenced statistical variation in single-event peak noise levels. PK 15(met) is the peak noise level, without frequency weighting, expected to be exceeded by 15 percent of all firing events.
Ambient Noise Level	The normal or existing level of environmental noise at a given location.

Since dBs are logarithmic units, sound pressure levels (SPLs) are not added arithmetically. When two sounds of equal SPL are added, the result is an SPL that is 3 dB higher. For example, if the sound level was 70 dB when 100 cars pass by in a certain time period, then it would be 73 dB if 200 cars pass the observer during the same period. Doubling the amount of energy results in a 3 dB increase to the sound level.

Frequency relates to the number of pressure oscillations per second, or Hertz (Hz). The range of sound frequencies that can be heard by healthy human ears varies from about 20 Hz at the low-frequency end to 20,000 Hz at the high-frequency end.

There are several methods for characterizing sound. The most common is the A-weighted sound level or dBA. This scale filters out very low and very high frequencies to replicate human sensitivity. For

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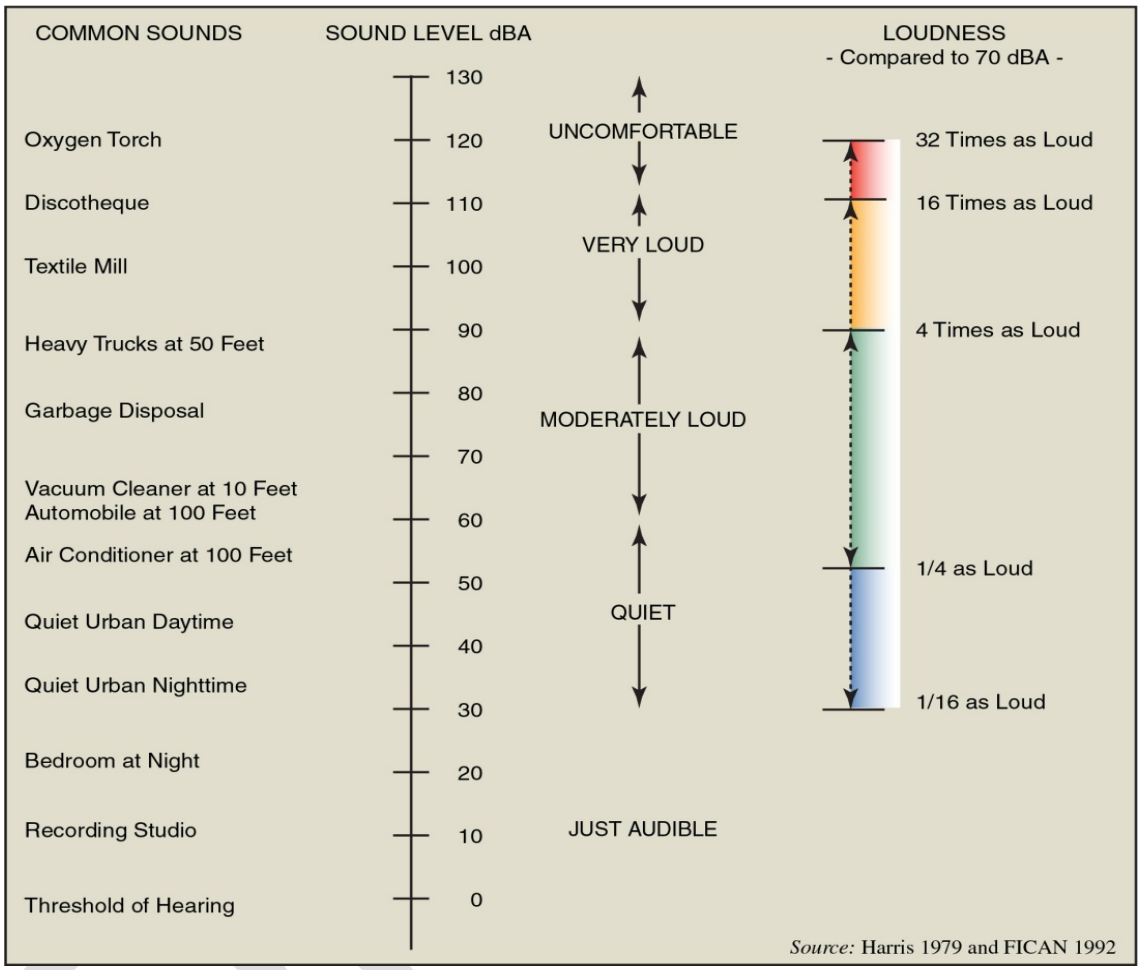
purposes of this document, dB levels provided are A-weighted unless otherwise noted. Examples of typical A-weighted noise levels are shown in Figure 3.6-1. Other frequency weighting is used to describe noise levels for specific types of noise (e.g., explosives and munitions). Certain munitions noise levels are C-weighted, using an adjustment that de-emphasizes low-frequency noise to a lesser extent than A-weighting.



3.6-1. Typical A-Weighted Levels of Common Sounds

3.6.2 Affected Environment

The ROI for noise includes areas on and adjacent to MCLB Barstow. Aircraft could use several designated MTRs or variable, non-designated paths to access MCLB Barstow. MTRs traverse hundreds of miles and are used with highly variable frequency under baseline conditions. Any incremental increases to the frequency of operations on MTRs would be negligible. Therefore, MTRs are not considered to be part of the ROI.

3.6.2.1 Existing Noise Sources

MCLB Barstow is located in a sparsely populated desert region in western San Bernardino County, California, 3.5 miles (6 kilometers) east of the City of Barstow (Figure 1.1-2). The Town of Daggett is located approximately 1 mile (1.6 kilometers) southwest of the Yermo Annex and the Town of Yermo is located approximately 1 mile (1.6 kilometers) northeast of the Yermo Annex. The areas adjacent to the project footprint include military and industrial land uses and undeveloped land. Noise in the vicinity of MCLB Barstow results from vehicular traffic on I-40, I-15, and adjacent roads; rail traffic associated with Marine Corps Logistics and Maintenance Center operations; air traffic associated with aviation training at MCLB Barstow and the Barstow-Daggett Airport (approximately 6 miles [9.6 kilometers] southeast of the project footprint); tactical ground vehicle traffic; live-fire marksmanship training; and periodic construction activities. USMC and civilian personnel working at MCLB Barstow are exposed to a diverse range of sounds associated with military training activities.

Measured, site-specific noise data are not available for baseline noise levels near the project footprint. However, based on noise levels measured in similar rural areas, the ambient noise level within the project footprint when military training is not occurring is assumed to be 45 dBA. Noise sources in the immediate vicinity of the project footprint include vehicular traffic on I-40, I-15, and adjacent roads; air traffic; and munitions associated with live-fire marksmanship training at the KD Range Complex.

Maximum noise levels associated with individual overflights by Lakota (UH-72) aircraft, which currently operate at MCLB Barstow on a periodic basis, are provided in Table 3.6-2. There are about 96 annual aircraft sorties conducted at MCLB Barstow. Approximately 10 percent of these aircraft operations occur between 7:00 p.m. to 10:00 p.m., and approximately 10 percent occur during 10:00 p.m. to 7:00 a.m. Under baseline conditions, aircraft operations are sufficiently infrequent that monthly community noise equivalent level ($CNEL_{mr}$) is below the ambient noise level of 45 dB.

Table 3.6-2. Direct Overflight Single-Event Maximum Noise Levels (L_{max})

Aircraft[1]	Flight Configuration	Lmax at Altitude (feet AGL)[2]				
		300	500	1,000	2,000	8,000
UH-72	100 knots	87	82	76	69	53

Notes: [1] Used surrogate reference acoustic data for aircraft not available in DoD database (UH-72).
[2] Source is SELCALC with standard acoustic propagation conditions (59°F [15°C] and 70 percent relative humidity).
AGL = above ground level; DoD = Department of Defense; Lmax = maximum sound level; and Knots = nautical miles per hour.

Approximately 45,000 rounds of live ammunition including 5.56mm, 9mm, .45 caliber, and shotgun rounds are fired annually at the KD Rifle Range, KD Pistol Range, and 100-yard shotgun range. Approximately 5 percent of munitions firing occurs in the evening (7:00 p.m. to 10:00 p.m.), and 5 percent occurs at night (10:00 p.m. to 7:00 a.m.). In addition, blank rounds are fired and high-explosive detonations are conducted to support existing tactical combat training within the project footprint. Existing high-explosive detonations are conducted in a container, reducing noise levels in surrounding areas.

3.6.2.2 Noise Sensitive Receptors

Noise sensitive receptors include human receptors and wildlife. The effects of noise on wildlife are discussed in Section 3.3, *Biological Resources*. Noise sensitivity is related to the receptor's activities, or land uses that may be incompatible with exposure to elevated noise levels. Land use activities most sensitive to noise typically include residential and commercial areas, public services (schools, hospitals, nursing homes, churches, and libraries), and recreational facilities.

For the most part, areas surrounding the project footprint are undeveloped or currently used for military and industrial land uses (e.g., operations and training, maintenance, and supply and storage). Seven sensitive land uses are located in the project vicinity, as shown in Figure 3.6-2.

For the purposes of this analysis, all structures were evaluated as sensitive receptors to account for the fact that, without confirmation, there is a possibility that they could be inhabited.

The Desert View military housing area within the Nebo Annex is located about 5,400 feet (1,646 meters) northwest of the proposed LHA/LHD site and about 2,000 feet (610 meters) north of the proposed access road. A small cluster of residential structures is located approximately 6,900 feet (2,103 meters) northeast of the LHA/LHD site and 4,800 feet (1,463 meters) north of the Range Main Supply Route training area. Several residences are located adjacent to I-40 approximately 2,800 feet (853 meters) from LZ 1 and 1,600 feet (488 meters) east of the Range East and KD Range Complex training area. The Town of Daggett, which includes residential, commercial, and public service land uses, is located about 5,800 feet (1,768 meters) east of LZ 1 and 5,600 feet (1,707 meters) east of the Range East and KD Range Complex training area. Scattered residences and a recreational vehicle park are located west of Daggett-Yermo Road and north of I-40. The closest structure within this area is 2,500 feet (762 meters) from LZ 2 and the proposed access roads. Silver Valley High School is located about 5,300 feet (1,615 meters) northwest of LZ 2 and proposed access roads. The Yermo Stables are located within the Yermo Stables training area and are about 900 feet (274 meters) from LZ 2 and proposed access roads. An overview of the receptor location, land use designation, and estimated ambient noise level is provided in Table 3.6-3. No noise measurements were taken at these locations. However, based on ambient noise conditions for similar land uses, it is estimated that the baseline noise condition at the sensitive receptor locations ranges between 45-50 dBA.

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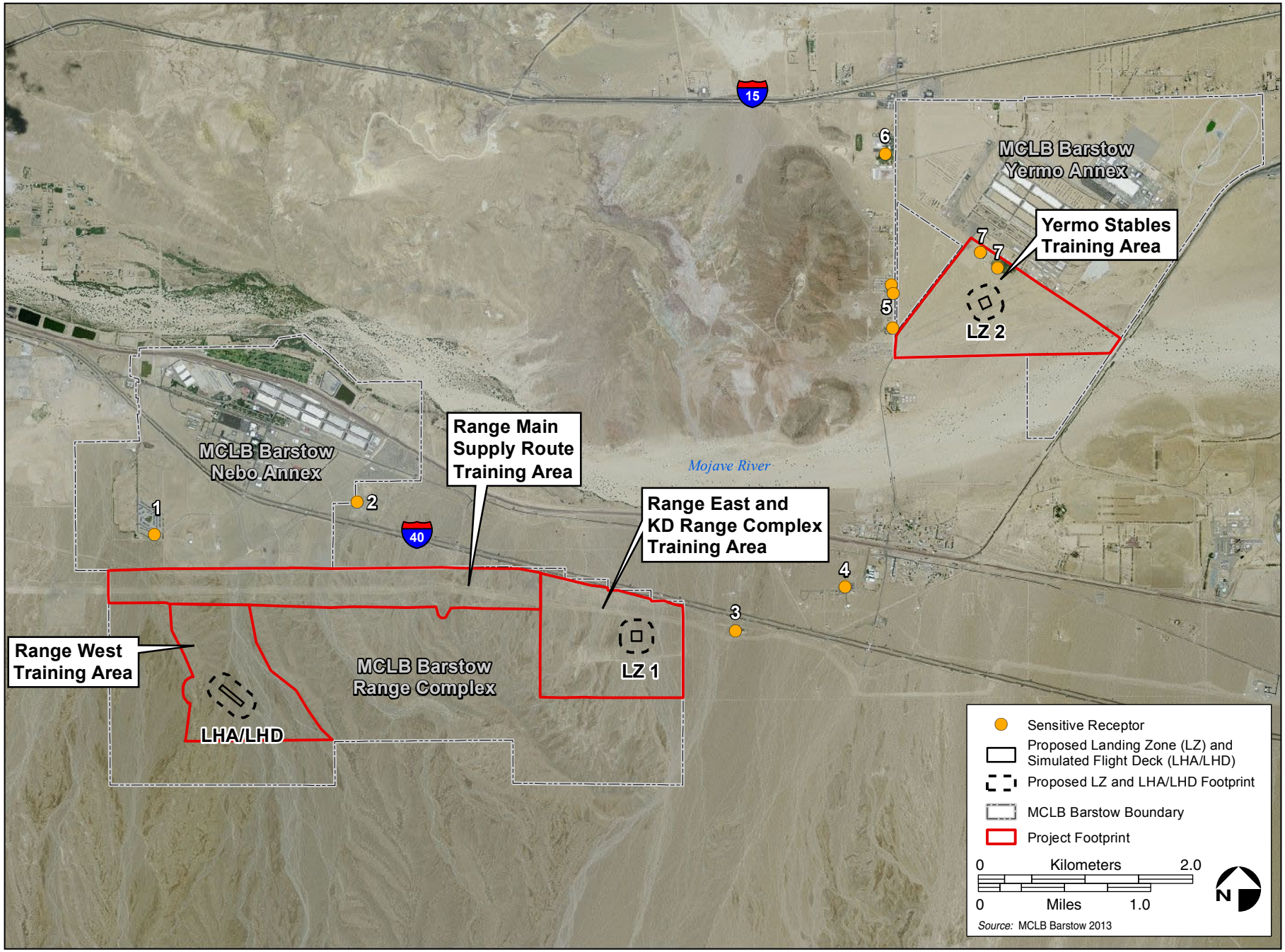

Figure 3.6-2. Noise Sensitive Receptors in the Project Vicinity

Table 3.6-3. Noise-Sensitive Receptor Locations

Sensitive Receptor	Land Use	Distance to Closest LZ or LHA/LHD (feet)	Distance to Proposed Road (feet)	Distance to Closest Training Area (feet)	Existing Estimated Noise Level (dBA, $L_{eq\text{-}24\ hour}$)
Sensitive Receptor 1: Desert View Military Housing	Residential	5,400	2,000	1,000	45 to 50
Sensitive Receptor 2: Residences immediately east of Nebo Annex and north of I-40	Residential	6,900	4,800	2,000	45 to 50
Sensitive Receptor 3: Residences east of Range East and KD Range Complex and adjacent to I-40	Residential	2,800	2,800	1,600	45 to 50
Sensitive Receptor 4: Town of Daggett	Residential, Public Services, and Recreation	5,800	5,600	5,000	45 to 50
Sensitive Receptor 5: Residences and Recreational Vehicle Park west of Daggett-Yermo Road	Residential and Recreational	2,500	2,500	250	45 to 50
Sensitive Receptor 6: Silver Valley High School	Educational	5,300	5,300	3,700	45 to 50
Sensitive Receptor 7: Yermo Stables	Recreational and Agricultural	900	900	0	45 to 50

Notes: dBA = A-weighted sound level; I-40 = Interstate 40; KD = Known Distance; LHA = Landing Helicopter Assault; LHD = Landing Helicopter Dock; and LZ = landing zone.

3.6.3 Environmental Consequences

Construction

Evaluation of potential construction noise impacts resulting from Alternative 1 involved three tasks: (1) sensitive receptor sites were selected to characterize public and other noise-sensitive uses in the study area; (2) assumptions were made concerning the existing baseline noise levels at the selected receptor sites; and (3) noise data from the proposed construction activities were assembled (Table 3.6-4) and extrapolated from published sources for assessing construction noise impacts.

Table 3.6-4. Estimated Maximum Construction Equipment Noise Levels at Distance of 50 Feet

Equipment	Maximum Noise Level (L_{max}) in dBA
Backhoe	78
Dozer	82
Grader	85
Pickup Truck	75
Dump Truck	77

Notes: dBA = A-weighted sound level; FHWA = Federal Highway Administration.
Source: FHWA 2006.

The noise created by construction equipment varies greatly during a project, depending on such factors as how many pieces of equipment operate simultaneously, the types of equipment being used, and the exact location of the equipment relative to a listener. Construction noise levels were calculated for a hypothetical workday in which one piece of equipment of each type listed in Table 3.6-4 operates at the closest point to each representative noise-sensitive location. The Federal Highway Administration

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(FHWA) Roadway Construction Noise Model standard values were used for the percent of the workday in which each piece of equipment is in operation.

Operations

Operational noise impacts are based on the audible increment of noise above a background level. The most common impact associated with exposure to elevated noise levels is public annoyance. Public annoyance due to aircraft noise can be predicted based on the noise metric day-night average sound level (DNL) (Schultz 1978; Finegold et al. 1994). When subjected to DNL of 65 dB, approximately 12 percent of persons so exposed will be "highly annoyed" by the noise. At levels below 55 dB, the percentage of annoyance is correspondingly lower (less than 3 percent). The USEPA has identified 55 dB DNL as a level below which any impacts to human health and welfare are unlikely to occur (USEPA 1974). Based on numerous sociological surveys and recommendations of federal interagency councils, the most common benchmark referred to is 65 dB DNL. This threshold is often used to determine residential land use compatibility around airports, highways, or other transportation corridors. It is well below levels that are known to damage hearing or cause non-auditory health impacts (OSHA 1983). In any given noise environment, the community noise equivalent level (CNEL) is similar to the DNL, and the same thresholds that are applied to DNL are also applied to CNEL.

MOA and Route Noisemap were used to calculate time-averaged aircraft noise levels under proposed training scenarios. MOA and Route Noisemap calculate noise levels based on typical aircraft configuration, altitude band usage, and frequency of operations within a defined volume of airspace. The model was specifically designed for application to environments where flight paths are highly variable and semi-random over extended periods of time. The Rotorcraft Noise Model and SELCALC were used to calculate single overflight noise levels for rotorcraft.

The U.S. Army is responsible for setting munitions noise policy and has established land use recommendations based on munitions noise levels near training ranges. U.S. Army Regulation 200-1 discourages noise-sensitive land uses, such as residential, where small arms firing noise exceeds 87 dB peak and strongly discourages such land uses where levels exceed the 104 dB peak level exceeded 15 percent of the time (PK 15[met]). Munitions noise levels were calculated using the Small Arms Range Noise Assessment Model, version 2.6, to determine the distance at which noise level thresholds are exceeded. The noise level generated by small arms fire depends on the direction in which the weapon is pointed. Blank rounds fired in the training areas could be fired with the muzzle pointed in any direction. For this analysis, firing noise levels are reported for a location at 90 degrees from the direction of firing.

Noise impacts would be significant if noise levels at a large number of noise-sensitive locations (defined for the purposes of this analysis as greater than 100 structures) were to increase to greater than 65 dB $CNEL_{mr}$ or if any residences were to be exposed to greater than 75 dB $CNEL_{mr}$. Noise impacts would also be significant if peak small arms noise levels would exceed 104 dB PK 15(met) at known noise-sensitive locations.

3.6.3.1 Alternative 1

Construction

Proposed construction activities include: (1) grading and stabilizing the designated LZs, LHA/LHD site, access roads, bivouac sites, and vehicle loading/refueling areas; (2) installing the LHA/LHD landing platform; (3) constructing new 700-, 800-, and 900-yard firing lines at the KD Rifle Range; (4) upgrading the KD Rifle Range and 100-yard shotgun range; (5) raising the existing berms around the 100-yard shotgun range for safety purposes; (6) constructing new support facilities (e.g., tear gas training facility,

restroom facility, range office and classroom building, ready locker, storage sheds, and pressurized propane gas storage tank); (7) installing solar and security lighting; (8) performing utility infrastructure modifications; and (9) installing permanent fencing at the Yermo Stables training area. The activities would use standard equipment including trucks, earthmovers (e.g., dozers, scrapers, loaders, and excavators), and compressors, over an approximate 24-month period. As such, increases in noise associated with the construction activities would be temporary; no long-term construction noise impacts would occur.

Estimated noise levels at the sensitive receptor sites (Table 3.6-5) associated with construction of the designated LZs, LHA/LHD site, support facilities (e.g., tear gas training facility, restroom facility, range office and classroom building, ready locker, storage sheds, and pressurized propane gas storage tank), utility infrastructure modifications, and installation of permanent fencing at the Yermo Stables training area would result in a short-term increase above ambient noise levels (assumed to be 45 dBA) ranging from 0 to 17 dBA.

Table 3.6-5. Estimated Construction Noise Levels at Noise-Sensitive Receptors

Sensitive Receptor	Estimated Distance Between Source and closest Receptor (feet)	Estimated Noise Level (dBA, Leq-Workday)
Sensitive Receptor 1: Desert View Military Housing		
Construction of LHA/LHD site in Range West	5,400	46
Construction of Proposed LHA/LHD Access Road	2,000	55
Sensitive Receptor 2: Residences immediately east of Nebo Annex and north of I-40		
Construction of LHA/LHD site in Range West	6,900	44
Construction of Proposed LHA/LHD Access Road	4,800	47
Sensitive Receptor 3: Residences east of Range East and KD Range Complex adjacent to I-40		
Construction of LZ 1 and KD Range Complex improvements/support infrastructure	1,600	57
Construction of Proposed LZ 1 Access Road	2,800	52
Sensitive Receptor 4: Town of Daggett		
Construction of LZ 1 and KD Range Complex improvements/support infrastructure	4,400	48
Construction of Proposed LZ 1 Access Road	5,600	46
Sensitive Receptor 5: Residences and Recreational Vehicle Park west of Daggett-Yermo Road		
Construction of LZ 2, Utility Infrastructure Upgrades, and Installation of Permanent Fencing	2,500	53
Construction of Proposed LZ 2 Access Roads	2,500	53
Sensitive Receptor 6: Silver Valley High School		
Construction of LZ 2, Utility Infrastructure Upgrades, and Installation of Permanent Fencing	5,300	46
Construction of Proposed LZ 2 Access Roads	5,300	46
Sensitive Receptor 7: Yermo Stables		
Construction of LZ 2, Utility Infrastructure Upgrades, and Installation of Permanent Fencing	900	62
Construction of Proposed LZ 2 Access Roads	900	62
Notes: dBA = A-weighted sound level; I-40 = Interstate 40; KD = Known Distance; LHA = Landing Helicopter Assault; LHD = Landing Helicopter Dock; and LZ = landing zone.		

Construction of the LHA/LHD site would generate 44 dBA Equivalent Sound Level (Leq) -workday at Sensitive Receptor #2 (residences immediately east of Nebo Annex and north of I-40). At this site, construction noise would be below ambient levels and would not be readily noticed. Construction noise levels at Sensitive Receptor #7 (Yermo Stables), which is located closest to a construction site, would be approximately 62 dBA Leq-workday. Construction noise experienced at the stables could be disruptive at times potentially annoying horses and their caretakers. Horses typically get used to construction noise

relatively rapidly when it continues at a consistent intensity over a long period of time. At the other representative noise-sensitive locations, construction noise would be less disruptive. Construction would occur during a 24-month period, but construction at any particular site would require substantially less time to complete. Construction noise would generally occur during normal working hours (7:00 a.m. to 5:00 p.m.). Therefore, no significant impacts on noise would occur.

Operations

Ground Training

A wide variety of tactical vehicles would be used to support training operations (e.g., convoy training, FARP operations, bivouac sites, tactical sustainment training, and vehicle maintenance) within the four training areas: Range West; Range East and KD Range Complex; Range Main Supply Route; and Yermo Stables. Noise levels associated with tactical vehicle types are listed in Table 3.6-6. The ROI is currently exposed to traffic noise generated along I-40, I-15, and adjacent roads. In addition, the Yermo Stables training area currently supports tactical vehicle operations. Noise generated by tactical vehicle operations within the project footprint would not substantially differ from the existing noise environment within the project vicinity. Therefore, operational activities would not result in a significant increase in noise levels over what currently exists in the project vicinity, and no significant impacts on noise would occur.

Table 3.6-6. Tactical Vehicle Noise Levels

Vehicle Type	Noise Level at 50 Feet (15 mph)
High-Mobility Multipurpose Wheeled Vehicle	65
Medium Tactical Vehicle Replacement	77
Logistical vehicle system (MK16 Tractor)	78
M9 ACE Combat Excavator (support engineering equipment, construction vehicle)	85
Stryker light armored vehicle	84
Notes: mph = miles per hour. *Source*: U.S. Army 2004.	

Under Alternative 1, a new 700-, 800-, and 900-yard firing line at the KD Rifle Range would be established to provide more advanced training requirements for sniper team training. Proposed live-fire marksmanship training would also result in changes to the types and quantities of munitions fired at the KD Range Complex. Blank rounds, which generate less noise than live rounds, would be fired from any location within the training areas to support combat training activities. Blank rounds used during training activities would include 5.56mm (7,600 annually), 7.62mm (3,600 annually), and .50 caliber (3,600 annually). The noise generated by firing depends on the location of the receptor site relative to the direction of fire. Table 3.6-7 provides the distances at which peak small arms noise levels drop below 87 dB and 104 dB PK 15(met) for firing that is perpendicular (i.e., at a 90-degree angle) relative to the direction of a receptor site. As noted in Table 3.6-1, the PK 15(met) noise metric reflects un-weighted peak noise levels when weather conditions are unfavorable for noise transmission such that noise at the receptor site would only be louder 15 percent of the time.

Table 3.6-7. Small Arms Noise Threshold Distances

Munitions Type	Distance in Feet at Which Noise is Below Peak Noise Level (dB PK 15[met])[1]	
	87 dB	104 dB
5.56-mm blank	530	180
.50 Cal blank	5,060	1,140
7.62-mm blank	3,780	850

Notes: [1] Small Arms Range Noise Assessment Model (SARNAM) used to calculate small arms noise levels; all distances rounded to the nearest 10 feet (3 meters).
dB = decibel; mm = millimeter; and PK 15(met) =peak level exceeded only 15 percent of the time.

Figures 3.6-3 and 3.6-4 show the distances from the edge of the training areas at which peak noise levels could potential exceed 87 and 104 dB PK15(met). Per U.S. Army Regulation 200-1, residential areas are discouraged at noise levels in excess of 83 dB PK15(met) and strongly discouraged at noise levels greater than 140 dB PK15(met).

The Desert View military housing area within the Nebo Annex would be potentially affected by noise levels in excess of 104 dB PK15(met) generated during the use of Mg M2 (.50 caliber blank) ammunition in support of convoy training and tactical sustainment training in the Range Main Supply Route training area (Figure 3.6-5).

A recreational vehicle park, scattered residential structures, and the Yermo Stables would be affected by noise levels in excess of 104 dB PK15(met) generated during training activities using certain ammunition types (i.e., Mg M2 and M240G) in the Yermo Stables training area (Figure 3.6-5). People experiencing munitions noise levels exceeding 104 dB PK15(met) would be likely to be disturbed by the noise, particularly when it occurs during the evening (7:00 p.m. to 10:00 p.m.) or night (10:00 p.m. to 7:00 a.m.). Horses have a wide range of reactions to gunfire depending on the characteristics of the individual horse, their surroundings, and the specific noise event. Horses generally get used to noise events over time. Horses that have not experienced gunfire in the past would be more likely to have a stronger reaction to the sounds of blank rounds being used to support training activities.

Noise impacts associated with unrestricted firing of blanks could generate significant noise impacts on sensitive receptors. However, implementation of Special Conservation Measure 22 (*Munitions Firing Restrictions*), described in Appendix B, would restrict the use of certain ammunition types during training activities in portions of the Range Main Supply Route and Yermo Stables training areas. Therefore, no significant impacts on noise would occur.

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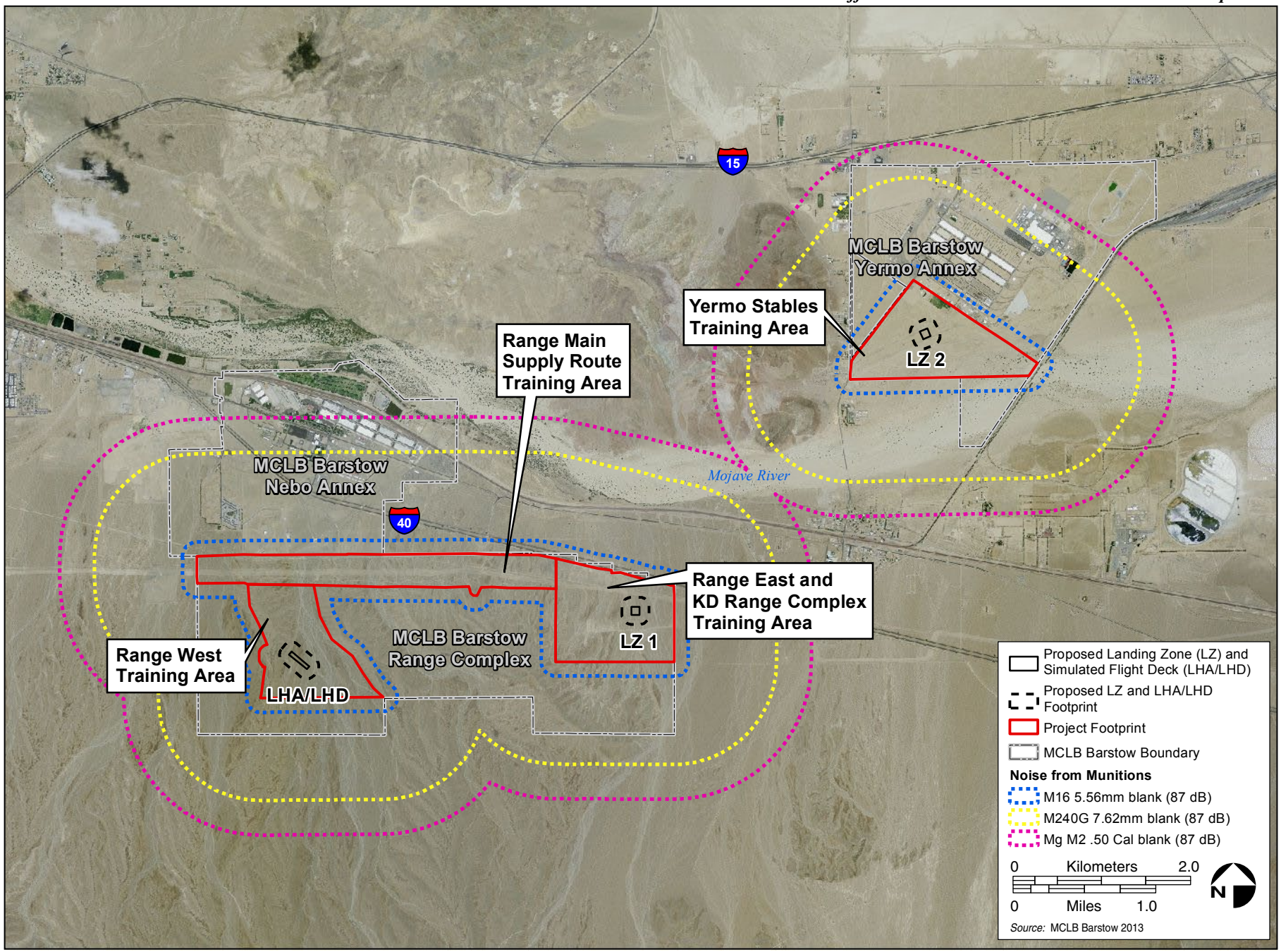

Figure 3.6-3. Small Arms Peak Noise Levels (87 dB) Distances

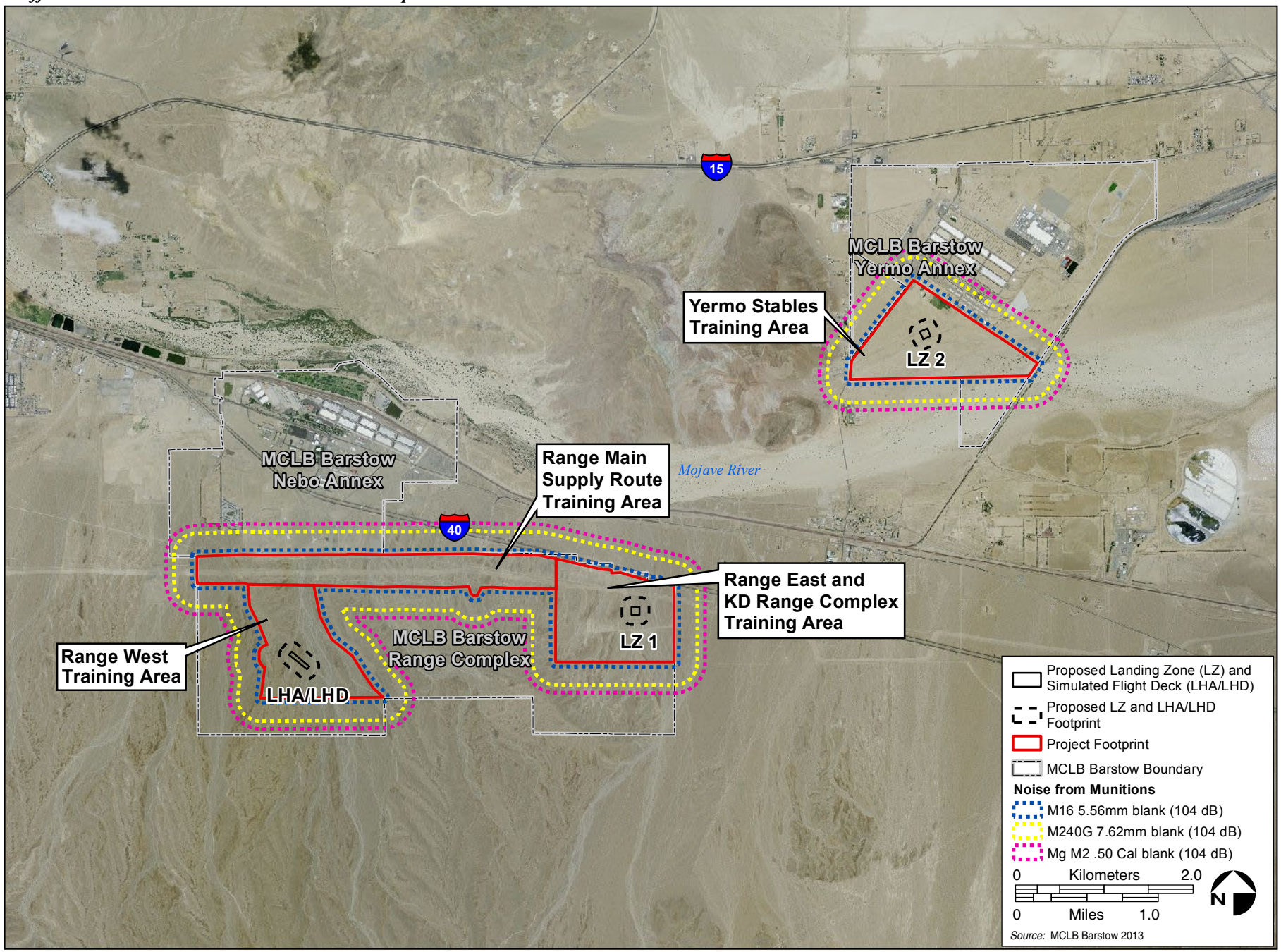

Figure 3.6-4. Small Arms Peak Noise Levels (104 dB) Distances

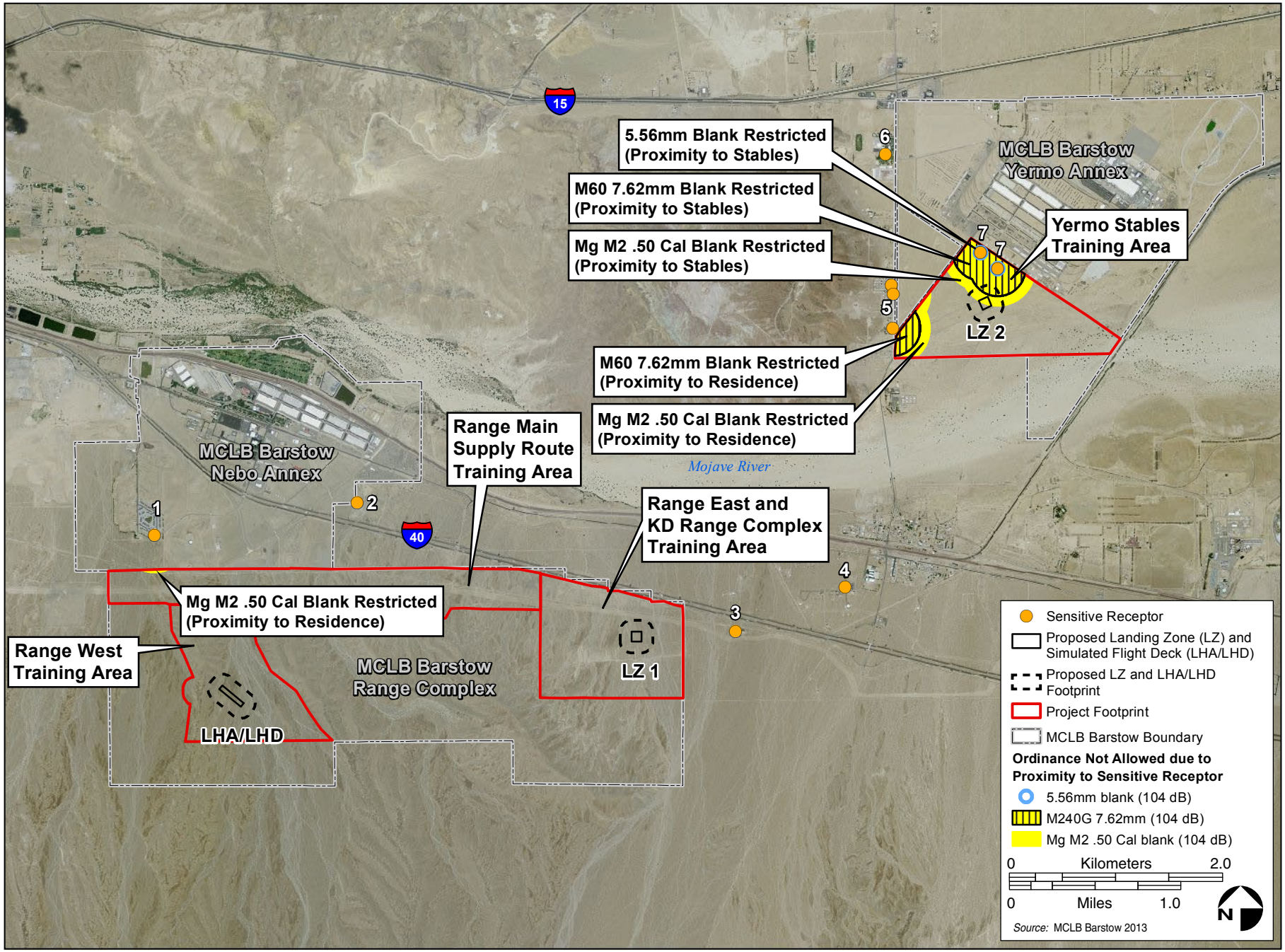

Figure 3.6-5. Restricted Munitions Use Areas within Project Footprint

Under Alternative 1, the total number of rounds fired annually at the KD Range Complex (i.e., KD Rifle Range, KD Pistol Range, and 100-yard shotgun range) would decrease from approximately 45,000 to 32,000. Similar to existing conditions, 5 percent of munitions firing at the KD Range Complex would occur in the evening (7:00 p.m. to 10:00 p.m.), and 5 percent would occur at night (10:00 p.m. to 7:00 a.m.). The decrease in the number of live rounds fired at the KD Range Complex would be roughly equivalent to the increase in the number of blank rounds fired outside the KD Range Complex annually. In addition, existing high-explosives detonations would be discontinued under this alternative. Under Alternative 1, new munition types (i.e., .22 cal., .38 cal., and 7.62mm) would be used at the KD Range Complex. Proposed sniper rifle proficiency training using 7.62mm munition at the 1,000-yard firing line would generate about 107 dB PK15(met) at the closest structure (assumed to be residential). This peak noise level would be approximately 2 dB louder than the peak noise level generated by 5.56mm rounds fired from the same location. The increase in noise levels associated with the change in munition types at the KD Range Complex would not be substantially higher than existing conditions (approximately 2 dB and barely audible). Therefore, no significant impacts on noise would occur.

Aviation Training

Proposed aviation training would add approximately 1,240 annual aircraft sorties (i.e., one arrival and departure or visit) and 3,868 operations (e.g., a touch and go or pad landing) at MCLB Barstow (Table 2.3-3). Under Alternative 1, MV-22 and CH-53 aircraft would conduct 672 and 192 annual sorties, respectively. Proposed CH-47, UH-60, and UH-1/AH-1 aircraft would conduct 72, 72, and 96 annual sorties, respectively. C-23 aircraft operations would include four annual sorties. Proposed aerial delivery of troops and equipment and parachute drops from C-130 aircraft flying at or above 1,000 feet (305 meters) AGL would be conducted approximately 36 times per year. Proposed UH-72 aircraft operations would be the same as existing conditions (96 annual sorties). An estimated 20 percent of total aviation training operations would be conducted in the evening between 7:00 p.m. and 10:00 p.m., and approximately 10 percent of operations would occur at night between 10:00 p.m. and 7:00 a.m. Overflight noise levels associated with the aircraft types that would use the general aviation areas and designated LZs and LHA/LHD site are provided in Table 3.6-8.

Table 3.6-8. Estimated Single Aircraft Overflight Maximum Noise Levels (Lmax)

Aircraft[1,2]	Flight Configuration	Lmax at Altitude (feet AGL)[3]				
		300	500	1,000	2,000	8,000
H-1 (UH-1/AH-1)	100 knots	90	85	78	72	55
MV-22	60 degree nacelle tilt, 100 knots	89	85	79	72	52
CH-53	100 knots	95	90	84	77	62
CH-47	100 knots	94	89	83	76	62
UH-72	100 knots	87	82	76	69	53
UH-60	100 knots	87	83	76	69	52
C-130[4]	505 MGT; 140 knots	96	91	84	76	58
C-23	50 percent RPM; 140 knots	82	77	71	64	48

Notes: [1] Used surrogate reference acoustic data for aircraft not available in DoD database (Sikorsky-76 for UH-72).
[2] Used specific measured aircraft to represent several potential types (C-130J for C-130, CH-53E for CH-53, and AH-1G for H-1).
[3] For all aircraft except MV-22, CH-53, and UH-72, source is SELCALC; used Rotorcraft Noise Model for MV-22, CH-53, and UH-72; all calculations made for standard acoustic propagation conditions (59°F [15°C] and 70 percent relative humidity).
[4] C-130 and C-23 aircraft would not normally operate at MCLB Barstow at altitudes less than 1,000 feet AGL.
AGL = above ground level; Lmax = maximum sound level; MGT = Measured Gas Temperature; knots = nautical miles per hour; and RPM = Revolutions Per Minute.

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Group 1 unmanned aircraft systems, including the RQ-11B, RQ-12A, and RQ-20A, would also be used to support aviation training at MCLB Barstow. All three UAS are short range, man-portable (i.e., transported on a person), hand-launched with electric engines that generate sound levels comparable to commercially available, remote-controlled aircraft. The RQ-11B would be the most commonly used of the three UASs, conducting about 80 percent of the 1,200 total annual UAS flying hours. Overflights of the RQ-11B at altitudes of 60 to 200 feet (18 to 61 meters) AGL generate noise levels ranging between 60 and 70 dBA, which is comparable to the sound intensity of a conversation (USGS 2014). RQ-12A and RQ-20A aircraft, which would cumulatively make up 20 percent of UAS flying hours, are similar in design to the RQ-11B and generate similar noise levels. In addition, noise levels generated by UAS are approximately 10 dBA less than noise levels generated by rotary wing (helicopter) and tilt-rotor (MV-22) aircraft. Therefore, no significant impacts on noise would occur.

Aircraft transiting to or from MCLB Barstow would use variable routes. Unless an approved MTR is used, aircraft would typically operate at greater than 500 feet (152 meters) AGL. Individual overflight noise levels associated with aircraft utilizing the general aviation areas and designated LZs and LHA/LHD site are listed in Table 3.6-7. After reaching MCLB Barstow, aircrews would typically conduct one or more approaches to the designated LZs, LHA/LHD site, or general aviation areas. Approximately 70 percent of the total approaches would occur at the LHA/LHD landing platform, with the remainder of the operations being split evenly between LZ 1 and LZ 2. A typical training event could consist of one or more aircraft approaching the LZ, loading/unloading troops and equipment, and then departing the LZ. MV-22 approaches typically start 5 nautical miles from the LZ, and C-130 airdrops would begin at 20 nautical miles from the LZ. Other aircraft (i.e., UH-1, AH-1, CH-53, and UH-72) would conduct the approach and maneuver within 1.5 nautical miles of the LZ. Aircrews would vary flight paths due to variable environmental factors (e.g., winds) and to facilitate pilot judgment and safety training/risk management. Over time, flight paths would be distributed semi-randomly, with flying activity concentrated near the designated LZs and LHA/LHD site. Under a worst-case training scenario in which all aircraft operations would be concentrated within 1.5 nautical miles of the designated LZs, LHA/LHD site, and general aviation areas, noise levels would not exceed the 65 dB CNEL noise level threshold. However, aviation operations would be less concentrated because a portion of each MV-22 LZ approach would occur more than 1.5 nautical miles from the designated LZs, LHA/LHD site, and general aviation areas, and noise levels would be slightly lower than those shown in Table 3.6-9.

Table 3.6-9. CNELmr Under Baseline Conditions and Alternative 1

Area	CNELmr	
	Baseline[1]	Proposed
LHA/LHD	<45	59
LHA/LHD and LZ1 (1.5 NM radius area overlap)	<45	60
LZ-1	<45	52
LHA/LHD and LZ2 (1.5 NM radius area overlap)	<45	55
LZ2	<45	52

Notes: [1] Noise levels below nominal ambient noise level (45 dB) are listed as <45.
CNEL = community noise equivalent level; LHA = Landing Helicopter Assault; LHD = Landing Helicopter Dock; LZ = landing zone; and NM = nautical mile.
Source: Military Operations Area and Route Noisemap.

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Figure 3.6-6 depicts the areas of highest concentrations of aircraft operations within 1.5 nautical miles of the designated LZs, LHA/LHD site, and general aviation areas. Most of the area is undeveloped, open land. The Desert View military housing area within the Nebo Annex is located about 1 nautical mile northwest of the LHA/LHD site and would be exposed to about 59 dBA $CNEL_{mr}$. A small cluster of potentially habitable structures are located approximately 500 feet (152 meters) north of I-40 and immediately east of the Nebo Annex. These structures are within 1.5 nautical miles of LHA/LHD site and LZ 1 and would be exposed to about 60 dBA $CNEL_{mr}$. However, aircraft noise would be less noticeable at this location because vehicular traffic on I-40 is a dominant noise source in the area.

The Town of Daggett is located between LZ 1 and LZ 2 and would potentially be affected by aircraft noise during approaches to these LZs. Scattered residential and commercial structures located west of Daggett-Yermo Road and north of I-15 would be within 1.5 nautical miles of LZ 2 and exposed to approximately 52 dB $CNEL_{mr}$. Under Alternative 1, the increase in aircraft operations and addition of new aircraft types (i.e., UH-1/AH-1, CH-53, MV-22, CH-47, UH-60, C-23, and C-130) would result in noticeable changes in ambient noise levels and an increased frequency of potentially disturbing noise events. However, implementation of Special Conservation Measure 23 (*Aircraft Flight Restrictions*), described in Appendix B, would restrict low-level overflights and minimize noise exposure to noise-sensitive receptors. Aircrews would avoid direct overflight of the towns of Daggett and Yermo and structures west of Daggett-Yermo Road at below 500 feet (152 meters) AGL. To ensure aircrews are aware of the location of sensitive noise receptors, avoidance areas would be integrated into local flying guidance reviewed before flight.

Enhancing operational capabilities of existing training areas and ranges in the project footprint would result in a substantial increase in the number of low-altitude overflights of the Yermo Stables. Horses are kept at the stables and associated fenced areas throughout the year, including transient horses during rodeos.

Horses sometimes exhibit strong behavioral reactions to the sight and sound of low-altitude aircraft (e.g., panicked movement, biting, or kicking) potentially causing injury to themselves, other horses, and humans. Although the likelihood of a strong reaction is heavily dependent on the characteristics of the individual horse, the surroundings, and other factors, strong reactions have been found to occur most frequently when the overflight noise level is above 95 dBA (U.S. Air Force 1994). Several of the aircraft types proposed to conduct operations at LZ 2 generate noise levels equal to or exceeding 95 dBA when operating at altitudes below 500 feet (152 meters) AGL (refer to Table 3.6-8). Overflight at these altitudes could potentially result in dangerous behavioral reactions particularly from horses not accustomed to military aircraft overflights. Implementation of Special Conservation Measure 23 (*Aircraft Flight Restrictions*), described in Appendix B, would restrict direct overflight of the Yermo Stables below 500 feet (152 meters) AGL at all times and require scheduling aircraft training at LZ 2 to avoid coinciding with rodeos. Restricting flights to no less than 500 feet (152 meters) AGL from the stables and associated fenced areas would help ensure that overflight noise events would not exceed 95 dBA, thereby reducing the risk of strong behavioral reactions. Scheduling aircraft training events to avoid coinciding with rodeos, which may include an increased number of horses not accustomed to military aircraft noise, would also reduce the risk of strong behavioral reactions in horses. Therefore, no significant impacts on noise would occur.

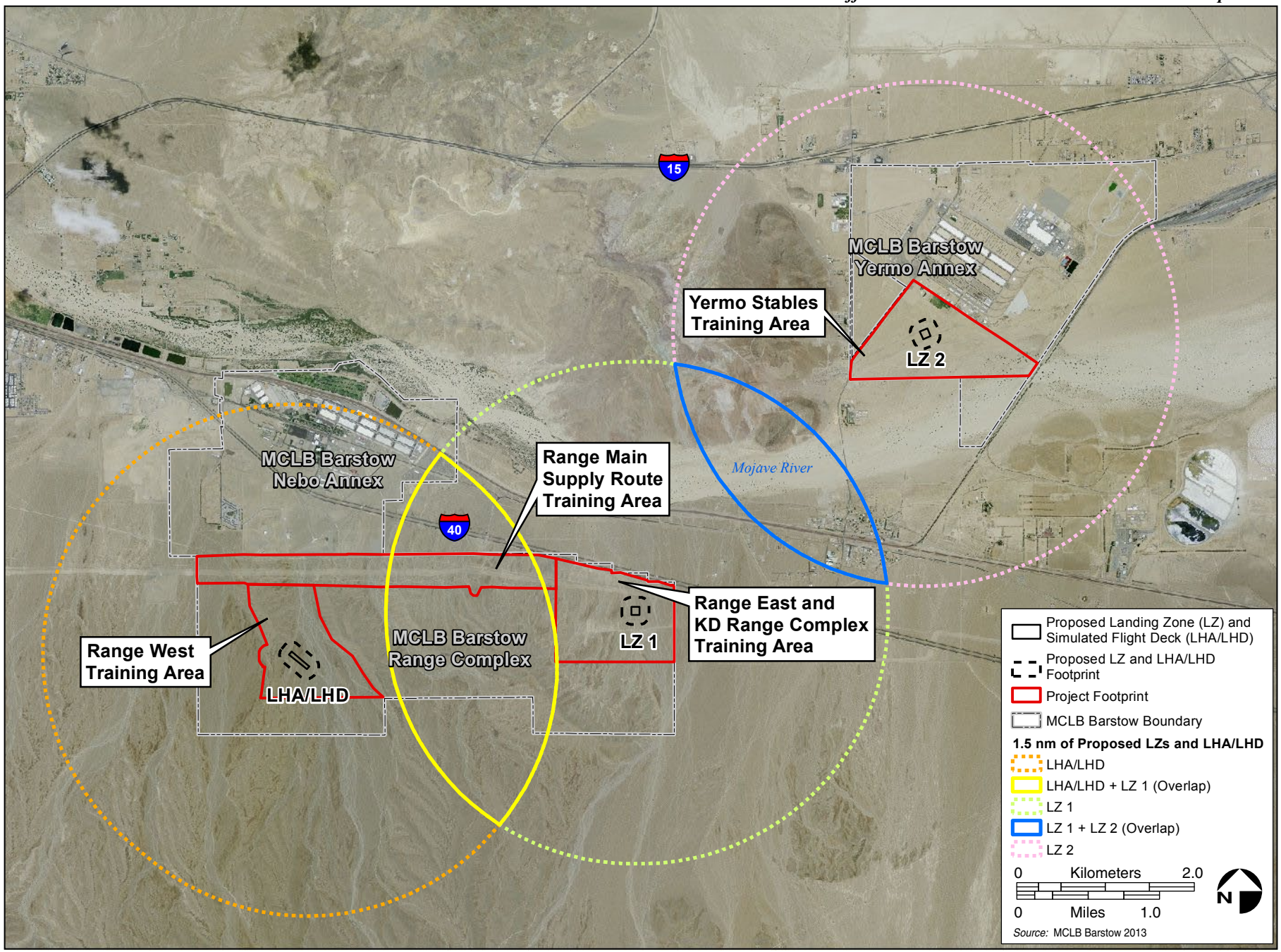

Figure 3.6-6. Areas of Highest Concentration of Aircraft Operations

Range Maintenance and Sustainment

Proposed range maintenance and sustainment activities would include periodic road maintenance/grading, gravel replacement, utility infrastructure repairs, periodic reapplication of soil stabilizers at the designated LZs and LHA/LHD site, berm maintenance and lead removal, range sweeps to collect debris, and target repairs. These activities would use standard equipment including trucks and earthmovers (e.g., dozers, graders, and loaders). Proposed range maintenance and sustainment activities would result in an increase in noise above existing conditions at sensitive receptor sites. These higher noise levels would be infrequent and would occur for very short time periods during maintenance activities. Because of the short duration, the increased noise would not represent a significant disturbance to sensitive receptors. Therefore, no significant impacts on noise would occur.

3.6.3.2 No-Action Alternative

Under the No-Action Alternative, existing training ranges and areas would not be enhanced to support combat readiness of USMC operating forces and limited ground training and live-fire training at the KD Range Complex would continue under current conditions. Existing noise conditions would remain as described in Section 3.6.2, *Affected Environment*, and the potential disturbance to noise-sensitive receptors would be avoided. No impacts on noise would occur.

3.7 Public Health and Safety

3.7.1 Affected Environment

3.7.1.1 Protection of Children (EO 13045)

EO 1345, *Protection of Children from Environmental Health Risks and Safety Risks (Protection of Children)*, was issued in 1997. This order requires each federal agency to "make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children and shall…ensure that its policies, programs, activities, and standards address disproportionate risks to children…"

The areas adjacent to the project footprint include desert recreational areas, a utility ROW, I-40, and military land uses. The Desert View military housing area is located 0.25 mile (0.4 kilometer) northwest of the Range Complex and community support facilities are located immediately north of the Yermo Stables training area (MCLB Barstow 2006). The closest children's school to the Range Complex is located 1.5 miles (2.4 kilometers) to the northwest, and the closest children's school (Silver Valley High School) to the Yermo Stables training area is located about 3,300 feet (1,006 meters) to the northwest.

3.7.1.2 Aviation Safety

As described in Section 3.1, *Airspace*, the FAA is responsible for ensuring safe and efficient use of airspace by military and civilian aircraft and supporting national defense requirements. To meet these requirements, the FAA has established regulations for airspace safety, developed airspace management guidelines, implemented a civil-military common system, and coordinated cooperative activities between the FAA and DoD.

The primary concern with regard to military training flights is the potential for aircraft mishaps (i.e., crashes) to occur, which could be caused by mid-air collisions with other aircraft or objects, weather difficulties, mechanical failures, pilot error, or bird-aircraft strikes. Comprehensive operating procedures are employed by the USMC to reduce the potential for aircraft accidents and increase aviation safety. For

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example, flight activities must conform with FAA-mandated restrictions and military aviation operations guidance. All aircraft would also operate in accordance with their corresponding training manuals, which identify measures and limitations on how a particular aircraft is flown. Should an emergency occur, the MCLB Barstow Range Regulations contain emergency and mishap response guidelines to react to an aircraft accident. These guidelines assign agency responsibilities and prescribe functional activities necessary to react to major mishaps.

3.7.1.3 Ordnance Safety Zones

Safety requirements for ordnance training are stipulated in MCO 3570.1C, *Range Safety*, and U.S. Army Pamphlet 385-63. These regulations prescribe safety precautions required to minimize the possibility of accidents associated with firing and other uses of ammunition and explosives during military training activities.

MCLB Barstow uses three small arms ranges within the KD Range Complex for live-fire marksmanship training: the KD Rifle Range; KD Pistol Range; and 100-yard shotgun range. Although these ranges are located adjacent to one another, the ranges differ in operational aspects, such as the types of ammunition used, expenditure rates, direction of fire, and established engineered controls.

The KD Rifle Range, KD Pistol Range, and 100-yard shotgun range have established surface danger zones (SDZs), as required by MCO 3570.1C. SDZs delineate the area in which personnel and/or equipment could be endangered by ground weapons firing. SDZs are designed to make the probability of hazardous fragment or round escapement from Base boundaries unlikely and minimize the danger to the public, military personnel, facilities/equipment, and property.

The size and shape of SDZs are dependent on the performance characteristics of the weapon system, ammunition used, training requirements, geographical location, and environmental conditions. The two basic SDZs are the cone and the batwing. The simpler cone SDZ extends from the firing point to encompass a safety area (dispersion cone) on either side of the firing line that accounts for human error, gun/cannon tube wear, and propellant temperature. The batwing SDZ, which is utilized at the KD Range Complex, has safety zones that extend to the sides of the main dispersion cone, which provide for greater containment of ricochets (Figure 3.7-1). The required safety distances for rifle ammunition typically used at MCLB Barstow is provided in Table 3.7-1.

The KD Rifle Range, including the range footprint and its associated SDZ, occupies approximately 757 acres (306 hectares) of the 2,438-acre (987-hectare) KD Range Complex. The KD Rifle Range is oriented for firing to the west. The KD Pistol Range and 100-yard shotgun range are located south of the KD Rifle Range and are oriented for firing to the southwest.

The KD Pistol Range and 100-yard shotgun range have overlapping SDZs and a combined area of approximately 275 acres (111 hectares). The combined SDZs of all the ranges extend south and west over the KD Range Complex and the Base boundary onto BLM property (MCLB Barstow 2014). Figures 3.7-2 and 3.7-3 depict the batwing SDZs associated with the KD Rifle Range and the KD Pistol Range and 100-yard shotgun range, respectively.

Due to the restrictions associated with SDZs, no construction can occur within these zones, in accordance with U.S. Army Pamphlet 385-63/MCO 3570.1A (*Policies and Procedures for Firing Ammunition for Training, Target Practice, and Combat*). Buildings and structures on the KD Range Complex must be located east of the firing positions in the opposite direction of the firing path (MCLB Barstow 2006; MCLB Barstow 2014).

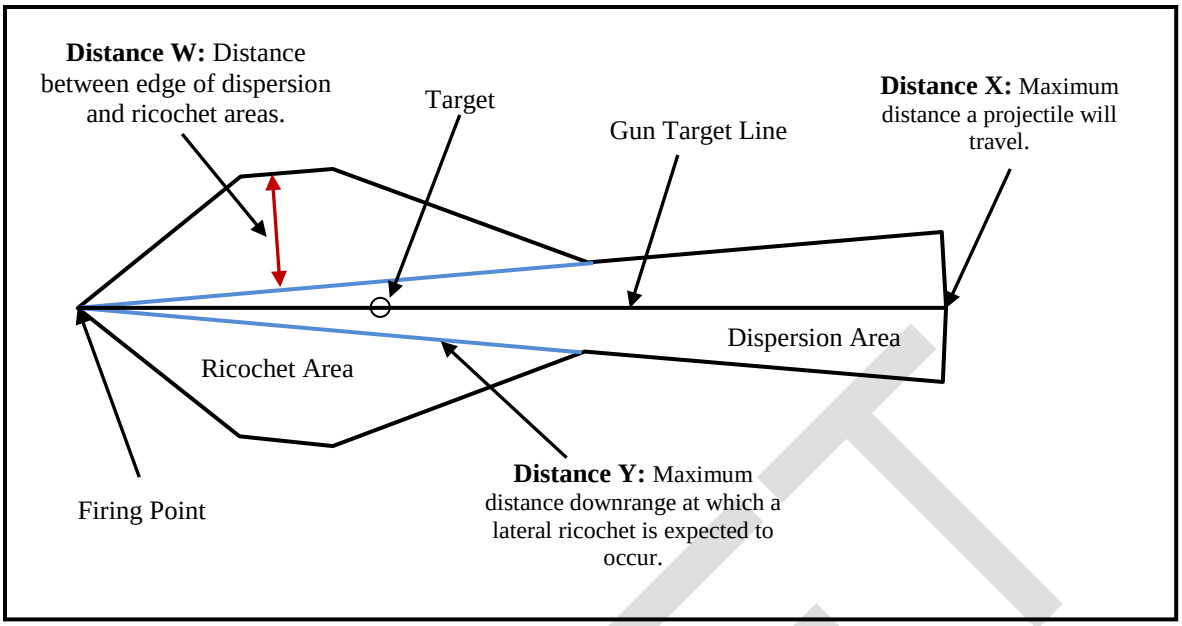

Figure 3.7-1. Features of Typical Batwing SDZ

Table 3.7-1. Safety Distances for Ammunition used at MCLB Barstow

Ammunition Type	Distance X in Feet	Distance Y In Feet	Distance W In Feet
.22 cal., Ball, Match (A093)	4,593	3,389	509
9mm, Ball (A363	5,905	3,533	518
.38 cal., Ball (A400)	5,925	3,642	502
.45 cal., Ball (A475)	5,545	3,333	384
12 gauge, Buckshot (A014)	902	Not Required	Not Required
5.56mm, Ball, M855	11,276	6,657	1,516
7.62mm, Special Bal, M118	17,349	15,748	5,069
Notes: MCLB = Marine Corps Logistics Base. *Sources:* MCLB Barstow 2014, U.S. Army Pamphlet 385-63, 14 April 2014.			

When the KD Rifle Range, KD Pistol Range, and 100-yard shotgun range are in use, specific safety requirements must be implemented, including the use of a Range Safety Officer to manage training operations and ensure safety requirements. Other safety measures include signage and barriers to preclude non-participating personnel from entering the area, and the use of personal protection equipment (e.g., eye and ear protection) for personnel using the range. Additionally, when the KD Pistol Range is active the KD Rifle Range and the 100-yard shotgun range cannot be occupied. When the 500-yard firing line on the KD Rifle Range is active, the KD Pistol Range cannot be occupied.

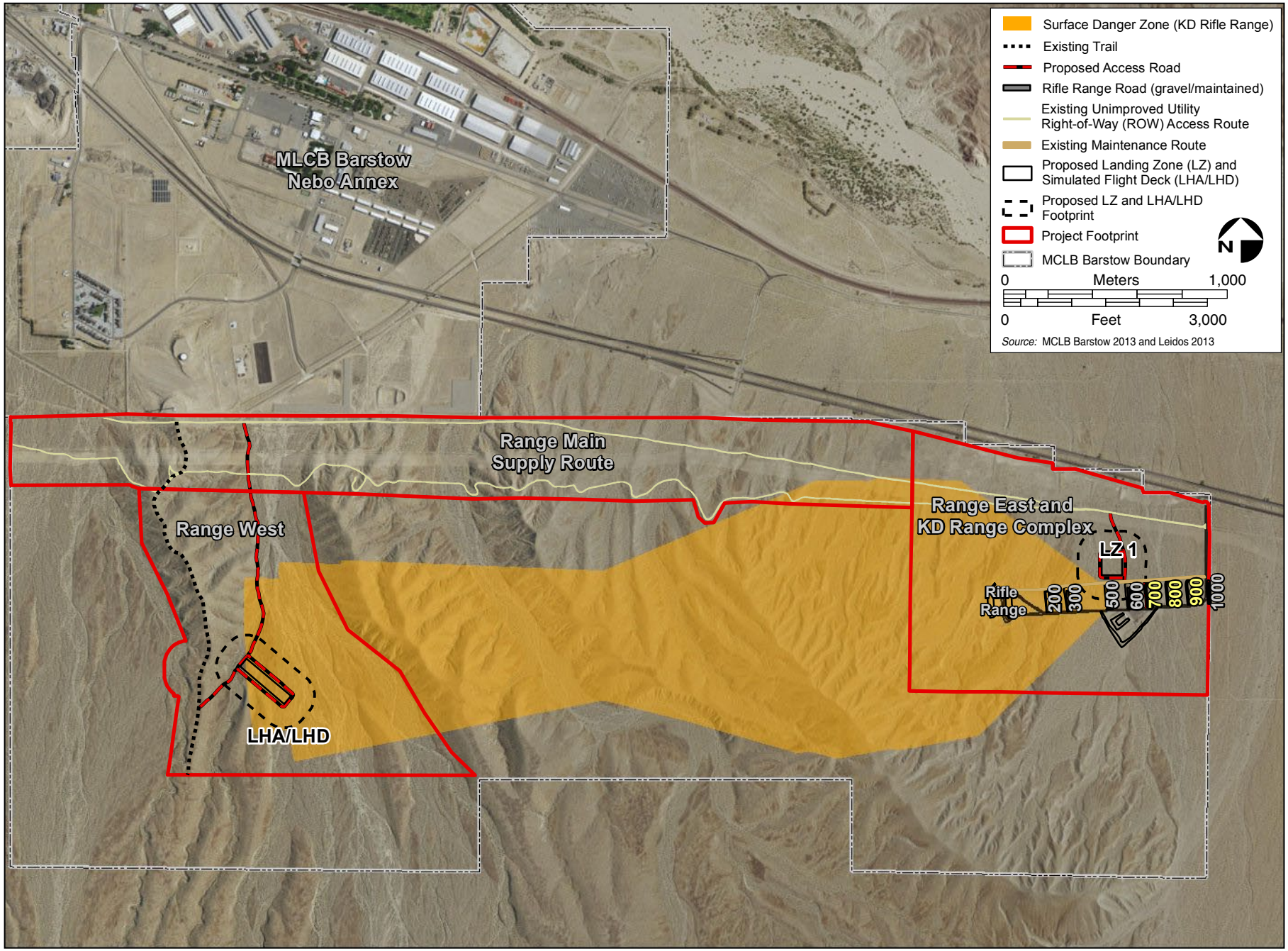

Figure 3.7-2. KD Rifle Range Surface Danger Zones

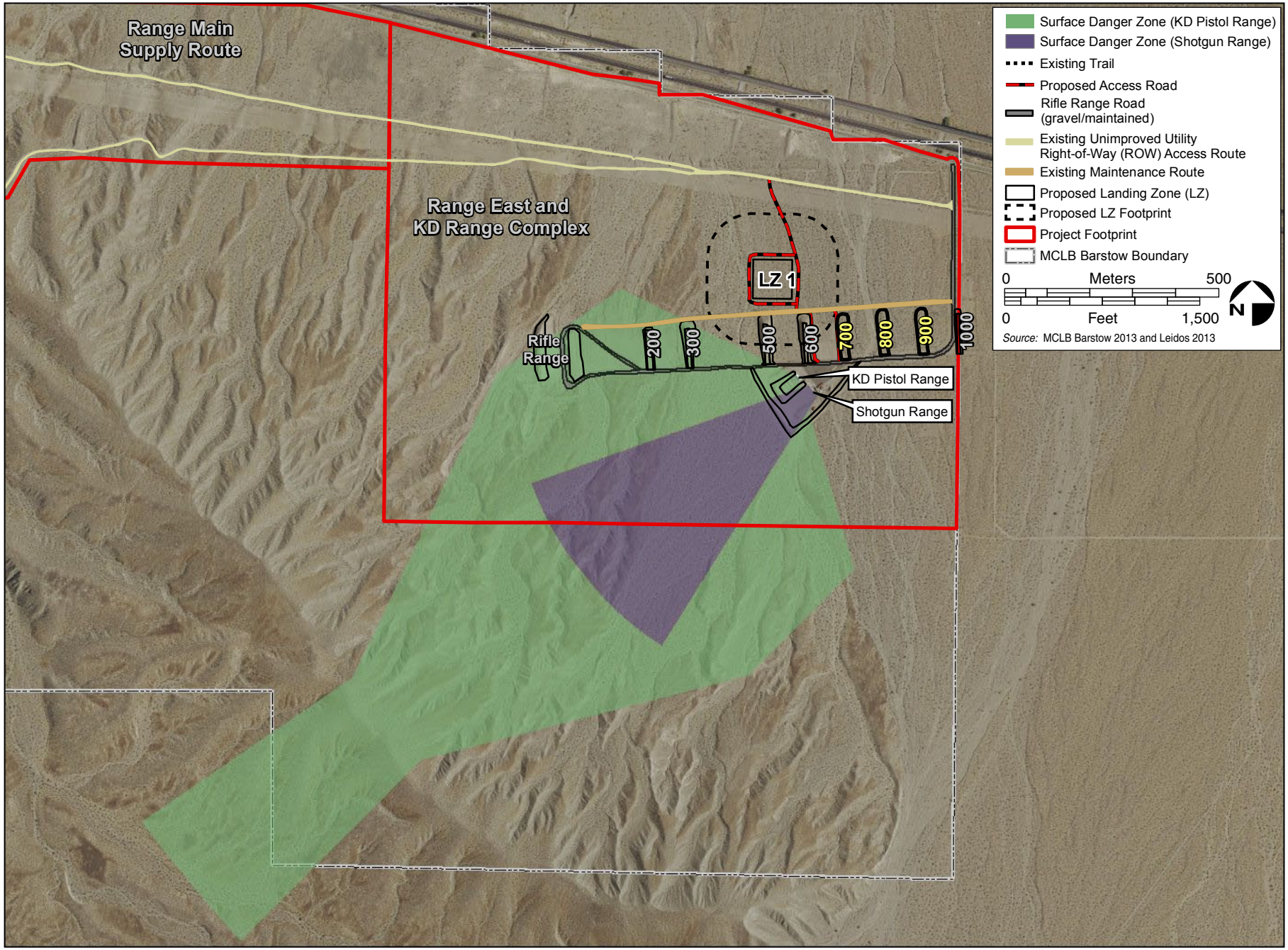

Figure 3.7-3. KD Pistol Range and 100-yard Shotgun Range Surface Danger Zones

3.7.1.4 Tear Gas Training

A temporary, tear gas training facility consisting of two ISO containers (8 feet by 20 feet [2.4 by 6.1 meters]) welded together, is located in the KD Range Complex administration area (Figure 2.3-5). The facility is used for annual CS gas (i.e., tear gas) training that allows Marines to experience the effects of CS gas, a non-lethal, riot control agent. All CS gas training activities are conducted in accordance with the safety regulations stipulated in MCO 3400.3G, *Chemical, Biological, Radiological and Nuclear Defense Training Requirements*. Per safety regulations, all military personnel are screened to ensure that they are medically qualified to undergo CS gas training. During training, functioning and properly fitted protective masks are worn. Additionally, a certified emergency medical technician who is familiar with the effects of CS gas and heat stress is present during the CS gas exercise. In addition, the Facility Manager determines the number of participants to be allowed in the chamber at any given time, while the unit CBRN Specialists and Range Safety Officer ensure overcrowding does not occur inside the chamber. Only CS canisters/containers are allowed within the facility. The use of CS grenades is not permitted.

For outdoor training activities using CS grenades (i.e., live CS gas), the training area must be a minimum of 1,640 feet (500 meters) from public traffic routes and the nearest inhabited structure, and 3,280 feet (1,000 meters) from Base boundaries. The MCLB Barstow Range Control Officer (or other responsible authority) must approve the training area before commencement of training activities.

3.7.1.5 Unexploded Ordnance

The USMC's primary mission at MCLB Barstow is to receive, store, distribute, maintain, and repair military supplies and equipment and conduct training for mission-related and combat tasks. These activities generally do not include large-scale ammunition storage. The risk of explosion or detonation exists from storage of ammunition associated with live-fire marksmanship training at the KD Range Complex and security requirements. The DoD has established policies, as stipulated in DoD 3200.15, *Sustainment of Ranges and Operating*, which provide guidance for the sustainment and environmental and explosive safety of the ranges and training areas at MCLB Barstow.

Before 2001, there were no records of ordnance clearance, decontamination, or dedudding associated with MCLB Barstow or its historical predecessors. Since 2001, there have been at least three efforts to remove debris and lead from the ranges. In 2007, an informal cleanup of the KD Rifle Range was conducted and more than 5,000 pounds (2,268 kilograms) of recyclable material was removed. Similarly, in 2008, 7 tons (6,350 kilograms) of metal was removed. A larger project was undertaken in 2012 at all three ranges to excavate, sift, and remove lead and other debris, and reconstruct the berms. Approximately 12,110 pounds (5,493 kilograms) of lead was removed from the berms for recycling (MCLB Barstow 2014).

3.7.1.6 Toxic Chemical Reporting

A variety of ordnance (e.g., small arms ammunition and CS gas) is used at MCLB Barstow as part of proficiency and qualifications training. Ordnance-related residues at small arms ranges and CS gas training facilities can include chemical air emissions and non-hazardous solid waste. Depending on the hazardous nature of these residues, this waste may be subject to management under the Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986, the Solid Waste Disposal Act (SWDA) of 1976, and/or the Resource Conservation and Recovery Act (RCRA) of 1976. EPCRA, or Title III of the Superfund Amendments and Reauthorization Act of 1986, acknowledges the public's right to information concerning toxic chemical usage and releases to the environment. The RCRA and the SWDA regulate the treatment, storage, and disposal of solid wastes, both hazardous and non-hazardous.

Small arms training generates air emissions (chemical by-products resulting from the detonation of explosive materials) and metallic debris (brass casings and lead bullets). Because of the small-caliber nature of the ammunition used, air emissions are minor when compared to metallic debris. Small quantities of solid waste debris (e.g., empty canisters) are generated during CS gas training.

Releases to the environment from ordnance utilized in proficiency and qualification training require annual reporting to the USEPA under the EPCRA Toxic Release Inventory (TRI) program for approximately 700 specifically listed chemicals. Training is subject to a TRI reporting threshold of 10,000 pounds (4,536 kilograms) per year for most common "otherwise used" chemicals, with lower reporting thresholds for chemicals classified as persistent bioaccumulative toxic. These persistent bioaccumulative toxic chemicals include mercury with a reporting threshold of 10 pounds (4.5 kilograms) and lead with a reporting threshold of 100 pounds (454 kilograms).

TRI reporting is also required for listed chemicals which are "manufactured" in quantities greater than 25,000 pounds (11,340 kilograms). These include chemicals generated as by-products from the detonation of explosive materials during training activities. In cases where a threshold is exceeded, the installation must report on a "Form R" report to the USEPA the quantity of ordnance-related waste released to the environment or recovered and disposed of.

Chemical releases resulting from the use of munitions at MCLB Barstow were based on the type and quantity of munitions associated with live-fire marksmanship training at the KD Range Complex, and the chemical composition data obtained from the TRI Data Delivery System (TRI-DDS) database. The TRI-DDS database is a product of the Joint Service EPCRA Workgroup and is intended to provide a consistent method to assess chemical constituent data that could be used by DoD installations when reporting chemical releases and waste management practices. Table 3.7-2 lists the type and quantity of munition items that are annually used at MCLB Barstow.

Table 3.7-2. Existing Annual Munition Usage Data for KD Range Complex Operations

Existing Usage		TRI-DDS Munition Items used in Analysis	
Munition Type*	Annual # Rounds	DODIC	Description[1]
CTG, 12 Gauge Shotgun 00 Buckshot	2,880	A011	CTG 12GA SHOTGUN
CTG, 5.56MM Ball F/M16A2	10,080	A066	CTG 5.56MM BALL M193
CTG, 5.56MM BLK F M16A1/A2	2000	A080	CTG 5.56MM BLK M200
CTG, 9MM 147 GR JHP MK 243 MOD 0	3000	A364	CTG 9MM HPT M905
CTG, 9MM Ball Pistol	24000	A363	CTG 9MM BALL M882
CTG, .45 CAL BALL M1911	5000	A475	CTG CAL .45 BALL M1911
CTG, 9MM FX Marking Red Ink	250	A363	CTG 9MM BALL M882
CTG, 9MM FX Marking Blue Ink	1200	A363	CTG 9MM BALL M882
CTG, 12 Gauge Breaching	10	A011	CTG 12GA SHOTGUN
CHG, Demo BLK 1-1/4# C4	5	M031	CHG DEMO BLOCK TNT
CHG, Demo BLK 1/4LB TNT	4		
Cord, DET Type-1	20	M670	DETONATING CORD - 20 Feet
Dynamite F/Scent Kit	6	M591	MILITARY DYNAMITE M1
Fuse, BLST Time M700	20	NA	FUSE BLASTING TIME M700
Prop Powder, IMR 4064 F	2	NA	PROP PWDR (PROP IMR 4064)

Notes: [1] This information described the TRI-DDS munition items used in the analyses to estimate releases from munitions.
DDS = Data Delivery System; DODIC = Department of Defense Identification Code; KD = Known Distance; and MCLB = Marine Corps Logistics Base; and TRI = Toxic Release Inventory.
Source: MCLB Barstow 2015.

Table 3.7-3 lists the estimated annual chemical releases from existing live-fire marksmanship training at the KD Range Complex. In 2012 and 2013, MCLB Barstow reported that 988 and 572 pounds (448 and 259 kilograms) of lead, respectively, were released on-site from all sources, including munitions training operations (USEPA 2015b).

Table 3.7-3. Estimated Annual Chemical Releases from KD Range Complex Operations

Chemical	Air Releases (lbs)	Non-Air Releases (lbs)
Copper	0	110
Lead	0	607
Lead compounds	0.5	0
Notes: DDS = Data Delivery System; KD = Known Distance; and TRI = Toxic Release Inventory. *Source:* TRI-DDS 2015.		

Established procedures require that all brass casings are collected after each training event and transported off-site for recycling. The recovery of lead bullets embedded in the KD Rifle and KD Pistol Range berms is also conducted on a periodic basis. In 2012, soils were excavated, sifted, lead and other debris was removed, and berms were reconstructed at all three ranges. Approximately 2,500 cubic yards (1,911 cubic meters) of soil were excavated from the berms and 258 cubic yards (197 cubic meters) of sand was imported, sifted, and used for reconstruction of the berms. All metal items larger than 3/16 inch (48 millimeters) were removed. A total of 12,110 pounds (5,493 kilograms) of lead were transported to a recycling facility (MCLB Barstow 2014). Established procedures also require the collection and disposal of solid waste residues from CS gas training.

3.7.1.7 Range Environmental Vulnerability Assessment

The Marine Corps Range Environmental Vulnerability Assessment (REVA) program is a proactive and comprehensive program designed to support the Marine Corps' Range Sustainment Program. The REVA program meets the requirements of the current DoD Directive 4715.11, *Environmental and Explosives Safety Management on Operational Ranges within the United States*, and DoD Instruction 4715.14, *Operational Range Assessments*. The purpose of the REVA program is to identify whether there is a release or substantial threat of a release of munitions constituents from an operational range, or range complex, to off-range areas. This is accomplished through an assessment of operational areas, development of a conceptual site model, and (as applicable) screening-level and transport modeling of the REVA indicator munitions constituents.

To evaluate whether there is a release or substantial threat of a release of munitions constituents from the operational ranges at MCLB Barstow, an initial REVA was conducted in 2008. The REVA was conducted only in association with small arms training activities, because high explosives ammunition is not used during live-fire marksmanship training at MCLB Barstow. The primary munitions constituent at small arms ranges is lead, as it is the most prevalent (by weight) potentially hazardous constituent associated with small arms ammunition. Small arms ranges are qualitatively assessed under the REVA program to identify factors that influence the potential for lead migration, incorporating information such as lead loading, surface water and groundwater characteristics, and potential receptors to determine if there is a possible threat of a release of lead from the ranges. The baseline assessment indicated there is little potential for off-range migration of lead to human or ecological receptors and no further action (NFA) was required for the KD Rifle Range, KD Pistol Range, and 100-yard shotgun range (USMC 2013c).

Review assessments are required every 5 years following the baseline assessment; therefore, a 5-year assessment was completed in 2013, documenting the period of munitions loading from 2007 to 2012. This assessment similarly concluded there is a low potential for migration of lead to receptor points. The findings were based on the infrequent use of the KD Rifle Range, KD Pistol Range, and 100-yard shotgun

range and site characteristics, such as very low precipitation, high evaporation rates, neutral pH of surface water and soils, and the deep groundwater table. NFA was recommended with respect to potential remediation of munitions constituents (USMC 2013c).

3.7.1.8 Installation Restoration Program

In the 1980s, the DoD developed the Installation Restoration Program (IRP) to identify, assess, characterize, and clean up or control contamination from past hazardous waste disposal operations and hazardous materials spills. The DoD instructed each branch of the armed services to comply with the requirements of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. In response, the IRP was developed to remediate contamination at military facilities caused by past use, storage, handling, and disposal of hazardous and other potential toxic substances, as required by CERCLA Section 121. Regulatory oversight for the IRP is provided by the USEPA, state of California Environmental Protection Agency (CalEPA), Department of Toxic Substance Control (DTSC), and RWQCB.

The USEPA classifies IRP sites with a Hazard Ranking System, and those sites with the potential to pose an ecological or health risk are placed on the National Priorities List (NPL). MCLB Barstow is on the NPL and as such, there is a Federal Facilities Agreement (FFA) to facilitate clean-up of the IRP sites. IRP sites on NPL locations are classified as Operable Units (OUs): OU-1 and OU-2 are groundwater contamination areas in the Nebo and Yermo Annexes, and OU-3 through OU-7 are soil contamination areas in the Nebo and Yermo Annexes and subclassified as CERCLA Areas of Concern (CAOCs). Investigations conducted between 1983 and 2006 identified 236 solid waste management units (SWMUs) and 45 CAOCs at MCLB Barstow. Of the aforementioned sites, 236 SWMUs and 37 CAOCs have received regulatory closure. The eight remaining CAOCs are within OU-7, which was established to include sites that were not covered under OU-1 through OU-6 and are still in the investigative stage.

Range Complex

Of the eight CERCLA CAOCs within OU-7 that have not received regulatory closure, none of these CAOCs are located within the Range West, Range East and KD Range Complex, and Range Main Supply Route training areas. However, two sites are located in proximity to the Range Complex. CAOC 10 is located approximately 500 feet (150 meters) to the north and CAOC N2 (Area 1) is located approximately 300 feet (90 meters) to the north (MCLB Barstow 2005; MCLB Barstow 2006).

CAOC 10 was used for burial of metal debris. A human health and ecological risk assessment at CAOC 10 indicated that contaminants detected in soil and soil vapor at CAOC 10 do not pose significant risk, with the exception of lead in surface soil in a relatively small surface hot-spot area. Proposed soil remediation would lower contaminant concentrations within levels considered protective of human health and the environment (NAVFAC 2014).

Site N2 (Area 1) was used as a skeet/trap shooting range. Primary contaminants of concern are lead (from lead shot), polycyclic aromatic hydrocarbons, and polychlorinated biphenyls (PCBs). The primary exposure pathway is ingestion of soil or inhalation of air-borne dust containing site contaminants. Proposed soil remediation would lower contaminant concentrations within levels considered protective of human health and the environment (NAVFAC 2014).

Yermo Stables Training Area

Of the eight CERCLA CAOCs within OU-7 that have not received regulatory closure, one site, CAOC 9.60, is located 0.5 mile (0.8 kilometer) northeast of the Yermo Stables training area. CAOC 9.60

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was the former site of a 40,000-gallon (151,147-liter) capacity underground storage tank (UST) (T-530b). The UST, which was removed in 1992, was used to store oil and other waste liquids (MCLB Barstow 2005; MCLB Barstow 2006). Based on a remedial investigation completed at this site, NFA or land use controls are proposed for CAOC 9.60 (NAVFAC 2014).

The Record of Decision (ROD) for one CAOC that has received regulatory closure, CAOC 23, contains a stipulation that any actions planned for the area, or changes in site use, should be coordinated and reviewed by MCLB Barstow Environmental Division (Jacobs Engineering Group, Inc. 1997). The southwest portion of this CAOC overlies a portion of the Yermo Stables training area (Figure 3.7-4). CAOC 23, known as the Landfill Area, was divided into six strata, or areas. The areas that overlap with the Yermo Stables training area are designated as Stratum 5, which is a potential waste burial area, and Stratum 5A, a "PCB-hit" area.

Soil sampling indicated that Strata 5 and 5A soils contained concentrations of chlorinated pesticides, PCBs, petroleum hydrocarbons, and metals. However, with the exception of an isolated area of PCBs, none of these concentrations exceeded regulatory action levels established for each of the compounds. Stratum 5 soils are generally considered protective of human health and the environment.

An exception to this conclusion occurs at Stratum 5A, which is an area where Aroclor-1254 (a PCB) concentrations in the upper 6 feet (1.8 meters) of soil were above the risk-based concentration (RBC) of 47.3 micrograms/kilogram. However, these PCB concentrations, which appear to be isolated, are below the USEPA suggested action level of 1 milligram/kilogram for residential uses and 10 to 25 milligrams per kilogram for industrial uses. Because the carcinogenic risk falls within the risk range, based on site-specific RBCs, the ROD indicates that any actions planned in this area, or changes in site use, should be coordinated and reviewed by MCLB Barstow Environmental Division (Jacobs Engineering Group, Inc. 1997).

3.7.1.9 Electromagnetic Radiation

Communications and electronic devices (e.g., radar and other radio transmitters) are sources of electromagnetic radiation. Radar and other high-energy electromagnetic emissions can constitute a hazard to humans when they are exposed to such emissions/signals above a maximum power density. In addition, electromagnetic signals emanating from equipment can also interfere with and adversely affect ordnance. Hazards are reduced or eliminated by establishing minimum distances from electromagnetic radiation emitters for people, ordnance, and fuel. These effects are managed under the regulations of the Navy's Hazards of Electromagnetic Radiation to Personnel program. Hazards to ordnance and fuel are managed by the Navy's Hazards of Electromagnetic Radiation to Ordnance and Hazards of Electromagnetic Radiation to Fuel.

The Maintenance Center, located in the Yermo Annex, uses radars that emit electromagnetic radiation. However, a hazard zone (i.e., Hazards of Electromagnetic Radiation to Ordnance) or other safety distance arcs are not required for this area. The only restriction required is that Maintenance Center radars cannot transmit on the same frequencies as the radio beacons used for navigating local aircraft.

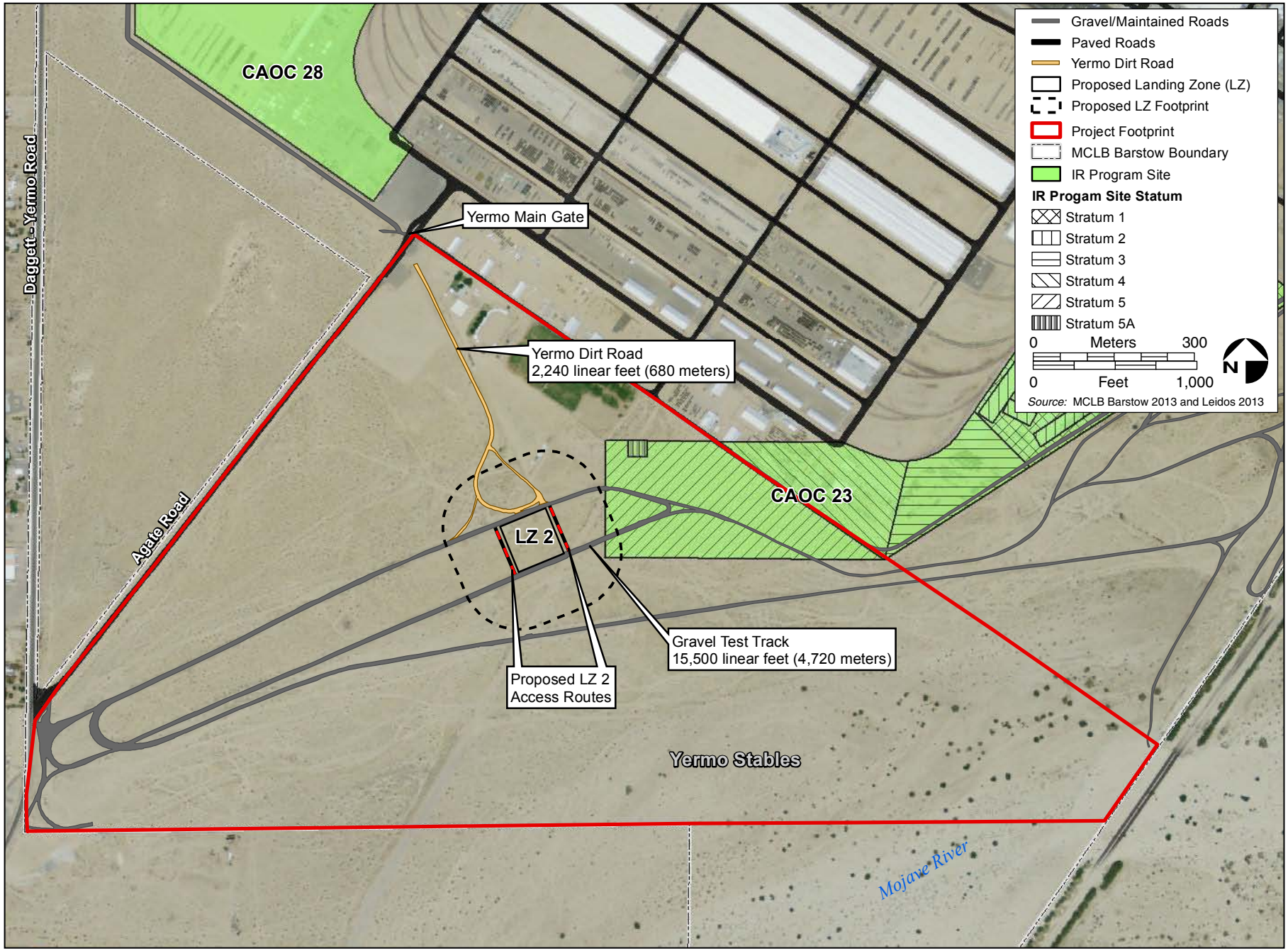

Figure 3.7-4. IR Program Sites in the Yermo Stables Vicinity

3.7.1.10 Other Federal Health and Safety Requirements

The Navy has historically maintained safety and health programs to protect its personnel and property. Occupational health is a key element of the overall Navy Occupational Safety and Health program, which includes explosive, nuclear, aviation, industrial, and off-duty safety.

All proposed construction and operation activities must meet the requirements of the Energy Policy Act of 2005 (Section 109), EO 13693 – *Planning for Federal Sustainability in the Next Decade* (dated 19 March 2015) standards, and other applicable laws. These requirements are intended to ensure, wherever feasible, that pollution would be prevented or reduced at the source; pollution that cannot be prevented or recycled would be treated in an environmentally safe manner; and disposal or other releases to the environment would be employed as a last resort. These requirements would be contained in all construction contractor documents associated with the proposed action.

3.7.2 Environmental Consequences

3.7.2.1 Alternative 1

Protection of Children (EO 13045)

Children live and play in proximity to a portion of the project footprint. The Desert View military housing area is located 0.25 mile (0.4 kilometer) north of the Range Main Supply Route training area. Proposed improvements in the western portion of Range Main Supply Route training area would be limited to a designated refueling, decontamination, and laydown/storage area and range maintenance and sustainment improvements (e.g., periodic road maintenance/grading, drainage improvements, and security gate/fencing inspections). In addition, convoy operations, tactical sustainment training, and CBRN training including the use of blanks, CSM grenades, and pyrotechnics would occur in this area.

The proposed LHA/LHD site within the Range West training area would be located approximately 1 mile (0.6 kilometer) from the Desert View military housing area, at the closest point. The southern portion of Range West, furthest from the military housing area, would be a high-intensity training area (i.e., Pre-Designated Range Training Area), with less intensive training operations occurring in more remote areas of the training area. In addition, no live-fire exercises would be conducted in the Range West training area.

All proposed training activities would occur within the project footprint and public access is limited. Controlled, secured access gates prevent public access to the Range Complex. The Yermo Stables training area is located in a publicly accessible area; however, Alternative 1 would install permanent fencing along the boundary of the Yermo Stables training area to preclude public access and provide enhanced public safety. All other portions of the project footprint have controlled, secured access gates. Accordingly, children would not be exposed to environmental conditions or military activities in the project vicinity. Therefore, no significant impacts to the protection of children would occur.

Aviation Safety

Three new aircraft landing areas – two proposed LZs and an LHA/LHD site – and general aviation areas would be established within the project footprint to support aviation training operations. Proposed aviation training would add approximately 1,240 annual aircraft sorties (i.e., one arrival and departure or visit) and 3,868 operations (e.g., a touch and go or pad landing) at MCLB Barstow (Table 2.3-3). Aircraft would be allowed to land anywhere within the general aviation areas. Proposed aircraft operations could occur as part of MAGTF-level training operations or as standalone events. In general, standalone aviation

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training would occur at the designated LZs and/or LHA/LHD site. However, integrated MAGTF aviation training would generally occur at variable locations within the general aviation areas to facilitate pilot judgment and safety training/risk management. Aviation training could involve one or two rotary wing aircraft, but no more than one aircraft would land at an LZ or the LHA/LHD landing platform at a time.

Comprehensive operating procedures are employed by the USMC to reduce the potential for aircraft accidents and increase aviation safety. Current aviation safety procedures, including FAA-mandated restrictions and military aviation operations guidance, would continue to be implemented and additional flight operations at MCLB Barstow would adhere to established safety procedures. In addition, the emergency and mishap response guidelines stipulated in the MCLB Barstow Range Regulations would be updated, as needed, to include procedures and response actions necessary to address a mishap involving any new aircraft platforms. With this update, safety conditions at MCLB Barstow would be similar to existing conditions. No changes or additions to the existing airspace structure would be required to accommodate proposed aviation training. Likewise, no changes would be required to those procedures that have been implemented by the USMC and the FAA for scheduling and managing use of this airspace environment. Therefore, no significant impacts to aviation safety would occur.

Safety and Environmental Health

Alternative 1 would include a new 700-, 800-, and 900-yard firing line at the KD Rifle Range to provide more advanced training requirements for sniper team training. The existing SDZs would be shifted to the east, depending on which yard line was being used. The existing safety distances and zones would continue to be adequate to accommodate the new munition types (i.e., .22 cal., .38 cal., and 7.62mm). Units conducting live-fire marksmanship training at the KD Range Complex would preclude concurrent use of the other training areas within the Range Complex, including Range East, Range West, and Range Main Supply Route.

Under Alternative 1, range maintenance and sustainment activities would be conducted on a periodic basis to support training operations. Proposed maintenance activities at the KD Range Complex would include maintaining and periodically replacing approximately 30 target carriages (i.e., small arms training target system) at the KD Rifle Range. Existing berms at the KD Rifle Range, KD Pistol Range, and 100-yard shotgun range would be fixed by filling in areas that have been eroded (e.g., rip-rap protection). The existing berms around the 100-yard shotgun range would be raised by 3 feet (0.9 meter) for safety purposes. The lead bullets embedded in the KD Rifle and Pistol Range berms would be periodically removed and recycled. Additional maintenance activities would include periodic range sweeps to collect debris and routine inspection and maintenance (repairs and/or replacement) of security gates, barbed wire, chain linked fencing, and portions of the MCLB Barstow perimeter fence with the project footprint. Proposed range maintenance and sustainment activities would ensure the small arms training ranges operate properly and safely for Marine forces. Therefore, no significant impacts on safety and environmental health associated with live-fire marksmanship training would occur.

A tear gas training facility would be constructed in the KD Range Complex. The MCLB Barstow Range Control Officer (or other appropriate/responsible MCLB authority) would approve the location and configuration of the facility. Proposed tear gas training would be conducted in accordance with required safety regulations, including medical screening and the use of personal protective equipment, and certified emergency medical technicians. Additionally, CS gas grenades would be used for training within the Range West and Range Main Supply Route training areas to support tactical scenarios. For outdoor training activities using CS gas grenades (i.e., live CS gas), the proposed training area would be approved by the MCLB Barstow Range Control Officer (or other responsible authority) before commencement of training activities. Therefore, no significant impacts on safety and environmental health associated with tear gas training would occur.

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Construction activities associated with updating operational capabilities of existing training areas and ranges and proposed ground and aviation training activities would not occur within a hazard zone. In addition, communications used during command/logistics post exercises (i.e., setting up temporary, remote communication assets) and aviation training would not generate large amounts of electromagnetic radiation. Therefore, no significant impacts on safety and health impacts associated with electromagnetic radiation would occur.

Hazardous and Toxic Materials and Waste

The KD Range Complex would continue to support live-fire marksmanship training. Table 3.7-4 lists munition items that would be used to support proposed training activities within the KD Range Complex. The table also includes description data for TRI-DDS munition items employed in the analyses to estimate releases.

Table 3.7-4. Annual Munition Usage for Proposed KD Range Complex Training Activities

Existing Usage		TRI-DDS Munition Items used in Analyses	
Munition Type	Annual # Rounds	DODIC	Description
.22 CAL	1200	A086	CTG CAL .22 LR BALL
.38 CAL	1200	A400	CTG CAL .38 SPEC BALL M41
CTG, 5.56MM Ball F/M16A2	1200	A066	CTG 5.56MM BALL M193
CTG, 5.56MM BLK F M16A1/A2	9600	A080	CTG 5.56MM BLK M200
7.62 MATCH	25600	A171	CTG 7.62MM MATCH M852
7.62 BLK	3600	A110	CTG 7.62MM BLK M82
50 CAL BLK	3600	A558	CTG CAL .50 BLK M1
CTG, 9MM Ball Pistol (NEW)	1200	A363	CTG 9MM BALL M882
CTG, .45 CAL BALL M1911	1200	A475	CTG CAL .45 BALL M1911
CS Grenades	24	G924	GREN HAND RIOT CS-1 M23A2
Pyro	96	5W59	CTG 5.125IN PYRO MK186 MOD2
Smoke	96	G940	GREN HAND SMK GRN M18

Notes: DDS = Data Delivery System; DODIC = Department of Defense Identification Code; KD = Known Distance; MCLB = Marine Corps Logistics Base; and TRI = Toxic Release Inventory.
Source: MCLB Barstow 2015.

Table 3.7-5 summarizes the resulting quantity of chemicals released to the air and ground from proposed training activities within the KD Range Complex. The table also identifies whether any chemicals exceeded TRI thresholds.

Under the EPCRA TRI program, federal facilities are required to report annual releases and off-site transfers (i.e., transfer of wastes for treatment or disposal) of listed chemicals associated with munitions training. As shown in Table 3.7-5, proposed live-marksmanship training activities would generate quantities of lead that exceed the TRI reporting threshold. MCLB Barstow has existing procedures in place to ensure compliance with TRI reporting requirements and currently reports for lead in annual Form R reports. Additionally, lead residue is recovered and removed from the KD Range Complex on a routine basis.

REVAs were conducted in 2008 and 2013 to evaluate whether there has been a release or substantial threat of a release of munitions constituents from live-fire marksmanship training in the KD Range Complex. Based on these assessments, there is a low potential for migration of lead from the KD Rifle Range, KD Pistol Range, and 100-yard shotgun range to receptor points. The findings were based on the infrequent use of the small arms training ranges and site characteristics, such as very low precipitation,

high evaporation rates, neutral pH of surface water and soils, and the deep groundwater table. NFA was recommended with respect to potential remediation of munitions constituents. Under Alternative 1, REVA updates would continue to be completed every 5 years. With continued implementation of policies and procedures associated with the reporting, management, and recovery of ordnance related residue, no significant impacts on public health and safety impacts would occur.

Table 3.7-5. Chemical Release Estimates from Proposed KD Range Complex Training Activities

Chemical	Air Releases (lbs)[1]	Non-Air Releases (lbs)[1]	Reporting Threshold Exceeded
Antimony	0	9	No
Antimony compounds	1	0	No
Asbestos (friable)	0	1	No
Barium compounds	1	0	No
Chlorine	1	0	No
Chromium	0	38	No
Copper	0	196	No
Hydrochloric acid	21	0	No
Lead	0	513	Yes
Lead compounds	1	0	No
Nickel	0	18	No

Notes: [1]Annual reporting thresholds are 25,000 pounds (11,400 kilograms), except for lead, which is subject to an overall reporting threshold of 100 pounds (45 kilograms).
DDS = Data Delivery System; KD = Known Distance; and TRI = Toxic Release Inventory.
Source: TRI-DDS 2015.

Installation Restoration Program Sites

Two CAOC sites are located in proximity to the Range Complex. CAOC 10 is located approximately 500 feet (150 meters) to the north and CAOC N2 (Area 1) is located approximately 300 feet (90 meters) to the north. Proposed soil remediation at these locations would minimize potential health and safety impacts associated with contaminated soil. Therefore, no impacts are anticipated with respect to construction and/or training activities in relative proximity to those sites.

The southwest portion of CAOC 23 overlies a proposed high-intensity training area within the Yermo Stables training area (Figure 3.7-4). The areas within CAOC 23 that overlap with the Yermo Stables training area are a potential waste burial area (Stratum 5) and a "PCB-hit" area (Stratum 5A). Soil sampling indicated that compounds in Stratum 5 soils (e.g., chlorinated pesticides, PCBs, petroleum hydrocarbons, and metals) did not exceed regulatory action levels. However, Aroclor-1254 (a PCB) concentrations in the upper 6 feet (1.8 meters) of soil in Stratum 5A are above the RBC of 47.3 micrograms/kilogram.

Proposed construction and training operations (e.g., breaching/constructing fortified positions, obstacles, and minefields) would occur within and adjacent to Stratum 5A (CAOC 23). Proposed utility installations (i.e., electrical and potable water) in the northeastern portion of the Yermo Stables training area would require trenching/excavations within and adjacent to Stratum 5A. However, installation of permanent fencing along the training area boundary and tie-ins to the Yermo Annex fencing would not occur within or adjacent to Stratum 5A. Ground-disturbing activities would occur during training activities to establish berms, trenches, fighting positions, and tank ditches. This area could also be cleared of vegetation and graded to support a bivouac area. Proposed ground-disturbing activities could potentially result in adverse health and safety impacts to personnel. However, all activities conducted in the Yermo Stables training area would be coordinated and reviewed by MCLB Barstow Environmental Division and Range

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Operations before initiating any ground disturbing activities to reduce potential exposure of on-site personnel to contaminated soil. Refer to Special Conservation Measure 24 (*Restrictions for Construction and Training within Proximity to IR Sites)*, described in Appendix B.

Incidental Spills and Construction Waste

Construction and training activities would include the use of heavy equipment that would be subject to potential spills of fuel, oil, lubricants, coolant, transmission fluid, hydraulic oil, or other miscellaneous fluids. Servicing vehicles/equipment could similarly result in spills of such petroleum products. In addition, Alternative 1 could generate small quantities of hazardous waste, such as solvents, adhesives, and paint. Spills of petroleum products or hazardous waste could potentially penetrate into on-site soils resulting in soil and/or groundwater contamination. Although the intensity and frequency of construction and operations would increase under Alternative 1, all activities would be conducted in accordance with the hazardous materials Best Management Practices (BMPs) stipulated in the MCLB Barstow Range Regulations. As discussed in Section 3.12, *Water Resources*, the construction contractor would develop and disseminate a Spill Prevention, Control, and Countermeasures (SPCC) Plan. Examples of BMPs in an SPCC Plan include establishment of designated areas for equipment fueling and maintenance; use of licensed, trained personnel for operation of vehicles and equipment; and completion of a regular, comprehensive equipment maintenance program. Spill containment structures would be provided to prevent spills, leaks, and unauthorized discharges. Per the MCLB Barstow Spill Reporting Advisory, all hazardous waste spills would be reported immediately to the MCLB Barstow Environmental Division. Therefore, no significant impacts associated with incidental spills and construction waste would occur.

Other Federal Health and Safety Requirements

All requirements of EO 13693 (*Planning for Federal Sustainability in the Next Decade*) (dated 19 March 2015) and other applicable laws such as designing new range facilities and infrastructure to meet LEED requirements to the extent feasible, solid waste diversion and recycling, and pollution prevention and management of toxic and hazardous materials, would be specified in construction contractor contracts and implemented using standard BMPs. These requirements would ensure, wherever feasible, that pollution would be prevented or reduced at the source and/or treated in an environmentally safe manner. Therefore, no significant impacts on public health and safety would occur.

3.7.2.2 No-Action Alternative

Under the No-Action Alternative, existing training ranges and areas would not be enhanced to support combat readiness of USMC operating forces and limited ground training and live-fire marksmanship training at the KD Range Complex would continue under current conditions. Existing public health and safety conditions would remain as described in Section 3.7.1, *Affected Environment*. Potential safety risks associated with public access to the Yermo Stables training area would still occur. No impacts on public health and safety would occur.

3.8 Topography and Geology

3.8.1 Affected Environment

3.8.1.1 Topography

The project footprint is located within the Mojave Valley, which in the project vicinity is generally formed by the Calico Mountains to the north and the Newberry Mountains to the south. The Range

Complex is located south of the Mojave River and the Yermo Stables training area is located north of the Mojave River.

The Range West training area consists of an approximately 80-foot (24-meter) high, north-trending ridge and adjacent north trending floodplain area. The Range East and KD Range Complex training area consists of undulating, north–south trending topography, with a maximum relief (i.e., change in elevation) of approximately 40 feet (12 meters) in the western portion, and more uniform, gently sloping topography in the eastern portion. The Range Main Supply Route training area consists of undulating topography, formed by the northern terminus of north-trending ridges and intervening drainages. The Yermo Stables training area occupies a relatively flat area that slopes gently to the east, immediately north of the Mojave River.

3.8.1.2 Faulting and Seismicity

MCLB Barstow has experienced several earthquakes from various faults, ranging in magnitude from 4.0 to 7.5. Four of the most significant earthquakes were the Kern County earthquake (7.5), the Landers Earthquake (7.3), the Big Bear Earthquake (6.4), and the Hector Mine Earthquake (7.1) (MCLB Barstow 2006).

The California Geological Survey, formerly known as the California Division of Mines and Geology, classifies faults as either active or potentially active, according to the Alquist-Priolo Special Studies Zone Act of 1972. A fault that has exhibited surface displacement within the Holocene Epoch (the last 11,000 years) is defined as active by the California Geological Survey. A fault that has exhibited surface displacement during the Pleistocene Epoch (which began about 1.6 million years ago and ended about 11,000 years ago) is defined as potentially active. Pre-Pleistocene faults are considered inactive. The California Geological Survey has established Alquist-Priolo Special Study Zones around faults identified by the state geologist as being active. The Alquist-Priolo Special Studies Zone Act limits development along the surface trace of active faults to reduce the potential for structural damage and/or injury due to fault rupture. The California Geological Survey also suggests that active faults, located within a 60-mile (96-kilometer) radius of a project footprint, be evaluated with respect to regional seismicity (California Division of Mines and Geology 1994; California Geological Survey 2007) (Table 3.8-1).

Table 3.8-1. Major Active Faults in the Project Vicinity

Major Active Faults	Distance of Fault from Project Footprint(Miles)	Maximum Probable Earthquake (Moment Magnitude)
Camp Rock-Harper Lake	Traverses the Range Main Supply Route	7.5
Lenwood	5	7.4
Calico	9	7.1
Helendale	21	7.3
Pisgah	25	7.0
Johnson Valley	23	7.3
North Frontal Zone	30	7.1
San Andreas	50	8.0
Garlock	50	7.6
San Jacinto	54	7.5
Cucamonga	55	7.0
Sources: California Division of Mines and Geology 1994; Southern California Earthquake Data Center 2013.		

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The Waterman Hills Detachment Fault, which is considered inactive, is exposed in the hills north of Barstow and probably extends southeastward beneath the Nebo and Yermo Annexes.

The Camp Rock-Harper Lake Fault Zone, which traverses the Nebo Annex, is part of a continuous fault system approximately 60 miles (100 kilometers) in length (Figure 3.8-1) (USGS 1997). About 12 miles (20 kilometers) of the Camp Rock Fault ruptured in the magnitude 7.3 Landers earthquake of 1992 (Southern California Earthquake Data Center 2013). Three of the five northwest-trending, strike-slip fault strands associated with this fault zone (i.e., Faults A, B, and C) traverse portions of the Range Main Supply Route training area (Figure 3.8-1). The other training areas are not underlain by fault strands. Fault investigations, including fault trenching on Fault C, which appeared to be the youngest of the faults, indicated that the fault has been active in Holocene time (past 11,000 years), which indicates the fault zone is active. Fault C has moved four times in the past 7,620 years, or on average about once every 1,900 years during this period (USGS 1997). However, this fault has not been zoned as an Alquist-Priolo Earthquake Fault Zone in the project footprint (California Geological Survey 2007). Although fault studies have not been completed for Faults A and B, those fault strands are considered potentially active based on seismicity of the Camp Rock-Harper Lake Fault Zone and their association with active Fault C.

Other older northwest-trending faults underlie the Yermo Annex and surrounding areas. However, none of these faults have exhibited surface displacement within the Holocene Epoch or Pleistocene Epoch and are, therefore, not considered active or potentially active (USGS 1997). Similarly, these faults have not been zoned as Alquist-Priolo Earthquake Fault Zones in the project footprint (California Geological Survey 2007).

3.8.1.3 Geologic Hazards

The active Camp Rock-Harper Lake Fault Zone traverses the project footprint, in the vicinity of the Range Main Supply Route training area. The potential exists for surface fault rupture within this fault zone. The primary geologic hazard is strong seismically induced ground shaking. There is a 10 percent probability that peak ground accelerations within the project footprint would exceed 0.2 to 0.3 percent of gravity during the next 50 years (Petersen et al. 1999). This level of ground shaking is a potentially serious hazard. The project footprint is located on sandy alluvial soils in proximity to the Mojave River, where groundwater is locally forced to the surface by the Camp Rock-Harper Lake Fault Zone (USGS 1997). Therefore, the potential for liquefaction[1] exists in the project footprint.

[1] A process by which water-saturated sediment temporarily loses strength and acts as a fluid.

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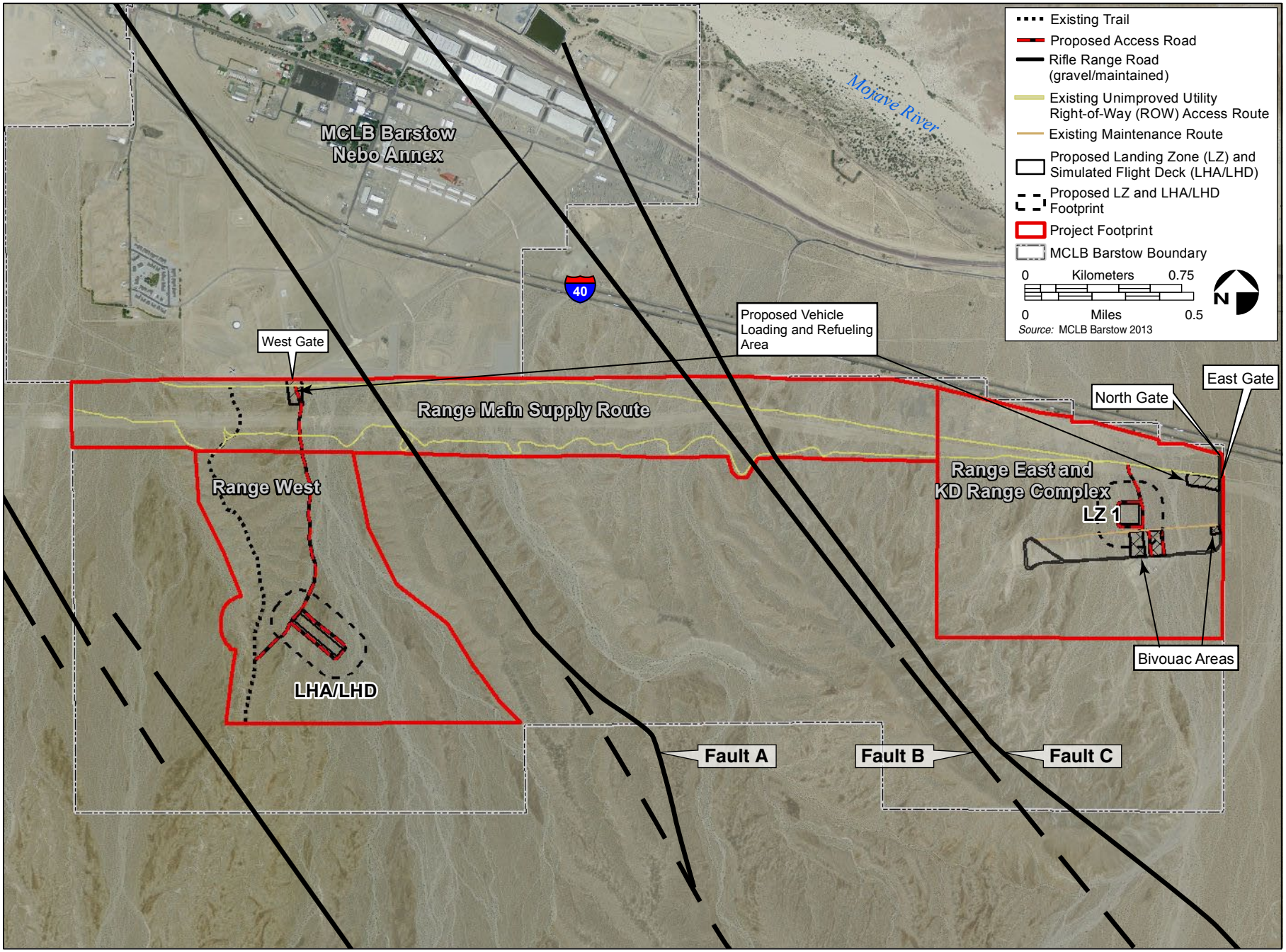

Figure 3.8-1. Camp Rock-Harper Lake Fault Zone

3.8.2 Environmental Consequences

3.8.2.1 Alternative 1

Construction

Topography

Site development would require excavation/grading. The topography of the areas proposed for development within the Range West, Range East and KD Range Complex, and Yermo Stables training areas are relatively flat to gently sloping. Development of the LHA/LHD landing platform could require up to 17,300 cubic yards (13,227 cubic meters) of fill. The fill would be needed to elevate the LHA/LHD landing platform above the floodplain and limit the change in topography on the southeastern edge of the landing platform for approaching aircraft. The fill could be excavated on-site from the two ridges south of the LHA/LHD landing platform. This would result in a flat area to the south of the LHA/LHD landing platform, with cut slopes up to 25 feet (7.6 meters) in height (Figure 2.3-3). This alteration of topography at the LHA/LHD landing platform would result changes to existing on-site drainage patterns, which are discussed in Section 3.11, *Water Resources*. Grading at LZ 1 would generally follow the orientation of the existing topography and have slopes of 2 percent or less. This would generally require cut from upslope areas and fill in downslope areas at this location. Minor slopes (less than 6 feet [1.8 meter] drop in elevation) would be created upslope and downslope of LZ 1 (Figure 2.3-6). All berm construction (700-yard, 800-yard, and 900-yard lines and raising the 100-yard shotgun berms) would require the importation of 36,620 cubic yards (27,998 cubic meters) of fill. The yard-line berms would be installed within the KD Rifle Range footprint and in between existing berms. Minimal grading would be required to construct LZ 2 located on a flat area within the Yermo Stables training area. Therefore, no significant impacts on topography would occur.

Seismicity

One active fault (Fault C) and two potentially active faults (Faults A and B) associated with the Camp Rock-Harper Lake Fault Zone traverse the Range Main Supply Route training area (Figure 3.8-1). The portions of the fault zones that traverse this training area have not been included as an Alquist-Priolo Special Study Zone; however, field investigations have determined that Fault C has ruptured during Holocene time and should, therefore, be considered active. Faults A and B are considered potentially active based on historic seismicity of the Camp Rock-Harper Lake Fault Zone and their association with active Fault C. The LHA/LHD site would have temporary structures (e.g., Hesco walls or CONNEX boxes) to simulate confined aerial landing. The Range East and KD Range Complex training area would include structures intended for human occupancy, such as a new range office and classroom building (replace Building 249). However, no active strands of the fault zone traverse these training areas and the potential for surface fault rupture would be confined to the Range Main Supply Route training area, which could readily be repaired in the event of fault rupture-related damage. No habitable structures would be located within the Range Main Supply Route training area; therefore, injuries to personnel would not occur. As a result, no significant impacts related to fault rupture would occur.

Active faults located within 60 miles (96 kilometers) of the project footprint could result in strong seismically induced ground shaking and associated differential settlement. In addition, portions of the project footprints could be susceptible to liquefaction, as a result of shallow groundwater and sandy soils. However, new facilities would be designed and constructed to comply with the seismic design criteria identified in the International Building Code, NAVFAC P-355 Seismic Design Manual, and the most stringent criteria identified in the latest design specifications of the Structural Engineering Association of California.

In addition, as required under California Code of Regulations Title 24, a standard, site-specific, geotechnical investigation that includes recommendations for design and construction would be prepared before construction. Therefore, no significant impacts related to seismic risk would occur.

Operations

Topography

Proposed training activities would include ground disturbing activities (e.g., excavation and grading) related to ground training, aviation training, and range maintenance and sustainment activities. All areas disturbed during ground training activities at the training areas would be restored to their original condition. Therefore, no significant impacts on topography would occur.

Seismicity

Proposed training activities within the Range Main Supply Route training area, including convoy operations, tactical sustainment training, and CBRN training, would occur along portions of one active fault (Fault C) and two potentially active faults (Faults A and B). No habitable structures would be located within the Range Main Supply Route training area to support training activities. Proposed training activities within the Range West, Range East and KD Range Complex, and Yermo Stables training areas would not occur within or adjacent to active faults. Therefore, no significant impacts related to seismic risk would occur during operations.

3.8.2.2 No-Action Alternative

Under the No-Action Alternative, existing training ranges and areas would not be enhanced to support combat readiness of USMC operating forces and limited ground training and live-fire marksmanship training at the KD Range Complex would continue under current conditions. Existing topography and geology conditions would remain as described in Section 3.8.1, *Affected Environment*. No impacts on topography and geology would occur.

3.9 Transportation

Transportation infrastructure includes the public roadway network, public transportation systems, airports, railroads, pedestrian/bicycle facilities, and waterborne transportation required for the movement of people, materials, and goods. This section evaluates whether the proposed action would have the potential to impact pubic roadways that provide access to MCLB Barstow, Base access control points or gates, and the internal roadway system.

3.9.1 Affected Environment

3.9.1.1 Local and Regional Traffic Circulation

MCLB Barstow is located in western San Bernardino County, California, 3.5 miles (6 kilometers) east of the City of Barstow (Figure 1.1-1). The Base is situated near the junction of three major highways systems: I-40; I-15; and State Highway 58. Regional access is provided to the Nebo Annex and Range Complex via I-40 (Figure 3.9-1). The Yermo Annex is accessed via I-40 from the south or I-15 from the north along Daggett-Yermo Road (Figure 3.9-2). Historic Route 66 parallels I-40 and extends through the Nebo Annex, and along the northern boundary of the Range Complex and Yermo Annex.

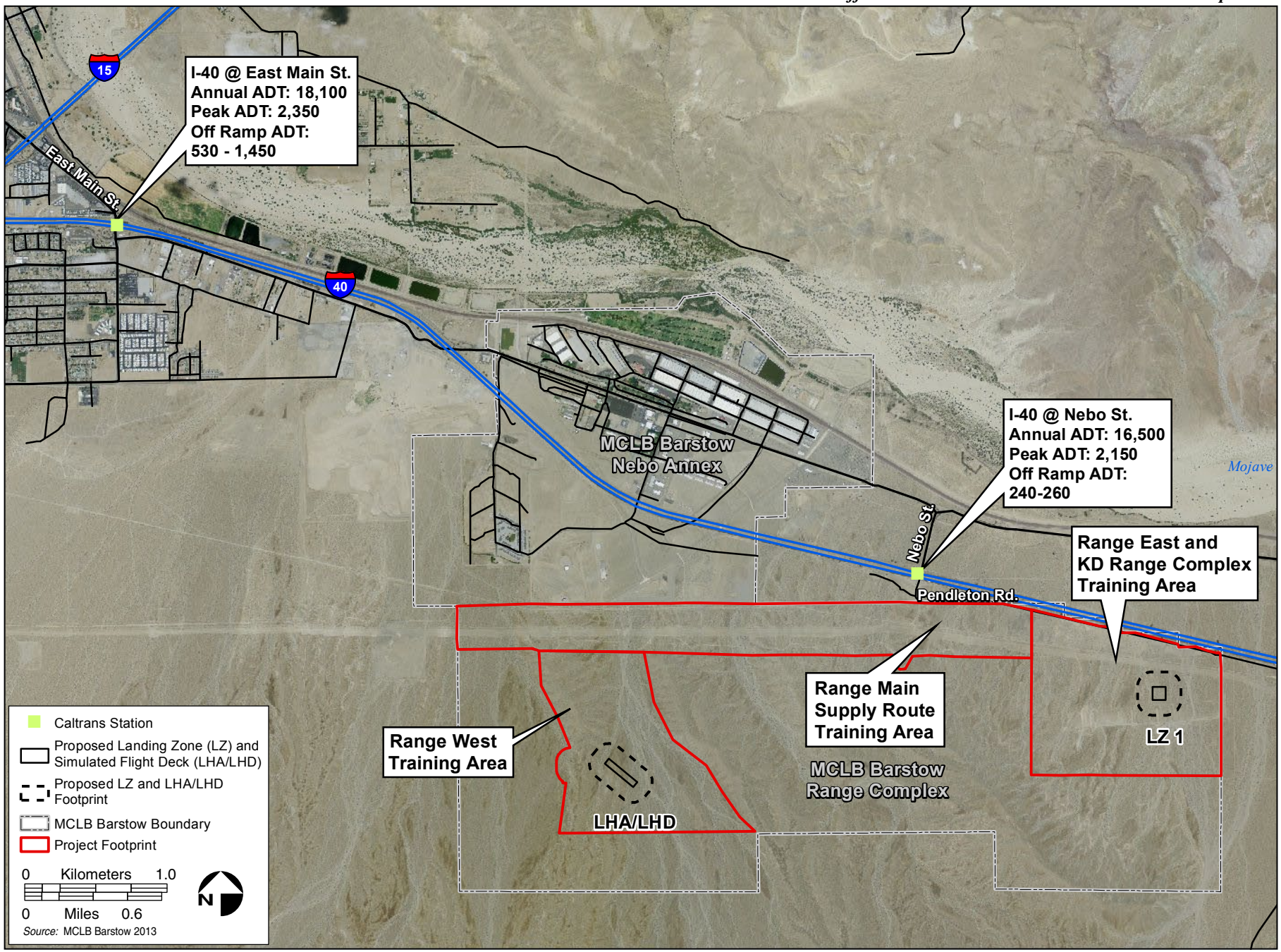

Figure 3.9-1. Existing ADT Volumes near the Range Complex

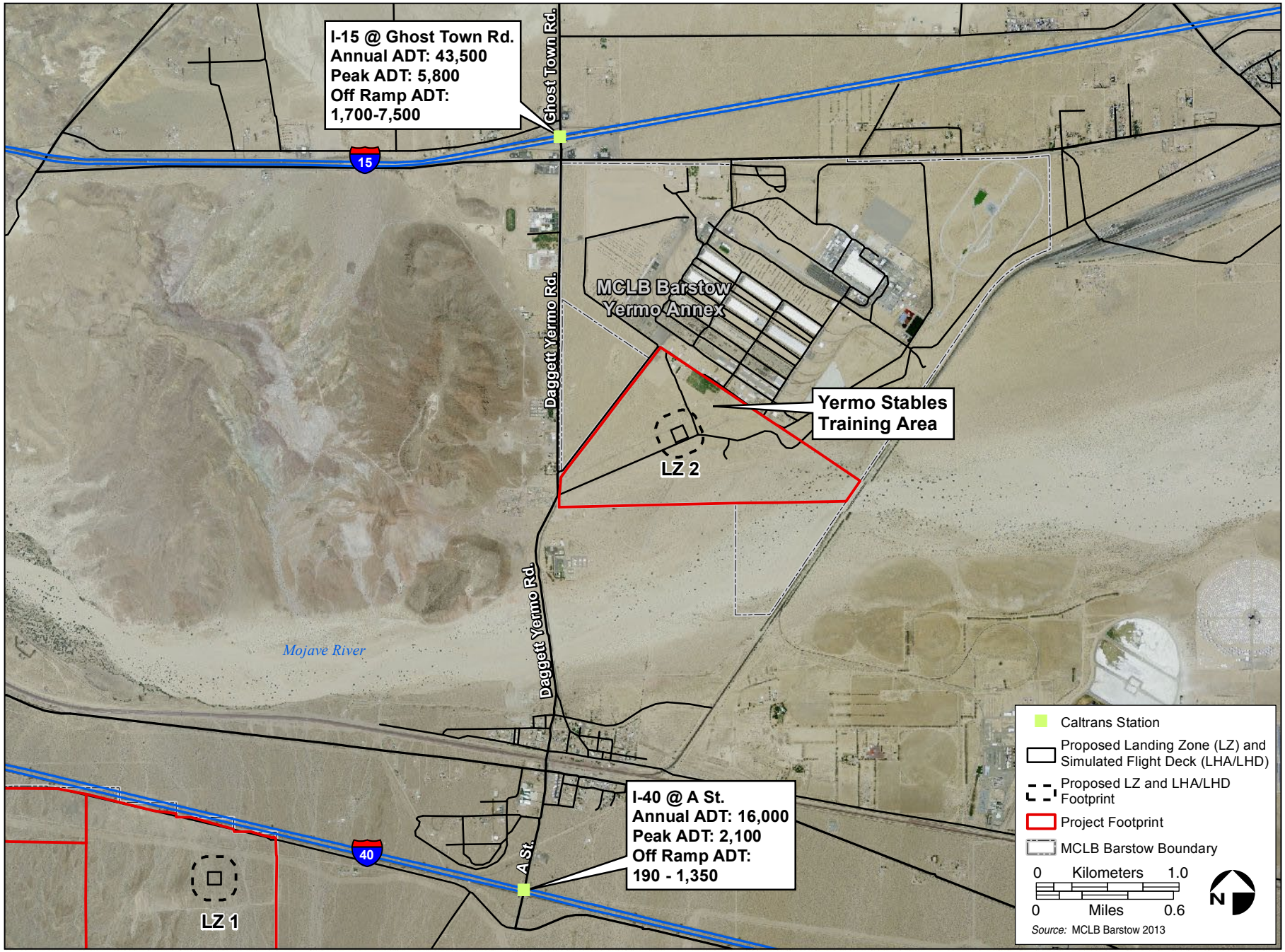

Figure 3.9-2. Existing ADT Volumes near the Yermo Annex

MCLB Barstow operates DoD's largest rail yard (owned by Burlington Northern-Santa Fe and Union Pacific) and serves as the primary rail support for the National Training Center at Fort Irwin. The rail yard is located in the Yermo Annex and numerous rail lines and spurs connect the Nebo Annex and Yermo Annex to the rail yard. The Burlington Northern and Santa Fe Railway crosses the northern portion of the Nebo Annex, and a rail spur east of Daggett runs along the eastern boundary of the Yermo Annex.

3.9.1.2 Traffic Circulation at MCLB Barstow

The existing street network at MCLB Barstow consists mostly of low-speed, two-lane roads that are well connected and generally sufficient. The Nebo Annex is accessed via I-40E (exit Main Street). The primary entrance to the Nebo Annex (Main Gate) is located at the west end of the annex on Joseph L. Boll Avenue. A second gate is located at the east end of the annex; however, this access point has scheduled hours of operations and is used for delivery/pick up of large commercial items.

The Range Complex can be accessed via I-40 (from either the Nebo Street to the west or Yermo/A Street exit the east) to Pendleton Road. It can also be accessed via Historic Route 66 (Nebo Street exit) to Pendleton Road from the west. The primary access point (North Gate) is located on Pendleton Road. A secondary access gate (East Gate), which provides access to the Range West and Range East and KD Range Complex training areas, is located on Rifle Range Road. Another access point (West Gate) is located along the fence line that separates the Nebo Annex and the publicly accessible I-40 frontage road (Pendleton Road) from the Range Complex. The primary route in the Range Complex is Rifle Range Road (gravel/maintained), which provides primary access to the Range East and KD Range Complex training area. Two existing unimproved, 4-WD utility ROW access routes provide primary access to the Range West training area.

The Yermo Annex is located approximately 5 miles (8 kilometers) east of the Nebo Annex and can be accessed from I-15 (Ghost Town Road exit) and I-40 (Yermo [A Street] exit) via Daggett-Yermo Road and Agate Road. The primary entrance (Main Gate) to the Yermo Annex is located at the north end of Agate Road, which is accessed from Daggett-Yermo Road. A second gate (closed) is located on F Street near its intersection with Yermo Road.

Due to the closure of the secondary access gates at MCLB Barstow, vehicles traveling from the Nebo Annex to the Yermo Annex travel on I-40 east to the Daggett (A Street) exit, and enter the Yermo Annex at the Main Gate. An alternate access route between the Nebo Annex and Yermo Annex is I-15 via the Ghost Town Road exit (MCLB Barstow 2006).

Level of service (LOS) is a measure of roadway operation, which uses a qualitative grading scale from A to F. LOS A represents the best traffic operations and LOS F represents the worst traffic operations. LOS can be used to characterize the overall traffic operations along a roadway or at an intersection.

The principal roadways that serve the project footprint are described below.

I-15 is a four-lane, north–south-oriented freeway located to the north of MCLB Barstow and provides regional access between the San Bernardino/Los Angeles/San Diego areas to the south and Las Vegas, Nevada/Utah areas to the north. The freeway is oriented east–west near MCLB Barstow. The annual average daily trips (ADT) volume near Yermo Annex (at Ghost Town Road) is 53,000 with a peak hour ADT of 5,800 (Caltrans 2013a) (Figure 3.9-2). There is no direct access to the Nebo Annex from I-15.

I-40 is a four-lane, east–west-oriented freeway that has its western terminus at the I-15 Freeway in the City of Barstow. I-40 provides regional access through the Mojave Desert to northern Arizona. The annual ADT near Nebo Annex (at Main Street) is 18,100 with a peak hour ADT of 2,350 (Caltrans 2013a)

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(Figure 3.9-1). The annual ADT near Yermo Annex (at A Street) is 16,000 with a peak hour ADT of 2,100 (Caltrans 2013a) (Figure 3.9-2).

A Street is a two-lane, north–south-oriented freeway that has its northern terminus at Historic Route 66 where the road turns into Daggett-Yermo Road and its southern terminus at Pendleton Road. The existing volume at the I-40 on/off-ramps at A Street near the Yermo Annex is between 190 and 1,350 ADT (Caltrans 2013b) (Figure 3.9-2).

East Main Street is an east–west arterial that has interchanges with I-15 and I-40 and provides local access to the Nebo Annex. The existing volume at the I-40 on/off-ramps at Main Street near the Nebo Annex is between 530 and 1,450 ADT (Caltrans 2013b) (Figure 3.9-1).

Daggett-Yermo Road is a two-lane, north–south-oriented road that has its northern terminus at Yermo Road near I-15 and Ghost Town Road and its southern terminus at A Street and Historic Route 66. The ADT on Daggett-Yermo Road near Yermo Road is 3,225 (County of San Bernardino 2015) (Figure 3.9-2).

Ghost Town Road is a two-lane, north–south-oriented road that has its northern terminus at the Yermo Cutoff/Calico Road intersection and its southern terminus at the Yermo Road/Daggett-Yermo Road intersection near I-15. The existing volume at the I-15 on/off-ramps at Ghost Town Road near Yermo Annex is between 1,700 and 7,500 ADT (Caltrans 2013b) (Figure 3.9-2).

Nebo Street is a two-lane, north–south-oriented road that has its northern terminus at Historic Route 66 and southern terminus at I-40. The existing volume at the I-40 on/off-ramps at Nebo Street Road near the Range Complex is between 240 and 260 ADT (Caltrans 2013b) (Figure 3.9-1).

Pendleton Road is a two-lane, east–west-oriented road that has its western terminus at Nebo Street and its eastern terminus as Camp Rock Road. The ADT for Pendleton Road at East A Street is 30 (County of San Bernardino 2015).

3.9.2 Environmental Consequences

To assess the potential environmental consequences associated with transportation and increased utilization of the existing roadway system and access gates due to potential effects from construction activities and training operations is analyzed. Impacts could occur from physical changes to circulation, traffic delays, and changes in traffic volumes.

No construction or operational activities would occur within the Nebo Annex or Yermo Annex. However, all construction personnel would be required to check-in at the Nebo Annex Main Gate and/or Yermo Annex Main Gate before accessing the project footprint. Proposed construction and training activities would not affect MCLB Barstow rail operations and, therefore, are not addressed further.

3.9.2.1 Alternative 1

Construction

Construction activities associated with grading and stabilizing the designated LZs, LHA/LHD site, and access roads, and installing the LHA/LHD landing platform, KD Range Complex upgrades, new support facilities, utility infrastructure modifications, and installing permanent fencing at the Yermo Stables training area would require the delivery of materials to and removal of construction-related debris from the project footprint. Trucks associated with these activities, along with construction crews, would utilize

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existing roadways from the City of Barstow and the area immediately surrounding MCLB Barstow. Access to the Range Complex would be provided via the North Gate from Pendleton Road. Within the Range Complex, the Rifle Range Road would provide primary access to the Range East and KD Range Complex training area and the two existing unimproved, 4-WD utility ROW access routes would provide primary access to the Range West training area. Secondary access to the Range West training area could also be provided via the West Gate. The Yermo Stables training area would be accessed via Daggett-Yermo Road or the Yermo Dirt Road via Agate Road. Proposed construction activities within the Yermo Stables training area would occur outside the Yermo Annex Main Gate.

Construction-related traffic would comprise only a small portion of the total existing traffic volume in the area and at MCLB Barstow. Increased traffic associated with these activities could contribute to short-term increased congestion at the Nebo Annex and/or Yermo Annex Main Gates. Potential congestion impacts could be avoided or minimized by scheduling truck deliveries outside the morning and afternoon peak traffic periods. Also, many of the heavy construction vehicles could be kept at designated construction staging and laydown areas within the project footprint, resulting in fewer additional trips. Potential congestion impacts would be temporary, ending once construction activities have ceased. Therefore, no significant impacts on transportation would occur.

Operations

Alternative 1 would result in a change in the level of operational activities within the project footprint. Proposed training activities would primarily result in temporary/transient increases in military personnel. Individual and unit-level training could include up to 200 personnel and 4 administrative/logistics vehicles, while MAGTF-level training could result in up to 300 personnel and convoys of 60 to 70 vehicles (e.g., high-mobility multipurpose wheeled vehicles, medium tactical vehicle replacements, logistics vehicle systems, light and heavy forklifts, and tactical mobile electric power generators). These MAGTF-level training activities would entail movement along existing roads, access routes, and trails to occupy static locations to set up and perform command and/or logistical functions. In conjunction with these MAGTF-level training activities, smaller sized units of up to approximately 200 personnel with 20 to 30 vehicles would be required to temporarily pass through MCLB Barstow. These temporary units would transit along established roads and trails at MCLB Barstow to receive administrative and/or logistical support from command/logistical support tactical elements in the field. These units would immediately continue along the existing roads and trails, connect with off-Base roads and trails, and then continue to other locations outside of MCLB Barstow.

Under Alternative 1, improvements to existing access routes/trails and construction of new access roads would occur to support proposed independent and combined ground and aviation training activities. Proposed maintenance activities would include periodic road maintenance/grading, gravel replacement, and slope stabilization to minimize erosion. Proposed road improvements and maintenance activities would minimize deterioration of the existing access routes/trails associated with increased convoys during training activities. Convoys arriving to and departing from MCLB Barstow would use I-40 and I-15. Depending on the size of the convoys, temporary traffic delays/congestion could occur near the interstate exits that provide access to MCLB Barstow. All training activities would be conducted in accordance with Marine Corps Reference Publication 4-11.3F, *Convoy Operations Handbook*, which provides guidelines for the planning and execution of MAGTF convoy operations (USMC 2001). Proposed training activities would also be conducted in accordance with FHWA-HOP-05-029, *Coordinating Military Deployments on Roads and Highways: A Guide for State and Local Agencies* (FHWA 2005), which addresses military deployments and convoy operations on public roads. Therefore, temporary increases in marginal traffic volumes during large-scale (MAGTF) training events would not be significant.

Up to four additional permanent military and/or government civilian employees could be stationed at MCLB Barstow to support this alternative (e.g., range maintenance and sustainment activities). Consequently, there would be a negligible increase in overall traffic volumes or circulation patterns within the Base. Military and/or government civilian personnel would primarily travel from other parts of the Base (Nebo and Yermo Annexes) to the training areas. Therefore, traffic entering the Range Complex via Pendleton Road and the Yermo Stables training area via Daggett-Yermo Road and Agate Road could increase slightly over existing conditions. However, such an increase would have a negligible impact on the roadway system. Therefore, no significant impacts on transportation would occur.

3.9.2.2 No-Action Alternative

Under the No-Action Alternative, existing training ranges and areas would not be enhanced to support combat readiness of USMC operating forces and limited ground training and live-fire training at the KD Range Complex would continue under current conditions. Existing transportation conditions would remain as described in Section 3.9.1, *Affected Environment*. No impacts on transportation would occur.

3.10 Utilities and Infrastructure

Utilities and infrastructure include electricity, water systems, sewer system, and solid waste disposal. The following section evaluates whether proposed construction and training activities associated with the proposed action would have an effect on existing utilities and infrastructure in the project vicinity. Proposed construction and training activities would not affect natural gas or communication utilities or infrastructure and; therefore, are not addressed further.

3.10.1 Affected Environment

3.10.1.1 Electricity

The MCLB Barstow electrical distribution system receives power from Southern California Edison. The Nebo Annex electrical distribution system consists of the Nebo substation, two 5,000-kilovolt-ampere transformers, overhead and underground lines, and underground infrastructure (e.g., duct banks and manholes). The Yermo Annex electrical distribution system consists of the Yermo substation, three 7,500-kilovolt-ampere transformers (two primary and one backup), and underground (12-kilovolt) lines. Existing overhead electrical transmission lines within the KD Range Complex provide power to the KD Rifle Range pit area, KD Pistol Range target system, range office and classroom building (Building 249), and shop building (Building 243). In addition, an existing overhead electrical public utility easement crosses the northern portion of the Range Complex. Two existing unimproved, 4-WD utility ROW access routes are used by public utility personnel to conduct periodic inspections and maintenance activities.

3.10.1.2 Water System

The water supply for MCLB Barstow is supplied from the Southern California Water Company and on-Base wells (MCLB Barstow 2005; MCLB Barstow 2006). Potable (drinking) water is used to support military housing areas, administration, and community support facilities. Water (non-potable) is used to support industrial activities (e.g., maintenance and storage operations) and for fire protection. The Nebo Annex water distribution system obtains water from the Southern California Water Company, which is transported via water distribution lines and stored on-site in two, 2 million-gallon water storage tanks. Water is supplied to the Yermo Annex from an on-site well system consisting of three wells (Wells 5, 6A, and 7) via water distribution lines (MCLB Barstow 2006). The Yermo Annex water supply is treated and pumped via booster pumps to an elevated storage tank (Yermo Water Tank) and stored in several on-Base

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water storage tanks. There is no water distribution system at the Range Complex. Water is supplied to the Range Complex by water trucks, stored on-site, and filled periodically.

3.10.1.3 Sewer System

The wastewater system on MCLB Barstow consists of wastewater treatment facilities, conveyance lines, and evaporation ponds. Wastewater generated at the Nebo Annex is collected through a series of 18-inch (46-centimeter) pipes and is delivered to Building 325 (wastewater treatment plant). The wastewater gravity feeds to a wet well where it is treated and then discharged to an evaporation pond. Wastewater (domestic) generated at the Yermo Annex is collected through a series of 18-inch (46-centimeter) pipes and is delivered to Building 610 (wastewater treatment plant). The wastewater gravity feeds to a wet well where it is treated and then discharged to either the evaporation pond or the percolation ponds. Industrial wastewater generated at the Yermo Annex flows to Building 611, which is then pumped to Buildings 608 and 609. The industrial wastewater is stored in two 25,000-gallon (94,635-liter) tanks before it is treated. The wastewater is recycled or discharged to five evaporation ponds and then disposed of as dry sludge.

No wastewater infrastructure is located within the Range Complex. Portable toilets are located in the KD Range Complex administrative area and in between the KD Rifle Range firing line berms.

3.10.1.4 Solid Waste Disposal

The City of Barstow administers solid waste collection and diversion services for MCLB Barstow. Solid waste (non-hazardous) within the City of Barstow and MCLB Barstow is collected by Burrtec and disposed of at the Barstow Sanitary Landfill in the County of San Bernardino. The Barstow Sanitary Landfill is a Class III facility that accepts agricultural, construction/demolition, industrial, mixed municipal, biosolids, and other designated waste per California Code of Regulations Title 22 and 40 *CFR*. The landfill has a permitted throughput of 1,500 tons (1.36 million kilograms) per day; a permitted capacity of 80.3 million cubic yards (61.4 million cubic meters); and an estimated closure date of 1 May 2071. The remaining capacity is 77.3 million cubic yards (59.1 million cubic meters) (CalRecycle 2015).

3.10.2 Environmental Consequences

3.10.2.1 Alternative 1

Electricity

Alternative 1 would upgrade existing electrical utility infrastructure within the project footprint. Upgrading the KD Range Complex and its associated infrastructure would require repairs or upgrades to existing utility infrastructure. Electrical power would be provided to the KD Rifle Range, KD Pistol Range, and 100-yard shotgun berms and Rifle Range target area. Electrical power would also be required to motorize the North Gate and East Gate at the northeast corner of the KD Range Complex. The existing overhead electrical transmission lines located approximately 150 feet (45 meters) north of the Rifle Range Road would be demolished. Proposed electrical infrastructure would be installed below-ground in the existing, disturbed utility corridor along Rifle Range Road (Figure 2.3-5). Electrical system improvements within the Yermo Stables training area would include installing new electrical utilities below-ground within the northeastern portion of the training area, which would connect directly to an existing transformer at the Yermo Stables (Figure 2.3-8). Trenching would be required within and adjacent to previously disturbed areas within the project footprint to connect new utility lines from the proposed bivouac area to existing infrastructure and systems. Proposed electrical system upgrades would be designed consistent with Southern California Edison standards and would be sized to meet the needs of

proposed development and training activities. Therefore, no significant impacts on the electrical utility system would occur.

Water System

Alternative 1 would require water system modifications to support proposed training activities. In the Range Complex, up to a 10,000-gallon (37,854-liter) above-ground water storage tank would be installed within the KD Range Complex administrative area and filled periodically by water trucks. Additional water distribution lines would be constructed within the Yermo Stables training area that would connect directly to existing infrastructure in the northeastern portion of the training area. During high-intensity training activities in the Yermo Stables training area, potable water would be stored on-site in tactical water tankers and/or provided via the proposed potable water lines. Proposed water infrastructure would be designed and constructed in accordance with California Code of Regulations, Title 22 (Lead and Copper Rule). The proposed water system improvements would be adequate to accommodate temporary water demands associated with training operations. Therefore, no significant impacts on water system utilities would occur.

Sewer System

Alternative 1 would construct a permanent restroom facility with a 2,000 gallon (7,570 liter) underground waste storage tank and a 20-foot by 40-foot (6.1-meter by 12.2-meter) leach field in the KD Range Complex administrative area. Existing portable toilets in between the firing line berms would also be upgraded (e.g., with dry-pit toilets). In addition, proposed bivouac operations in the KD Range Complex (at the 500/600-yard firing line; 600/700-yard firing line; and 1,000-yard firing line) and Yermo Stables training area would include the use of portable toilets, showers, and/or laundry facilities. Temporary tactical bivouac sites at the LHA/LHD site would not include the use of portable toilets. As described in Section 2.3.1.1, *Proposed Training Operations*, all greywater generated during training operations within the Range Complex and Yermo Stables training area would be captured in secondary containment tanks and disposed of in accordance with federal, state, and local agency regulations. Portable toilets would be placed in secondary containment trays and serviced in accordance with applicable regulations.

Alternative 1 would result in temporary increases in demands on the MCLB Barstow sewer system during training activities. However, construction of a permanent restroom facility, the use of portable toilets during bivouac operations, and the collection and disposal of greywater would minimize potential impacts on the sewer system. In addition, the proposed sewer system improvements would be adequate to accommodate temporary wastewater demands associated with training operations. Therefore, no significant impacts on sewer system utilities would occur.

Solid Waste Disposal

Construction activities would generate debris (e.g., steel, siding, concrete, and asphalt) that would require disposal. All materials would be disposed of in compliance with the DoD Green Procurement Program and sustainability goals (e.g., recycling approximately 50 percent of municipal trash and 40 percent of construction and demolition waste), ensuring that eligible items are recycled. Non-recyclable materials would be disposed of off-site at Barstow Sanitary Landfill. In the event contaminated sediment is encountered during proposed construction activities, these materials would be disposed of at the appropriate off-site disposal facility in accordance with applicable federal, state, and local regulations.

Training and range maintenance and sustainment activities would also generate debris (e.g., disposal of KD Rifle Range target carriages, recycling of bullets embedded in berms, and periodic range sweeps to collect debris) that would require disposal. The four additional permanent military and/or government

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civilian employees stationed at MCLB Barstow to support this alternative would result in a negligible increase in demands on solid waste disposal. Sufficient capacity exists within the Barstow Sanitary Landfill to accommodate this increase in solid waste generation, and materials would be recycled to the extent feasible. Therefore, no significant impacts on solid waste disposal would occur.

3.10.2.2 No-Action Alternative

Under the No-Action Alternative, existing training ranges and areas would not be enhanced to support combat readiness of USMC operating forces and limited ground training and live-fire training at the KD Range Complex would continue under current conditions. Existing utility conditions would remain as described in Section 3.10.1, *Affected Environment*. Inadequate facilities (e.g., portable toilets) and limited water infrastructure would continue to support existing training activities. No impacts on utilities and infrastructure would occur.

3.11 Water Resources

This section describes water resources, including surface and subsurface water, within the project footprint. Due to the arid environment, surface water features within the project footprint are limited to ephemeral desert washes and the Mojave River. Subsurface water (i.e., groundwater) is typically found in aquifers, which consist of permeable layers of alluvium (i.e., sand, silt, clay, or gravel) and rock that can absorb and store water. Water quality describes the chemical and physical composition of water as affected by natural conditions (e.g., erosion) and human activities (e.g., hazardous waste spills).

3.11.1 Affected Environment

3.11.1.1 Surface Water

MCLB Barstow is located in the lower Mojave River Valley Basin. It is characterized by low ridges and terraces that surround and slope downward toward the Mojave River. The Mojave River channel is typically dry at MCLB Barstow, with surface flows only present during winter storms. The Range Complex, which includes the Range West and Range East and KD Range Complex training areas, contains ephemeral washes that drain Daggett Ridge and trend from south to north to the Mojave River. The Range West training area is located mostly in a wash surrounded on the east and west by steep, rocky ridges. The Range East and KD Range Complex training area is located on an alluvial piedmont (or *bajada*), where numerous small canyons have created a series of alluvial fans that have coalesced to form the broad-sloping piedmont. The Yermo Stables training area includes portions of the Mojave River floodplain and a relatively flat area immediately north of the Mojave River.

A jurisdictional delineation and hydrological analysis was conducted for the proposed action (refer to Appendix D-3 and Appendix F, respectively). Field mapping, aerial topography, and detailed contour data were used to map the ephemeral desert washes. As described by Lichvar and McColley (2008), the geometry of ephemeral washes in the arid west generally consists of three units (Figure 3.11-1):

- Low-flow channel conveys the low to moderate discharge events (2 year storms). Unstable over time and shifts with the low to moderate discharge events;
- Active floodplain conveys the 10-year storm event, generally stable over time with a break in bed and bank and change in vegetation, and where the majority of the erosion/deposition occurs; and
- Low terrace overbank floods only during the greater than 10-year storm events.

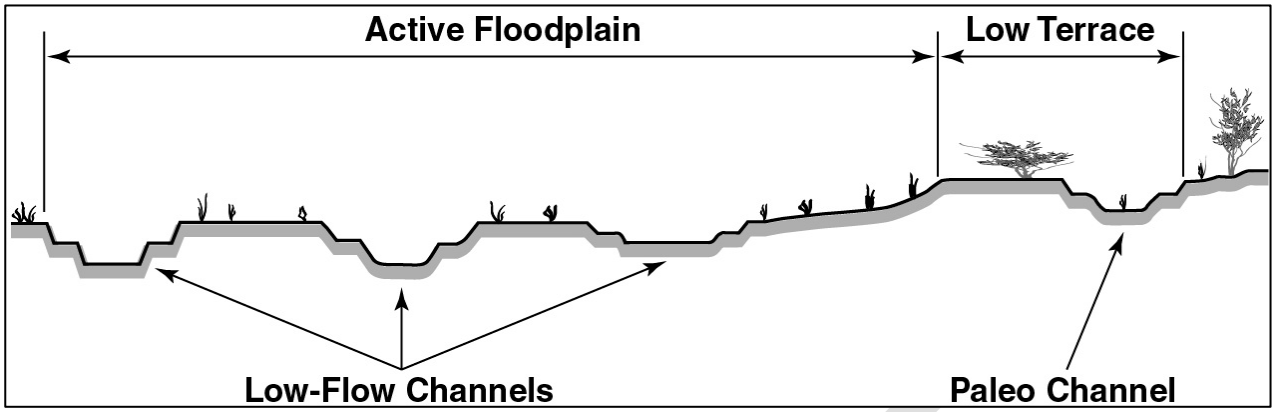

Figure 3.11-1. Representative Cross-section Showing Intermittent and Ephemeral Channel Forms in Desert Wash Systems (Lichvar and McColley 2008)

The mapping of the active floodplain and low terrace geomorphic units of the washes at the Range Complex and Yermo Stables training area is provided in Figures 3.11-2, 3.11-3, and 3.11-4.

The climate of the project region is characterized as very arid. High temperatures range from 60°F (16°C) during the winter to 100°F (38°C) during the summer. The project region receives an average of 4.6 inches (11.7 centimeters) of precipitation annually, with an annual minimum precipitation of 1.08 inches (2.7 centimeters) and an annual maximum precipitation of 15.6 inches (39.6 centimeters) recorded between 1913 and 2013 (Figure 3.11-5). The majority of the rainfall occurs from mid-latitude Pacific cyclonic storms during the winter. The highest flow measurements in the Mojave River have all occurred from December to April. However, summer thunderstorms occur frequently in July, August, and September. Most of the worst flooding events on record occurred due to heavy thunderstorms in the summer, which affect the small washes and drainages in the Mojave Desert (NOAA 2010). Flash floods result from strong, localized thunderstorms which produce considerable rain in a short period of time, fueling a surge of runoff in dry washes. In the Mojave Desert, the main erosion and sedimentation process is caused by flash floods and debris flows, which move with tremendous force and can transport massive loads of sediment (USGS 2004).

3.11.1.2 Flood Hazard

Major flood events have occurred frequently at MCLB Barstow in the past. While the overall rainfall totals are low, the intense summer thunderstorms can cause major flooding. This rainfall and runoff pattern is typical of desert terrain. The lack of vegetation and often hard-packed soils result in relatively small amounts of the precipitation being infiltrated and large percentages of the precipitation contributing to surface runoff. There is limited forewarning of these storm events and the runoff can travel long distances once concentrated in a watercourse.

The Range Complex is located on alluvial fans. Alluvial fans distribute sediment across a broad area. Because of the low depths and frequently changing microtopography, it is difficult to accurately delineate the extent of a 100-year storm event discharge (FEMA 2003). Channels shift from side to side over time as sediment is deposited in the fan. Therefore, for the purposes of this study, the extent of the 100-year storm event is approximated by the extent of the low terrace geomorphic unit defined by Lichvar et al. (2008) (refer to Appendix F). In alluvial fan environments, the geomorphic mapping of the extent of the active alluvial fan is an appropriate method of determining the 100-year flood hazard risk areas (FEMA 2003).

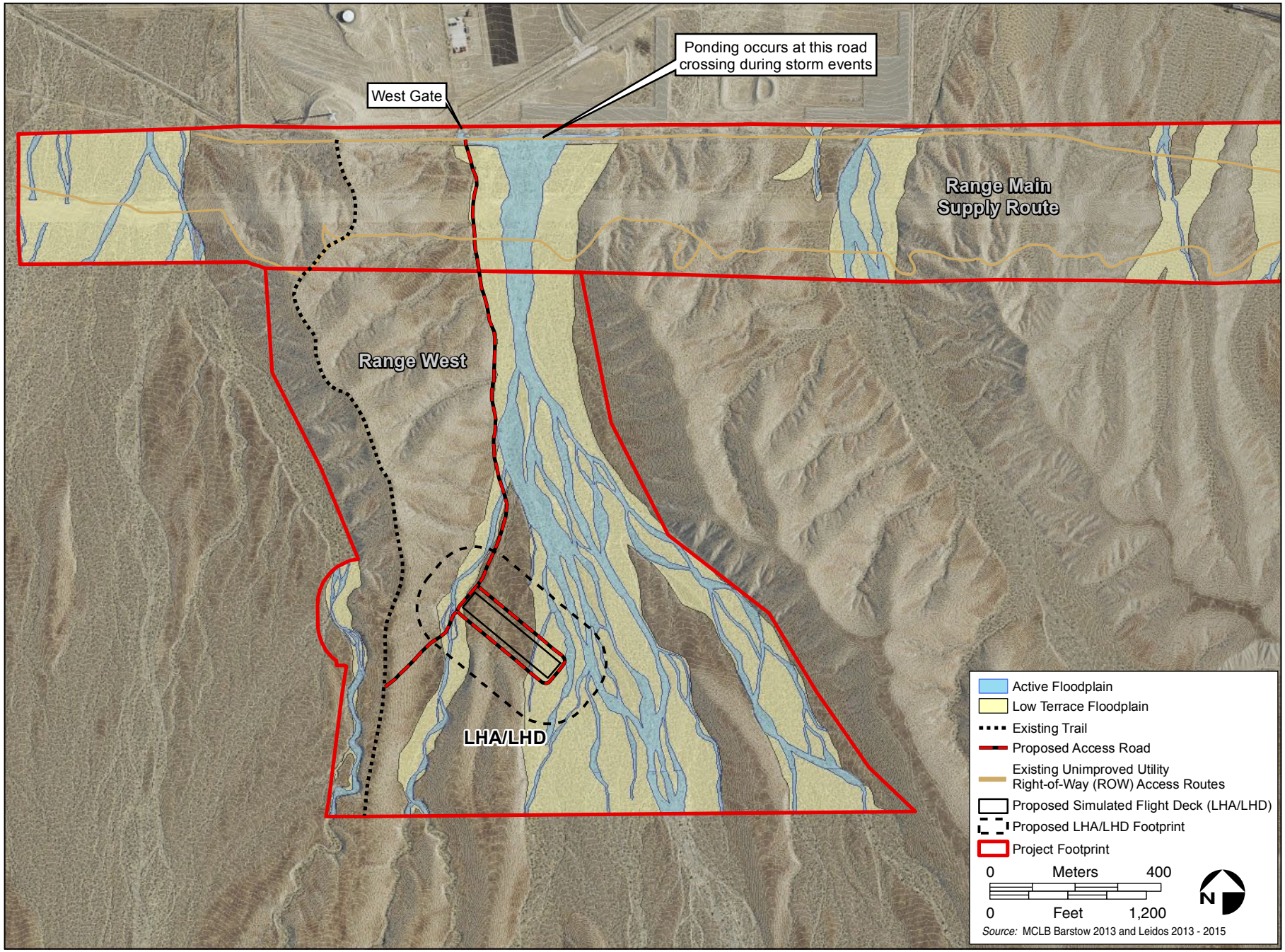

Figure 3.11-2. Range West Training Area - Surface Water Features

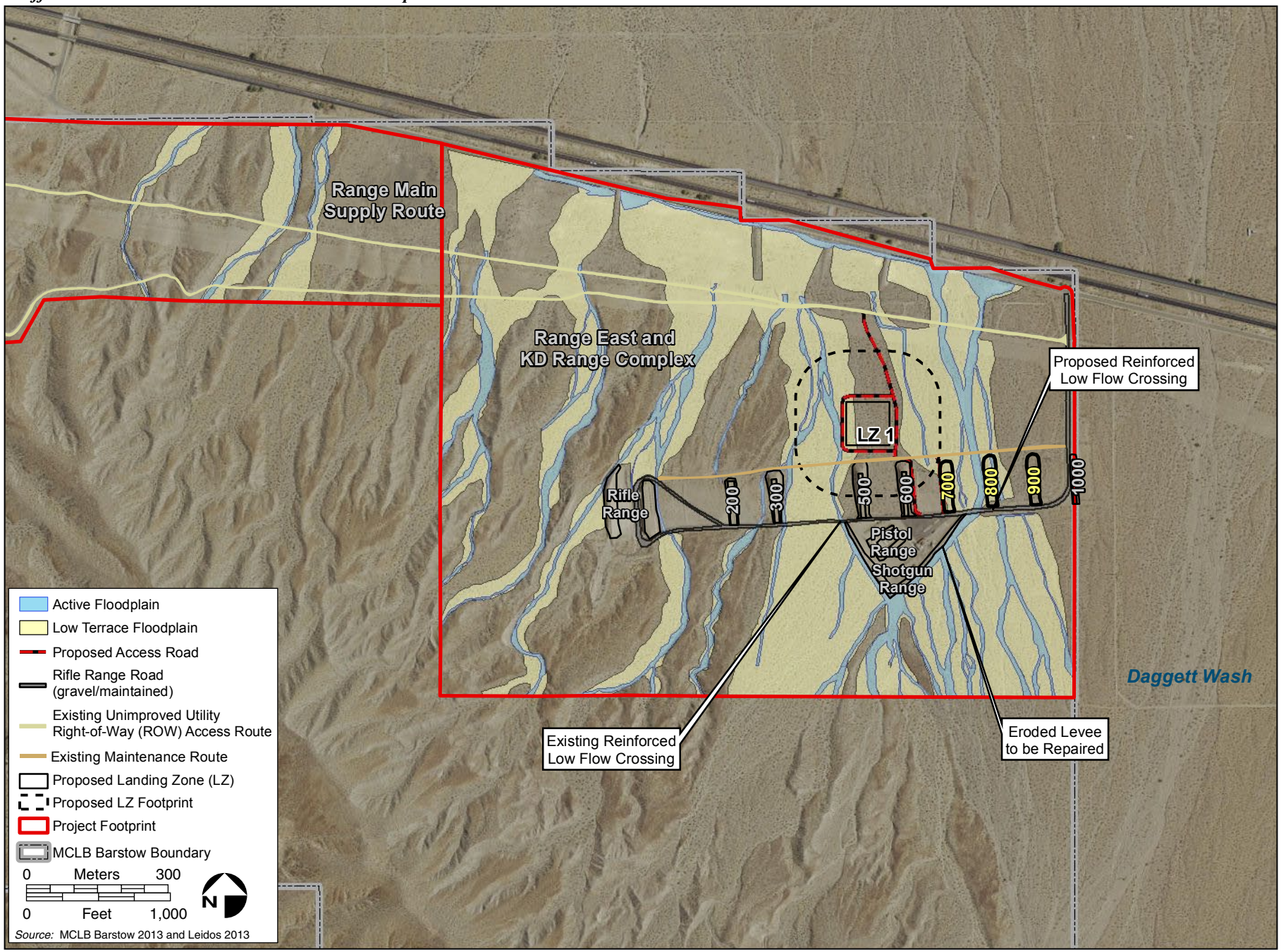

Figure 3.11-3. Range East and KD Range Complex Training Area - Surface Water Features

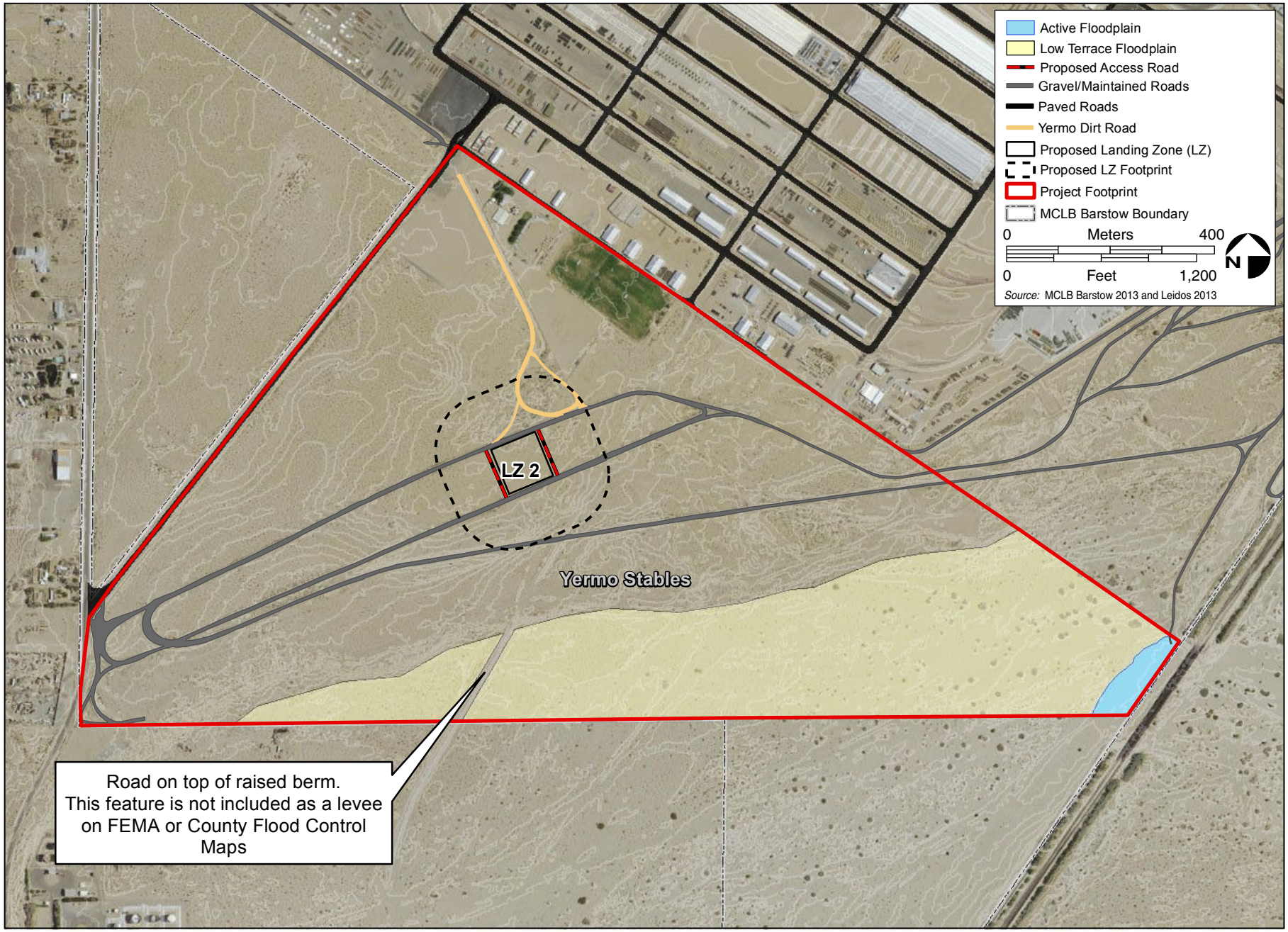

Figure 3.11-4. Yermo Stables Training Area - Surface Water Features

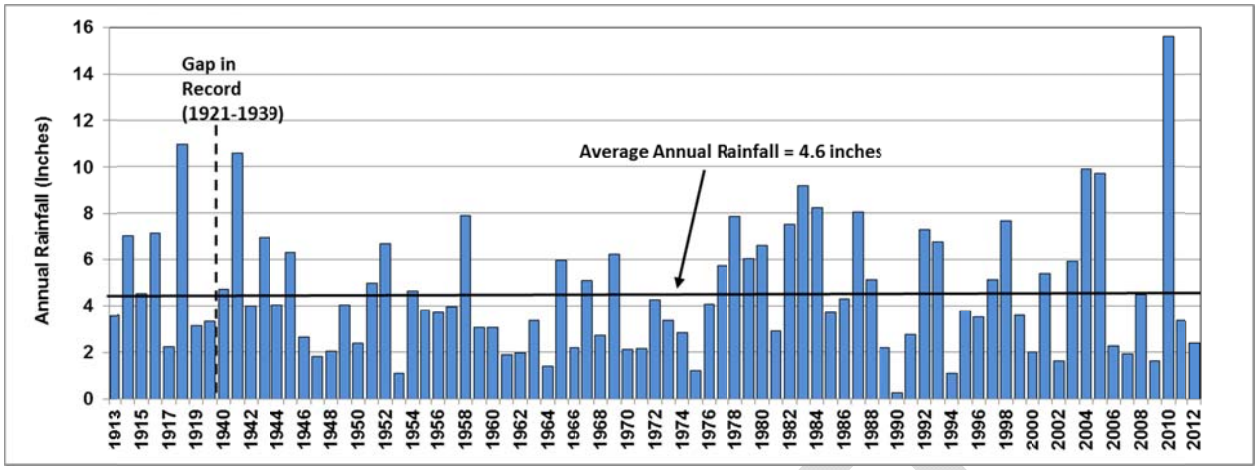

Figure 3.11-5. Annual Rainfall for Barstow, California (Western Regional Climate Center 2013)

3.11.1.3 Groundwater

MCLB Barstow is located in the Baja subarea of the Mojave River Basin (Mojave Water Agency 2004). The Mojave Groundwater Basin was adjudicated by a Stipulated Judgment in 1993, which assigned Base Annual Production quotas to each producer using 10 acre-feet (12.34 megaliters) per year. The production allowance was reduced over time to balance demands with available supplies. Mojave Water Agency is responsible for administering the water rights in the basin and importing state project water to replenish the groundwater to eliminate overdraft and meet future demands (Mojave Water Agency 2004). Designated beneficial uses for all groundwater basins within the Mojave Basin include municipal supply, agricultural supply, industrial service supply, freshwater replenishment, and aquaculture (California RWQCB Lahontan Region 2010). The Nebo Annex obtains drinking water from Golden State Water Company, which extracts water from wells in the Barstow and Lenwood area. Before 1977, the Nebo Annex obtained potable water from six on-Base production wells for drinking and operations. In 1997, MCLB Barstow stopped using the wells for drinking water and production water because of high levels of total dissolved solids (ATSDR 1999). Water is supplied to the Yermo Annex from USMC-owned wells. Potable water supplies for the KD Range Complex are trucked in and stored for use (MCLB Barstow 2005).

A large range of groundwater depths has been recorded at MCLB Barstow. The groundwater levels, as measured by monitoring wells along the Mojave River, are relatively shallow and have ranged from approximately 8 feet to 33 feet (2.4 to 10 meters) below ground surface (BGS) near the Nebo Annex (USGS 2015, 9N1W13B02S). Documented depth to water is between 160 and 210 feet (49 and 64 meters) BGS; depths up to 175 feet (53 meters) BGS have been noted on the alluvial fan south of I-40 near the KD Range Complex (Arcadis Malcolm Pirnie 2013). The depth to groundwater in the drinking water supply wells at the Yermo Annex range from 174 to 400 feet (53 to 122 meters) BGS (Arcadis Malcolm Pirnie 2013).

3.11.1.4 Water Quality

Groundwater quality in the Mojave Groundwater Basin is characterized as a sodium bicarbonate type (California Department of Water Resources 2004). High concentrations of dissolved solids have been noted in the project vicinity (Mojave Water Agency 2004), likely the result of releases of industrial and domestic effluent, irrigation return flow, and naturally occurring high-dissolved solids water from underlying and surrounding alluvial fan deposits (ATSDR 1999). The water quality associated with

ephemeral washes at MCLB Barstow is mainly influenced by the amounts of suspended sediment, which are expected to vary for different substrate types, such as bedrock or alluvial fans.

MCLB Barstow was listed on the USEPA NPL on 15 November 1989 as a result of potential soil and groundwater contamination throughout the Base. An FFA was signed on 24 October 1990, by the USMC, USEPA (Region 9), California RWQCB (Lahontan Region), and the CalEPA (Region 4) DTSC to establish a schedule for environmental investigations and required remedial actions at the site. For the purposes of the IRP, the Base has been divided into seven OUs. Each OU is divided into a number of CAOCs. OUs 1 and 2 pertain to groundwater contamination beneath the Yermo Annex and Nebo Annex, respectively. Groundwater contamination is primarily due to dissolved VOCs. The Base is implementing groundwater extraction and treatment, air sparging/soil vapor extraction systems, and groundwater monitoring and institutional controls for the groundwater underneath OUs 1 and 2 (MCLB Barstow 2005).

The southwest portion of the Yermo Stables training area contains CAOC 23, known as the Landfill Area (Figure 3.8-4). CAOC 23 has received regulatory closure with the stipulation that any actions planned for the area, or changes in site use, should be coordinated and reviewed by MCLB Barstow Environmental Division (Jacobs Engineering Group, Inc. 1997). CAOC 23 was divided into six strata, or areas. The areas that overlap with the Yermo Stables training area are designated as Stratum 5, which is a potential waste burial area, and Stratum 5A, a “PCB-hit” area. Based on the modeling and sampling completed for CAOC 23, contaminants remaining in the soils in Strata 5 and 5A are not a threat to impact the quality of groundwater and surface water (Jacobs Engineering Group, Inc. 1997).

3.11.2 Environmental Consequences

3.11.2.1 Alternative 1

Construction

Construction activities associated with: (1) grading and stabilizing the designated LZs, LHA/LHD site, access roads, bivouac sites, and vehicle loading/refueling areas; (2) installing the LHA/LHD landing platform; (3) constructing new 700-, 800-, and 900-yard firing lines at the KD Rifle Range; (4) upgrading the KD Rifle Range and 100-yard shotgun range; (5) raising the existing berms around the 100-yard shotgun range for safety purposes; (6) constructing new support facilities (e.g., tear gas training facility, restroom facility, range office and classroom building, ready locker, storage sheds, and pressurized propane gas storage tank); (7) installing solar and security lighting; (8) utility infrastructure modifications; and (9) installing permanent fencing at the Yermo Stables training area would include removal of vegetation and soil compaction by heavy equipment. These activities could contribute to increased runoff, increased erosion, and off-site sedimentation into adjacent ephemeral desert washes.

Because project construction would disturb more than 1 acre (0.4 hectare), the construction contractor would obtain authorization from the State Water Resources Control Board for construction under the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Order No. 2009-0009-DWQ/NPDES No. CAS000002). The construction contractor would be required to implement all appropriate BMPs for erosion and sedimentation control, as identified in Order No. 2009-0009-DWQ and as specified in a site-specific Stormwater Pollution Prevention Plan (SWPPP). Before commencement of grading, control devices such as silt fences, jute netting, geotextiles, and other materials would be placed within and around the proposed construction sites to reduce surface water flow velocities, slow down soil erosion and off-site transport, and protect sensitive habitats. Refer to Special Conservation Measure 25 (*NPDES Permit Compliance*), described in Appendix B.

Alternative 1 would result in the construction of new impervious surfaces (i.e., LHA/LHD landing platform, tear gas training facility, and restroom facility) within the project footprint, potentially increasing stormwater runoff volume and peak discharge rates. This potential increase in stormwater runoff would be managed such that discharge exiting the project footprint post-construction would be equal to or less than existing conditions through the use of appropriately designed runoff reduction features. Infiltration trenches and sedimentation or detention basins would be constructed downstream of the site to prevent concentrated off-site runoff (Figure 2.3-3). However, drainage features would need to be incorporated into the design of the tear gas training facility and restroom facility to eliminate any potential for significant erosion to adjacent areas. Refer to Special Conservation Measure 26 (*Low-Impact Development Runoff Reduction Features*), described in Appendix B.

Surface water and/or shallow groundwater quality impacts could potentially occur as a result of inadvertent dispersion of contaminants during construction and subsequent operations. Construction would require the use of vehicles and equipment powered by diesel fuel/gasoline and lubricated with oil and other mechanical fluids, which may be considered hazardous substances. Other types of construction waste that could affect downstream water quality or shallow groundwater quality include sediment, concrete wash-out, and paint. Accidental releases of such substances (e.g., spills arising from leakage of fuel, motor oil, or hydraulic fluid during operations and/or equipment maintenance) could also occur. As previously described, the construction contractor would obtain authorization for construction under the General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities from the State Water Resources Control Board. The construction contractor would also develop and disseminate an SPCC Plan. Examples of BMPs in an SPCC Plan include establishment of designated areas for equipment fueling and maintenance; use of licensed, trained personnel for operation of vehicles and equipment; and completion of a regular, comprehensive equipment maintenance program. As specified in Order No. 2009-0009-DWQ, stormwater discharges associated with construction activity must meet all applicable provisions of Sections 301 and 402 of the CWA, including pollutant discharge controls that utilize the best available technology and best conventional pollutant control technology economically achievable for toxic pollutants. Any releases of contaminated liquids to surface water during construction activities would be immediately reported to the MCLB Barstow Environmental Management Division. Also, as part of the SWPPP and SPCC Plan, the construction contractor would implement material and waste management programs during construction, such as solid, sanitary, septic, hazardous, contaminated soil, concrete, and construction waste management; spill prevention; appropriate material delivery and storage; employee training; dust control; and vehicle and equipment cleaning, maintenance, and fueling. Each of these programs would address proper secondary containment requirements, spill prevention and protection, structural material storage needs, proper concrete wash-out design and containment, perimeter and surface protection for laydown and maintenance areas, and communicating all requirements to construction staff.

Range West Training Area

The LHA/LHD landing platform would be approximately 850 feet by 150 feet (259 meters by 46 meters) and would resemble an amphibious assault ship deck. The LHA/LHD landing platform would be located on the western portion of a large desert wash. Approximately a third of the proposed LHA/LHD landing platform would encroach into the low terrace floodplain (i.e., 100-year floodplain) of the desert wash. The eastern portion of the LHA/LHD landing platform and superstructure could be damaged during a 100-year storm event. However, an earthen levee would be installed upstream of the LHA/LHD site at the west bank of the floodplain and connect to the outer edge of the LHA/LHD landing platform (Figure 2.3-3). The levee would protect the LHA/LHD site by rerouting flow of the small channel on the western edge toward the main channel in the center of the floodplain. The earthen levee would reduce the overall channel width. The floodplain in this location is over 1,000 feet (305 meters) wide and would be reduced by approximately 250 feet to 750 feet (76 to 230 meters). The levee would constrain the future movement

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of the channel throughout the desert wash on the western side, but would not significantly affect the existing flow dynamics (depth and velocity) of the active floodplain.

The proposed access road to the LHA/LHD site would involve the construction of 6,600 linear feet (1,880 meters) of new road approximately 12 to 18 feet (3.7 to 5.5 meters) wide. The proposed access road would be located at the toe of the slope of the ridgeline on the west side of the Range West training area (Figure 2.3-2). The proposed access road would be located out of the floodplain to avoid diversion of the wash onto the roadbed. Small erosional channels drain the side of the ridgeline and the road would be required to cross to desert washes. To prevent the diversion of flow down the roadbed, the proposed access road would be constructed to cross these side channels and washes perpendicular to the direction of flow, at grade, and dipping into each channel with a vertical sag curve. Refer to Special Conservation Measure 27 (*LHA/LHD Access Road Design Requirements*), described in Appendix B. To the extent practicable, the proposed access road would be constructed with an outsloped configuration to allow runoff from the ridgeline to continue over the road to the channel without diversion onto the roadbed. Implementation of Special Conservation Measure 27 (*LHA/LHD Access Road Design Requirements*), described in Appendix B, would minimize the potential for the proposed LHA/LHD access road to change runoff patterns and increase erosion.

Range East and KD Range Complex Training Area

LZ 1 would be located north and downstream of the KD Range Complex parking area (Figure 2.3-5). Two small levees protect the buildings/structures in the KD Range Complex administrative area, diverting the flow into two main channels. These levees would also provide protection for LZ 1. There are no active floodplain channels within or adjacent to LZ 1. Although upstream levees would route flow around LZ 1, one of the levee banks has eroded and should the levee fail, flooding could occur at LZ 1. However, implementation of Special Conservation Measure 28 (*Levee Repair, Inspection, and Maintenance*), described in Appendix B, would minimize flooding impacts at LZ 1.

Under Alternative 1, a new Arizona crossing (i.e., low-water crossing with reinforced roadbed) would be installed to stabilize a portion of the Rifle Range Road that washes out during storm events. The Arizona crossing would be constructed at-grade on the upstream side of the Rifle Range Road (Figure 2.3-5). Due to the existing configuration of the road, there is a large drop on the downstream side, which is partially armored with concrete rubble. Under this alternative, the downstream side would be fully armored with rip-rap to minimize downstream erosional impacts. The existing Arizona crossing west of the 500-yard firing line on the Rifle Range Road would also be maintained as part of this alternative. The proposed Arizona crossing and maintenance of the existing crossing would eliminate existing erosional issues on the Rifle Range Road.

Under Alternative 1, a new 700-yard, 800-yard, and 900-yard line would be installed at the KD Rifle Range to provide more advanced training requirements for sniper team training. The 800-yard line would be located adjacent to the active floodplain of the largest desert wash in the KD Range Complex. The western edge of the 800-yard line berm would obstruct the floodplain and would be susceptible to erosion during a major flood event. However, implementation of Special Conservation Measure 29 (*800-yard Line Flood Wall)*, described in Appendix B, would minimize the obstruction of the active floodplain and prevent erosion to the 800-yard line.

Range Main Supply Route Training Area

The two existing unimproved, 4-WD utility ROW access routes in the Range Main Supply Route training area would be improved (rough-graded and/or leveled) as part of Alternative 1. Gullies have formed along portions of the existing utility ROW access routes where there is a hydraulic drop between the roadbeds

and the downstream channels. Due to the underlying utility pipelines in most locations, it may not be feasible to re-grade/level the roadbeds. To prevent damage to the roadbeds, the downstream channels would be armored (i.e., rip-rap), as necessary, to dissipate surface flows during storm events.

Yermo Stables Training Area

No construction activities (i.e., grading and stabilizing LZ 2 and proposed access roads and trenching for utilities) would occur within or adjacent to the Mojave River channel and floodplain.

Implementation of *Special Conservation Measure 25 (NPDES Permit Compliance*), Special Conservation Measure 26 (*Low-Impact Development Runoff Reduction Features*), Special Conservation Measure 27 (*LHA/LHD Access Road Design Requirements*), Special Conservation Measure 28 (*Levee Repair, Inspection, and Maintenance*), and *Special Conservation Measure 29 (800-yard Line Flood Wall)*, described in Appendix B, would minimize impacts associated with increased flooding on- or off-site. Therefore, no significant impacts on water resources would occur.

Operations

Ground Training

Alternative 1 would result in a change in the level of operational activities within the project footprint. Proposed ground disturbing activities during training would consist of (1) construction and demolition of berms; (2) trenching to dig fighting positions and tank ditches; (3) convoy operations; (4) erecting temporary structures (e.g., tents, portable toilets, and showers/laundry facilities); (5) establishing personnel and equipment decontamination areas; (6) clearing and constructing road/trail obstructions; and (7) tactical dispersed landings of rotary wing and tilt-rotor aircraft throughout the general aviation area. Proposed operational activities would temporarily exacerbate the potential for erosion-induced sedimentation of the ephemeral desert washes within the project footprint. However, as stipulated in Special Conservation Measure 25 (*NPDES Permit Compliance*), described in Appendix B, permanent erosion control features would be constructed during the construction phase within the project footprint, in accordance with the NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Order No. 2009-0009-DWQ/NPDES No. CAS000002). These measures would be placed within and around the training areas to reduce surface water flow velocities, slow down soil erosion and off-site transport, and protect sensitive habitats.

Depending on the training operations, temporary increases in military population (up to 300 personnel for 60 days per year) would occur at MCLB Barstow. The USMC uses a logistic planning factor of 8.4 gallons (31.7 liters) per person per day for training exercises in arid environments. Using this factor, proposed training exercises would increase the water demand by approximately 0.15 million gallons (0.57 megaliters) per year or 0.46 acre-feet per year (0.57 megaliters per year). Up to four additional, permanent military and/or government civilian employees could be stationed at MCLB Barstow to support this alternative. Assuming an average of 2.8 persons per household and 287 gallons per capita per day use rate (Golden State Water Company 2011), water use associated with additional personnel stationed at MCLB Barstow would equal 3.6 acre-feet (4.4 megaliters) per year. The increase in water use associated with Alternative 1 would be negligible and no significant impacts on water resources would occur.

Under Alternative 1, individual and smaller-scale, unit-level training would continue at the KD Range Complex to support live-fire marksmanship training with small arms. The bullets embedded in the KD Rifle and Pistol Range berms would continue to be periodically removed and recycled. Lead is the most prevalent (by weight) of potentially hazardous constituents associated with small arms ammunition. Lead loading is currently low (730 pounds [331 kilograms] per year) at the KD Rifle Range, KD Pistol Range,

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and 100-yard shotgun range (Arcadis Malcolm Pirnie 2013). Lead mining of the impact berms at all three ranges was completed in August 2012. The final total lead weight for the projectiles recovered at MCLB Barstow is 12,110 pounds (5,493 kilograms) (Arcadis Malcolm Pirnie 2013). There is minimal potential for the transport of lead off-site via surface water and sediment due to low precipitation (less than 5 inches [13 centimeters]) and the side berm control structures that protect the target berms from surface flows (Arcadis Malcolm Pirnie 2013). The desert soils are also neutral to slightly alkaline, which limits the migration of lead via dissolution in surface water. High temperatures and low humidity promote evaporation and, therefore, limit the amount of water infiltrating down to the groundwater that is estimated to be at a depth of over 160 feet (49 meters) BGS. The pH of the groundwater is neutral and most lead would likely precipitate out of solution and not transport to potential receptors (Arcadis Malcolm Pirnie 2013). Therefore, no significant impacts on water resources would occur.

Tactical sustainment training (e.g., refueling operations, FASP, vehicle/equipment maintenance, and establishing personnel and equipment decontamination areas) would involve the use of hazardous materials, including petroleum, oil, and lubricants. Proposed training activities could result in waste discharges and/or accidental spills or releases of hazardous materials (e.g., petroleum products). Training exercises associated with Alternative 1 would also generate contaminated water from field laundry and shower units (greywater) and field kitchens and temporary mess facilities (blackwater). All activities would be conducted in accordance with the MCLB Barstow Range Regulations that include restrictions on the use of hazardous materials; treatment of hazardous wastes; and spill prevention, containment, and cleanup. No hazardous materials, hazardous waste, or solid wastes would be disposed of, left, buried, or abandoned in the project footprint. Refer to Special Conservation Measure 30 (*MCLB Barstow Range Regulations for Water Resources)*, described in Appendix B.

Implementation of Special Conservation Measure 30 (*MCLB Barstow Range Regulations for Water Resources*), described in Appendix B, would minimize impacts to surface waters from storage and disposal of wastewaters, storage and use of petroleum products, and/or containment and cleanup of spills. Also, given the low frequency of rain events within the project vicinity, the potential for dispersion and transport of spilled materials or wastes before cleanup is relatively low. Therefore, no significant impacts on water resources would occur.

Aviation Training

Several ephemeral desert washes traverse the project footprint. Alternative 1 would result in direct impacts to these ephemeral drainages within the designated LZs, LHA/LHD site, and general aviation areas as a result of downwash/rotor wash associated with aircraft landing and takeoffs. These impacts include disruption of soil structure; damage to or loss of vegetation, soil crust, and desert pavement; and soil compaction that could lead to increased runoff, erosion, and sedimentation. However, these impacts would not significantly alter the drainage pattern within the ephemeral desert washes. Therefore, no significant impacts on water resources would occur.

Range Maintenance and Sustainment

Alternative 1 would also include range maintenance and sustainment activities (e.g., fixing existing berms that have eroded [e.g., rip-rap protection], periodic reapplication of soil stabilizers at the designated LZs, and periodic road maintenance/grading, gravel replacement, and slope stabilization). As part of range maintenance and sustainment activities, inspection and maintenance for all roads/access routes in the project footprint would occur twice per year and on an as needed emergency basis to fix any issues, including erosion and slope stabilization. Regular inspection and maintenance would improve the existing condition of unpaved roads within the project footprint and prevent the development of major erosion issues (e.g., gullies and roadbed washouts). Implementation of proposed range maintenance and

sustainment activities, in addition to Special Conservation Measure 25 (*NPDES Permit Compliance*), described in Appendix B, would reduce potential erosional impacts during training activities. Therefore, no significant impacts on water resources would occur.

3.11.2.2 No-Action Alternative

Under the No-Action Alternative, existing training ranges and areas would not be enhanced to support combat readiness of USMC operating forces and limited ground training and live-fire training at the KD Range Complex would continue under current conditions. Existing water resource conditions would remain as described in Section 3.11.1, *Affected Environment*. No impacts on water resources would occur.

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4 Cumulative Impacts

4.1 Introduction

CEQ regulations implementing NEPA require that the cumulative impacts of a proposed action be assessed (40 *CFR* Parts 1500–1508). A cumulative impact is defined as the following:

> The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. (40 *CFR* § 1508.7)

CEQ's guidance for considering cumulative effects states that NEPA documents "should compare the cumulative effects of multiple actions with appropriate national, regional, state, or community goals to determine whether the total effect is significant" (CEQ 1997).

The first step in assessing cumulative effects, therefore, involves identifying and defining the scope of other actions and their interrelationship with the proposed action or alternatives. The assessment must consider other projects that are near or coincide, spatially or temporally, with the proposed action and other actions. Section 4.2, *Projects Considered in the Cumulative Analysis*, identifies relevant past, present, and reasonably foreseeable future actions. Projects were selected because they are either similar to the proposed action, large enough to have far-reaching effects, or in proximity to the proposed action. Section 4.4, *Cumulative Impact Analysis*, provides an analysis of cumulative impacts for relevant environmental resources, and further defines the ROI and relevant projects for each resource area.

4.2 Projects Considered in the Cumulative Analysis

Information on past, present, and reasonably foreseeable future projects and their associated anticipated impacts was gathered through a review of available environmental documentation (conducted in March and April 2014) and in coordination with the USMC. A list of the cumulative projects, summary information, and their associated impacts are presented in Table 4.2-1.

4.3 Methodology

4.3.1 Geographic Scope of the Cumulative Effects

For this analysis, a geographic scope, or ROI, for each cumulative effects issue was established. The ROI is generally based on the natural boundaries of the resources affected, rather than jurisdictional boundaries. The geographic scope may be different for each cumulative effects issue. The geographic scope of cumulative effects often extends beyond the scope of the direct effects, but not beyond the scope of the direct and indirect effects of the proposed action and alternatives. However, if the proposed action and alternatives are determined to have no direct or indirect effects on a resource, no future cumulative effects analysis is necessary. ROIs are defined in Section 4.4, *Cumulative Impact Analysis*, for each resource listed below. Because ROIs vary for different resources, not all of the cumulative projects listed in Table 4.2-1 would be located within the ROIs defined for a particular resource.

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Table 4.2-1. Cumulative Projects

Project Name	Project Location	Project Description	Project Time Frame	Relevant Areas of Potential Cumulative Impact
Military Projects				
KD Rifle Range Communication System Upgrades	MCLB Barstow (KD Range Complex)	Upgrades to the KD Rifle Range communications system, including construction of a new communication shelter and installation of a microwave antennae. The existing, temporary tear gas facility would be moved approximately 24 feet northeast from its location to accommodate construction of the new communication shelter. Project would include limited use of an emergency back-up diesel generator (<50 hp).	2016 to 2017	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Bachelor Officers Quarters (MILCON P110)	MCLB Barstow (Nebo Annex)	Construct a multi-story Bachelor Officer Quarters (15,672 sf) with 26 rooms for 14 officers. Community service areas include administrative area, laundry facilities, lounges, housekeeping areas, linen storage, community kitchen, mail service, game room, vending, and public restrooms. Existing Bachelor Officer Quarter (Building 11) would be demolished.	2011 to 2019	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Indoor Physical Fitness Center (MILCON P203)	MCLB Barstow (Nebo Annex)	Demolish Building 44 (physical fitness center) and construct a new physical fitness center (16,500 sf). Facility would include gym, basketball court, aerobics/exercise room, administrative area, fitness assessment room, laundry facility, vending area, and locker room with shower, toilets, and sauna.	2010 to 2018	Air Quality/GHGs; Cultural Resources; Noise
Building 573 Rehabilitation/ Modernization (MILCON P608)	MCLB Barstow (Yermo Annex)	Repair/replace and upgrade Building 573 (Combat Vehicle Maintenance Shop), including building components, heating and air-conditioning system, overhead cranes and crane tracks, breakrooms and restrooms, and electrical lighting figures.	2010 to 2017	Air Quality/GHGs; Noise
I&L Operations/Maintenance Facility (MILCON P804)	MCLB Barstow (Yermo Annex)	Demolish Building 588 (Operations/Maintenance Facility) and construct a new vehicle and equipment shop, lubrication shop, and railroad support maintenance facility (9,515 sf).	2010 to 2016	Air Quality/GHGs; Cultural Resources; Noise; Water Resources
Combat Vehicle Repair Facility (MILCON P930)	MCLB Barstow (Yermo Annex)	Construct a combat vehicle repair facility (10, 171 sf) including maintenance bays, administrative space, and locker/shower areas. Current combat vehicle work stations would be consolidated at this centralized facility.	2010 to 2017	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Fleet Support Operations/Training (MILCON P935)	MCLB Barstow (Yermo Annex)	Construct a new building (11,776 sf) to support existing administrative operations of the Fleet Support Center currently located in Warehouse 406.	2010 to 2017	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Composite Repair Facility (MILCON P938)	MCLB Barstow (Yermo Annex)	Construct a Composite Repair Facility (46,651 sf) to centralize Maintenance Center functions of the fabrication shop, body shop, and associated administrative functions.	2010 to 2017	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources

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Table 4.2-1. Cumulative Projects

Project Name	Project Location	Project Description	Project Time Frame	Relevant Areas of Potential Cumulative Impact
Engine Dynamometer Facility (MILCON P939)	MCLB Barstow (Yermo Annex)	Construct an Engine Dynamometer Facility (10,516 sf) to generate power to offset electricity costs at the Yermo Annex. Facility would include test room cells, test control spaces, administrative spaces, and a telecommunications room. Four cooling towers and a Paxman Dynamometer (i.e., device for measuring mechanical power) within Building 573 would be demolished.	2011 to 2013	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Potable Water Line Project (MILCON P941)	MCLB Barstow (Nebo Annex and Yermo Annex)	Construct an interconnecting potable water pipeline (33,973 linear feet) between the Nebo Annex and Yermo Annex and a pump station to provide adequate infrastructure and a reliable potable water supply.	2010 to 2014	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Paxman Addition (MILCON P944)	MCLB Barstow (Yermo Annex)	Construct a Paxman engine test and repair facility (10,506 sf) that includes engine test and spin test cells and control rooms.	2010 to 2016	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Electro-Optic Facility (MILCON P945)	MCLB Barstow (Yermo Annex)	Construct a new maintenance and repair shop (45,015 sf) for guided missile systems.	2010 to 2015	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Turret Facility (MILCON P946)	MCLB Barstow (Yermo Annex)	Construct a Turret Facility (60,000 sf) for maintenance and repair of small arms, automatic weapons, mortars, artillery guns, launchers, and turrets currently conducted in Building 573.	2010 to 2016	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Land Acquisition (MILCON P948)	MCLB Barstow (Nebo Annex)	Purchase 600 acres of privately held land (two single-family residences), transfer 4,500 acres of Bureau of Land Management property, and obtain local government easements. The land will be fenced off, existing buildings demolished, and public roads closed to develop a "land bridge" between the Nebo Annex and Yermo Annex.	2010 to 2016	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Operations/Training Facility (MILCON P949)	MCLB Barstow (Yermo Annex)	Construct an Operations/Training facility (36,845 sf) including administrative space, Command Control Center, training classrooms, and restrooms.	2010 to 2014	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Industrial Basins (MILCON P950)	MCLB Barstow (Yermo Annex)	Construct three evaporation basins (11,000 sf each) at the Industrial Waste Treatment Facility and relocate a vapor and electrical line.	2010 to 2017	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Material Handling Equipment Repair Shop (MILCON P953)	MCLB Barstow (Yermo Annex)	Construct a material handling equipment repair shop (6,760 sf) including a vehicle car wash.	2010 to 2017	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources

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Table 4.2-1. Cumulative Projects

Project Name	Project Location	Project Description	Project Time Frame	Relevant Areas of Potential Cumulative Impact
Consolidate Fire Department (MILCON P954)	MCLB Barstow (Nebo Annex)	Renovate Building 322 (14,354 sf) to consolidate all fire/rescue department functions within the Nebo Annex. Construction would include removal and disposal of asbestos and lead-based paint.	2010 to 2014	Air Quality/GHGs; Noise
Nebo Main Gate Improvement (MILCON 955)	MCLB Barstow (Nebo Annex)	Redesign the Nebo Main Gate to allow for adequate approach and response zones, a sentry booth, inspection enclosure, and overwatch structure (185 sf). A portion of Cape Gloucester Avenue would be demolished and the road would be realigned further east from the Base boundary.	2010 to 2017	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Yermo Main Gate Upgrades (MILCON P956)	MCLB Barstow (Yermo Annex)	Redesign the Yermo Main Gate to serve as both a truck inspection area and privately owned vehicle entrance (170 sf) and provide adequate approach and response zones. Project includes demolition of the current guard shack/ID checkpoint and construction of a new security checkpoint.	2010 to 2015	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise
Nebo Truck Inspection (MILCON P957)	MCLB Barstow (Neo Annex)	Redesign the Nebo Back Gate to provide a truck inspection area with adequate approach and response zones; demolish the existing guard shack/ID checkpoint; construct a sentry booth, inspection enclosure, and overwatch (185 sf) structure; and demolish a portion of Boll Avenue and re-route the road further west from the Base boundary.	2010 to 2017	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Construct Above-Ground Storage Tank (MILCON P958)	MCLB Barstow (Yermo Annex)	Construct three above-ground fuel storage tanks and a fuel dispersing spot (75 sf) in the Yermo Annex to provide fuel to government vehicles and decrease the number of tanker trips received from the Nebo Annex.	2010 to 2016	Air Quality/GHGs; Noise
Communication Station and Infrastructure (MILCON P959)	MCLB Barstow (Nebo Annex)	Construct a Communication Building (34,014 sf) to provide an alternative command and control facility on MCLB Barstow.	2010 to 2016	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Fire Station (MILCON P961)	MCLB Barstow (Yermo Annex)	Construct a fire station (16,921 sf) to support 2 fire engines, 1 ambulance, and 16 crew members.	2010 to 2015	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Family Service Center (MILCON P962)	MCLB Barstow (Nebo Annex)	Construct a Family Service Center (8,751 sf) to support informational programs and family services for military personnel and dependents.	2010 to 2016	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
School-Age Facility (MILCON P963)	MCLB Barstow (Nebo Annex)	Construct a childcare facility (2,336 sf), to provide before and after school care for youth between the ages of 6 and 12.	2010 to 2016	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources

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Table 4.2-1. Cumulative Projects

Project Name	Project Location	Project Description	Project Time Frame	Relevant Areas of Potential Cumulative Impact
General Warehouse (MILCON P964)	MCLB Barstow (Yermo Annex)	Construct a general warehouse (173,999 sf) to provide covered space for bulk storage, space for receiving and packing, office space, and restroom facilities.	2010 to 2017	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Yermo Back Gate (MILCON P966)	MCLB Barstow (Yermo Annex)	Reconstruct the Yermo Back Gate (5,737 sf) to provide a privately owned vehicle inspection area with adequate approach and response zones. Project includes construction of a sentry booth, ID inspection building, and new vehicle entry road/turnaround area.	2010 to 2016	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise
Combat Vehicle Repair Facility (MILCON P967)	MCLB Barstow (Yermo Annex)	Construct a Combat Vehicle Repair Facility (5,995 sf) to meet the requirements for ongoing fleet readiness.	2010 to 2015	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Warrior Training Facility (MILCON P968)	MCLB Barstow (Nebo Annex)	Construct a new training facility to accommodate the new increased mission for the Warrior Strengthening Program. Construct a 6,230 sf facility and 88 parking spots. Facility would include computerized training classrooms, training rooms, administrative space for training staff, and storage.	2010 to 2016	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Non-Military Projects				
Coolwater-Lugo Transmission Project (formerly South of Kramer)	Kramer Junction and Lucerne Valley	Expand transmission capacity in the Kramer Junction and Lucerne Valley areas and deliver renewable power. Project includes construction of 65 to 70 miles of new, high-voltage transmission lines; new Desert View Substation; upgrades to Coolwater and Lugo Substations; and 45 miles of new, overhead telecommunication cables.	2011 to 2018	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise
Barstow Casino and Resort	City of Barstow	Construction of a gaming facility, hotel, parking area, and other facilities (i.e., restaurants and retail, banquet/meeting, and administrative space) on 23 acres.	2001 to 2020	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Re-Grade Median Cross-Slopes on I-40	San Bernardino County along I-40, passing through the City of Barstow and communities of Daggett, Nebo, and Newberry Springs	Re-grade median cross-slopes along I-40 and conduct drainage improvements and modifications to the median over approximately 25-mile area. The project would also preserve and improve the existing California Highway Patrol access points on I-40.	2017 to 2019	Air Quality/GHGs; Biological Resources; Noise

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Table 4.2-1. Cumulative Projects

Project Name	Project Location	Project Description	Project Time Frame	Relevant Areas of Potential Cumulative Impact
Bureau of Land Management West Mojave Route Land Use Plan Amendment to the California Desert Conservation Area Plan	Portions of San Bernardino, Los Angeles, Kern, and Inyo counties	The project includes transportation management-related plan amendments to the California Desert Conservation Area Plan. The project includes planning recommendations/guidance for 3.1 million acres within the West Mojave Planning Area, managed by the Bureau of Land Management.	2016 to 2026	Air Quality/GHG; Biological Resources
Calnev Pipeline Expansion Project	MCLB Barstow (Range Complex and Yermo Annex)	The project would include the construction, operation, and maintenance of approximately 233 miles of new 16-inch-diameter pipeline and ancillary facilities from an existing facility in Colton, California to an existing facility in Las Vegas, Nevada. The proposed pipeline would parallel two existing system pipelines for most of the route.	2010 to 2020	Air Quality/GHGs; Biological Resources; Cultural Resources; Noise; Water Resources
Notes: GHG = greenhouse gas; hp = horsepower; I-40 = Interstate 40; MCLB = Marine Corps Logistics Base; MILCON = Military Construction Program; and sf = square feet.				

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4.3.2 Time Frame of the Cumulative Effects Analysis

A time frame for each issue related to cumulative effects has been determined. The time frame is defined as the duration of the effects anticipated. Time frames, like geographic scope, can vary by resource. Each project in a region has its own implementation schedule, which may or may not coincide or overlap with the schedule for implementing the proposed action. This is a consideration for short-term impacts from the proposed action. However, to be conservative, the cumulative analysis assumes that all projects in the cumulative scenario are built and operating during the operating lifetime of the proposed action.

Past actions are projects that have been approved and/or permitted, and that have either very recently completed construction/implementation or have yet to complete construction/be implemented. Present actions are actions that are ongoing at the time of the analysis. Reasonably foreseeable future actions are those for which there are existing decisions, funding, or formal proposals, or which are highly probable based on known opportunities or trends. However, these are limited to within the designated geographic scope and time frame. Reasonably foreseeable future actions are not limited to those that are approved for funding. However, this analysis does not speculate about future actions that are merely possible, but not highly probable based on information available at the time of this analysis.

4.4 Cumulative Impact Analysis

This section addresses the potential cumulative impacts of the proposed action in conjunction with the aforementioned cumulative projects. These projects represent past, present, and reasonably foreseeable actions with the potential for cumulative impacts when considered in conjunction with the potential impacts from the proposed action. However, if a project would not result in direct or indirect impacts on a resource area, it would not contribute to a cumulative impact on that resource area and no further evaluation from a cumulative impact perspective is warranted. The cumulative impact analysis focuses on: (1) those resource areas with the potential to be significantly impacted by the proposed action and/or (2) those resource areas currently in poor or declining health or at risk even if impacts associated with the proposed action would be relatively small (less than significant). The resources that do not meet these criteria are airspace (Section 3.1), land use (Section 3.5), public health and safety (Section 3.7), topography and geology (Section 3.8), transportation (Section 3.9), and utilities and infrastructure (Section 3.10). Therefore, the proposed action would not cumulatively contribute to impacts to these resources areas, and they are not evaluated further in this section.

4.4.1 Air Quality

4.4.1.1 Criteria Pollutants

The ROI for the criteria air pollutant cumulative analysis is primarily the MDAB and, more specifically, in proximity to MCLB Barstow. As described in Section 3.2, *Air Quality*, proposed construction, training, and range maintenance and sustainment activities would produce emissions that would remain below all emission significance thresholds. Emissions from cumulative projects potentially would contribute to ambient pollutant impacts generated from proposed activities. However, these emissions would occur far enough away from the locations of proposed construction and operational activities such that they would produce low ambient pollutant impacts in proximity to the project footprint. Therefore, air quality impacts from proposed construction and operational emissions, in combination with emissions from cumulative projects, would not be substantial enough to contribute to an exceedance of an ambient air quality standard. Implementation of standard fugitive dust and construction equipment emission control measures would ensure that air emissions from proposed construction activities would not produce significant impacts. Refer to Special Conservation Measures 1 and 2, described in Appendix B. Implementation of Special Conservation Measure 3 (*Fugitive Dust Control Measures for Operations*), described in

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Appendix B, would minimize fugitive dust emissions from proposed training activities in the vehicle loading and refueling area in the Range East and KD Range Complex training area. As a result, construction, training, and range maintenance and sustainment activities would not result in cumulatively significant impacts on criteria pollutant levels.

4.4.1.2 Greenhouse Gases

The potential effects of proposed GHG emissions are by nature global and cumulative impacts, as individual sources of GHG emissions are not large enough alone to have an appreciable effect on climate change. Therefore, an appreciable impact on global climate change would only occur when proposed GHG emissions combine with GHG emissions from other human activities on a global scale.

Currently, there are no formally adopted or published NEPA thresholds of significance for GHG emissions. Therefore, in the absence of an adopted or science-based NEPA significance threshold for GHGs, this EA compares the maximum amount of combined construction and operational GHG emissions that would occur from Alternative 1 to the U.S. net GHG emissions inventory of 2013 to determine the relative increase in proposed GHG emissions. Appendix C-1 presents estimates of GHG emissions generated by Alternative 1.

Table 4.4-1 summarizes the net change in annual GHG emissions that would occur from the proposed construction and operations (i.e., training and range maintenance and sustainment activities) under Alternative 1. These data show that Alternative 1 would increase CO_2e emissions by 4,792 metric tons from existing conditions at MCLB Barstow. These data also show that the ratio of CO_2e emissions from Alternative 1 to the CO_2e emissions associated with the net U.S. sources in 2013 is 0.0048/5,791 million metric tons, or about 0.00008 percent of the U.S. CO_2e emissions inventory. Since GHG emissions from Alternative 1 would equate to minimal amounts of the U.S. inventory, they would not substantially contribute to global climate change. Therefore, GHG emissions from Alternative 1 would not produce cumulatively significant impacts to global climate change.

Table 4.4-1. Annual GHG Emissions from Alternative 1

Scenario/Activity	Metric Tons per Year[1]			
	CO_2	CH_4	N_2O	CO_2e
Emission Increases – Alternative 1	-	-	-	4,792
U.S. 2013 Net Emissions (10^6 metric tons)[2]	-	-	-	5,791.2
Emissions as a percent of U.S. Emissions	-	-	-	0.00008

Notes: [1] $CO_2e = (CO_2 * 1) + (CH_4 * 21) + (N_2O * 296)$.
[2] Includes total sources and sinks (USEPA 2015a).
CO = carbon monoxide; GHG = greenhouse gas; and USEPA = United States Environmental Protection Agency.

Although Alternative 1 would not produce significant cumulative impacts to global climate change, the new buildings proposed under Alternative 1 would include sustainable design principles and energy conservation measures, including LEED® standards to the extent feasible. These design measures are consistent with the broad-based programs the USMC and Navy implement to reduce energy consumption and to shift to renewable and alternative fuels, thereby reducing overall emissions of GHGs.

Renewable energy projects currently implemented and planned within the jurisdiction of MCIWEST would reduce emissions of GHGs by about 250,000 metric tons (CO_2e) from current operations over a 25-year life cycle (MCIWEST 2009). These projects include thermal and photovoltaic solar systems, geothermal power plants, and wind generators. These renewable energy initiatives are not proposed as emission reductions to directly offset GHG emissions produced by Alternative 1, but rather demonstrate initial responses for the Navy to comply with EO 13693 (*Planning For Federal Sustainability in the Next*

Decade) (dated 19 March 2015) and to factor GHG management into Navy proposals and impact analyses.

Climate Change Adaptation

In addition to assessing whether Alternative 1 would potentially impact climate change, the following considers how climate change could impact these actions and what adaptation strategies, if any, would be required to respond to these future conditions. For projects within the inland regions of southern California, the main effect of climate change to consider is increased aridity, as documented in *Our Changing Climate 2012 – Vulnerability & Adaptation to the Increasing Risks from Climate Change in California* (California Energy Commission 2012). This report predicts that in the future, these regions will experience increased droughts, temperatures, wildfires, and scarcities of water supplies. Current operations at MCLB Barstow have adapted to droughts, high temperatures, and scarce water supplies in the area. Exacerbation of these conditions in the future could impede proposed activities during extreme events. Due to its desert surroundings and sparse vegetation, an increase in wildfires in the region would have little to no effect on activities at MCLB Barstow. No other substantial effects from future climate change would impact proposed construction and operational activities.

4.4.2 Biological Resources

The ROI for potential cumulative impacts on biological resources varies and is based on the presence of suitable habitat and known occurrences of a specific resource. Projects with potential direct and indirect impacts to biological resources include those that would result in the loss of native plant communities, permanent loss of sensitive plant populations, losses that affect species' population viability, and the reduction in adjacent habitat quality from temporary actions, including the addition of noise and dust during construction to permanent effects such as the addition of lighting. For native plant and wildlife communities, other significant impacts could include habitat fragmentation or the permanent loss of contiguous (connecting) native habitats such as migration or movement corridors.

Reasonably foreseeable cumulative projects in the region that require ground disturbance, vegetation clearing, grading, and excavations (e.g., KD Rifle Range Communication System Upgrades, Kinder Morgan Pipeline Replacement Project, Combat Vehicle Repair Facility, and Potable Water Line Project) could result in temporary and localized effects to biological resources that may be individually comparable to those associated with Alternative 1. Potential cumulative impacts associated with the loss of vegetation during construction and operations would be reduced with implementation of Special Conservation Measure 4 (*Invasive Plant Species Control*) and Special Conservation Measure 5 (*Restoration of Disturbed Habitats*), described in Appendix B, which would minimize the potential for establishment or spread of invasive plants. Potential direct and indirect cumulative impacts on general wildlife and habitat would be reduced with implementation of Special Conservation Measure 6 (*Vehicle Speed Limit Restrictions*), described in Appendix B. Potential cumulative impacts associated with direct impacts to Agassiz's desert tortoise and associated habitat and indirect affects to designated critical habitat for this species would be minimized by implementing vehicle speed limit restrictions, designating a MCLB Barstow Desert Tortoise Management Representative, continuing to implement a desert tortoise education program, conducting vehicle inspections, conducting pre-construction surveys, performing on-site biological monitoring, enforcing pet restrictions, providing waste management, preparing a MCLB Barstow Desert Tortoise Conservation Plan, performing annual desert tortoise surveys and reporting, coordinating with USFWS, delineating desert tortoise critical habitat, performing predator management, and adhering to wildfire prevention measures. Refer to Special Conservation Measures 6 - 19, described in Appendix B. Implementation of Special Conservation Measure 20 (*Seasonal Avoidance for MBTA-protected Bird Species)*, described in Appendix B, would minimize potential cumulative impacts associated with the loss of nesting habitat for MBTA species. Similarly, the spatial and temporal extent of potential

impacts on biological resources from other cumulative projects are expected to be limited due to implementation of special conservation measures and permit conditions that would maximize conservation of federally listed species that are comparable to those associated with Alternative 1. As a result, Alternative 1, combined with other cumulative projects, would not result in significant cumulative impacts on biological resources.

4.4.3 Cultural Resources

The ROI for potential cumulative impacts on cultural resources consists of MCLB Barstow and adjacent communities. Regional development and urbanization in the inland regions of southern California has resulted in extensive impacts on cultural resources, especially the destruction of archaeological sites and historic buildings. These types of cultural resources are limited, which is one of the reasons why strict federal and state regulations have been implemented to provide management and regulatory oversight.

Present and reasonably foreseeable projects at MCLB Barstow that involve ground-disturbing activities and/or modification or demolition of buildings or structures could result in impacts to cultural resources. Federal projects that have the potential to affect historic properties (assuming the presence of such properties) would undergo NHPA Section 106 review to consider any effects that the project may have on historic properties (as defined at 36 *CFR* 800.16). The significance of any effects would also be reviewed under NEPA.

As discussed in Section 3.4, *Cultural Resources*, there are four potentially NRHP-eligible sites (i.e., CA-SBR-73. CA-SBR-11840, CA-SBR-8319, and MCLB-SITE-7) that could be affected by Alternative 1. However, implementation of Special Conservation Measure 21 (*NRHP-eligible Site Buffer Zone*), described in Appendix B, would require clearly defined limits of construction, ground training, aircraft operations, and range maintenance and sustainment activities to avoid impacts to potentially eligible archaeological resources within the APE. MCLB Barstow is seeking concurrence from the California SHPO on the determinations of eligibility. Although highly unlikely, potential impacts to possible post-review discoveries would be minimized because MCLB Barstow would manage these resources in accordance with the NHPA and other federal laws and regulations, Marine Corps and DoD regulations, instructions, and orders, and DoD American Indian and Alaska Native Policy. MCLB Barstow would also follow the procedures stipulated in the MCLB Barstow ICRMP (Standard Operating Procedures) (MCLB Barstow 2011). Similarly, other cumulative projects would be subject to Section 106 review to consider their potential impacts to cultural resources as is required for Alternative 1. As a result, Alternative 1, combined with other cumulative projects, would not result in significant cumulative impacts to cultural resources.

4.4.4 Noise

The ROI for potential cumulative impacts on noise consists of the project footprint and adjacent areas on MCLB Barstow and surrounding communities. Development throughout MCLB Barstow and the surrounding areas, including KD Rifle Range Communication System Upgrades Project, Yermo Main Gate Upgrades (MILCON P956), and Potable Water Line Project (MILCON P941), would result in intermittent, short-term noise impacts throughout the region. The duration of these localized impacts would be limited to the construction phases of the individual projects and confined to the immediate construction area. Short-term noise associated with construction of designated LZs, LHA/LHD site, access roads, support facilities, utility infrastructure modifications, and installation of permanent fencing at the Yermo Stables training area could range from 0 to 17 dBA above ambient noise levels (assumed to be 45 dBA). However, noise levels at the sensitive receptor sites would remain at or below 75 dB $CNEL_{mr}$ during construction activities. Construction noise would decrease to levels not expected to be of concern at sensitive receptor locations. Other cumulative projects that could coincide in time with the

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proposed action would comply with applicable federal, state, and local regulations and/or requirements and would have to implement noise protection measures (e.g., solid walls, fences, or earthen mounds) and/or limit the hours of construction, as necessary, to minimize construction-related noise impacts. Therefore, cumulative construction-related noise impacts from Alternative 1, in conjunction with other projects in the regional vicinity, would not be cumulatively significant.

Proposed military projects (e.g., Warrior Training Facility [MILCON P968], Bachelor Officers Quarters [MILCON P110], and Operations/Training Facility [MILCON P949]) would generate increased levels of vehicular activity at MCLB Barstow that could increase noise levels affecting adjacent sensitive noise receptors. None of the cumulative projects would generate increased levels of training activity at MCLB Barstow that could increase aircraft, tactical vehicle, and/or munitions noise levels. Noise generated by tactical vehicle operations under Alternative 1 during ground training activities (e.g., convoy training, FARP operations, and tactical sustainment training) would not substantially differ from the existing noise environment within the project vicinity. Proposed training activities that would include the use of blanks, CS gas grenades, and pyrotechnics could generate noise levels at sensitive receptor locations that would potentially exceed 87 and 104 dB PK15(met). However, implementation of Special Conservation Measure 22 (*Munitions Firing Restrictions*), described in Appendix B, would restrict the use of certain ammunition types during training activities in portions of the Range Main Supply Route and Yermo Stables training areas. The noise exposure under Alternative 1 associated with the change in munition types at the KD Range Complex would be similar to baseline conditions, and the increase in noise levels at sensitive receptor locations would be minimal (i.e., approximately 2 dB) and would not result in an audible increase in ambient noise levels. Under Alternative 1, the increase in aircraft operations and addition of new aircraft types (i.e., UH-1/AH-1, CH-53, MV-22, C-130, C-23, CH-47, and UH-60) would result in noticeable changes in ambient noise levels and an increased frequency of potentially disturbing noise events. Proposed aircraft training at LZ 2 would result in a substantial increase in the number of low-altitude overflights of the Yermo Stables that could cause strong reactions from the horses at the stables. However, implementation of Special Conservation Measure 23 (*Aircraft Flight Restrictions*), described in Appendix B, would restrict low-level overflights such that the risk of strong behavioral reactions in horses at the Yermo Stables and noise exposure to noise-sensitive receptors would be minimized, and require scheduling aircraft training at LZ 2 to avoid coinciding with rodeos. Therefore, cumulative operations-related noise impacts from Alternative 1, in conjunction with other cumulative projects, would not be cumulatively significant.

4.4.5 Water Resources

The ROI for the water resources cumulative analysis includes the desert washes that receive surface water flows from the project footprint. Direct impacts to water resources could include the discharge of waste materials that would affect downstream water quality, the increase in impermeable surfaces that affect the volumes or patterns of surface flows or increase potentials for flooding, and increases in sedimentation into adjacent water bodies (i.e., desert washes). Cumulative development in proximity to the desert washes within the project footprint (i.e., receiving waters for cumulative projects), including the Re-Grade Median Cross-Slopes on I-40 Project and KD Rifle Range Communication System Upgrades Project, could result in temporary and localized effects to water quality that could be individually comparable to those associated with Alternative 1. Proposed construction activities could contribute to increased runoff, increased erosion, and off-site sedimentation into adjacent desert washes. Alternative 1 would incorporate BMPs for erosion and sedimentation control, as identified in Order No. 2009-0009-DWQ and as specified in a site-specific SWPPP to mitigate the adverse effects of construction-related erosion on water quality. Refer to Special Conservation Measure 25 (*NPDES Permit Compliance*), described in Appendix B. Alternative 1 would result in the construction of new impervious surfaces within the project footprint, potentially increasing stormwater runoff volume and peak discharge rates. This potential increase in stormwater runoff would be managed such that discharge exiting the project

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footprint post-construction would be equal to or less than existing conditions through the use of appropriately designed runoff reduction features. Refer to Special Conservation Measure 26 (*Low-Impact Development Runoff Reduction Features*), described in Appendix B. Potential surface water and/or shallow groundwater quality impacts associated with the inadvertent dispersion of contaminants during construction would be minimized by implementation of a SPCC Plan and BMPs as required under the General Permit for Storm Water Discharges Associated with Construction Activity from the State Water Resources Control Board. Implementation of Special Conservation Measure 27 (*LHA/LHD Access Road Design Requirements*), Special Conservation Measure 28 (*Levee Repair, Inspection, and Maintenance*), and Special Conservation Measure 29 (*800-yard Flood Wall)*, described in Appendix B, would minimize impacts associated with increased flooding on- or off-site. Therefore, cumulative construction-related water resource impacts from Alternative 1, in conjunction with other projects in the regional vicinity, would not be cumulatively significant.

Alternative 1 would result in a change in the level of operational activities within the project footprint. Potential surface water and groundwater quality impacts as a result of hazardous materials within small arms ammunition would be limited due to side berm control structures and low precipitation. Downwash/rotor wash associated with proposed aviation training activities would not significantly alter the drainage pattern within the desert washes in the project footprint. Implementation of Special Conservation Measure 30 (*MCLB Barstow Range Regulations for Water Resources*), described in Appendix B, would minimize impacts to surface waters from storage and disposal of wastewaters, storage and use of petroleum products, and/or containment and cleanup of spills during training activities. Although other reasonable foreseeable projects at MCLB Barstow and in adjacent areas/communities would have similar effects, these projects would also comply with applicable federal, state, and local regulations and/or requirements, and would have to implement similar types of protection measures. This would minimize the majority of potential impacts from Alternative 1 and other projects in the regional vicinity. Therefore, the cumulative operations-related water resource impacts from Alternative 1, in conjunction with other cumulative projects, would not be cumulatively significant.

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5 Other NEPA Considerations

5.1 Energy Requirements and Conservation Potential of Alternatives Including the Proposed Action

MCLB Barstow implements an energy conservation program that includes energy conservation awareness, energy-efficient standards for new development, and requirements for energy-efficient equipment. The proposed action would involve upgrades and modifications to existing utility infrastructure at the KD Range Complex and Yermo Stables training area. Electrical utility infrastructure upgrades include demolition of existing overhead electrical transmission lines north of Rifle Range Road and installation of new electrical infrastructure below-ground in the existing, disturbed utility corridor along Rifle Range Road. In addition, new electrical utilities would be installed below-ground within the northeastern portion of the Yermo Stables training area. Security lighting would be provided at the North Gate and East Gate at the KD Range Complex and the West Gate at the Range Main Supply Route training area. Some of the energy requirements for nighttime training, security, and entry gates would be provided by electricity produced by on-site solar.

Older buildings are generally less energy efficient than newer buildings. Sustainable design principles and energy conservation measures would be integrated into the design, development, and construction of the proposed facilities in accordance with the Energy Policy Act of 2005 (Section 109), EO 13693 — *Planning for Federal Sustainability in the Next Decade* (dated 19 March 2015), and other applicable laws. LEED® standards would be applied to the design of proposed range facilities and infrastructure to the extent feasible. LID design technologies to reduce stormwater runoff (e.g., impervious drainage features) would be implemented to the extent feasible in accordance with UFC 3-210-10.

5.2 Irreversible or Irretrievable Commitment of Natural or Depletable Resources

NEPA requires an analysis of significant, irreversible effects resulting from implementation of a proposed action. Resources that are irreversibly or irretrievably committed to a project are those that are typically used on a long-term or permanent basis; however, those used on a short-term basis that cannot be recovered (e.g., non-renewable resources such as metal, wood, fuel, paper, and other natural or cultural resources) also are irretrievable. Human labor also is considered an irretrievable resource. All such resources are irretrievable in that they are used for one project and, thus, become unavailable for other purposes. An impact that falls under the category of the irreversible or irretrievable commitment of resources is the destruction of natural resources that could limit the range of potential uses of that resource.

Implementation of the proposed action would result in an irreversible commitment of building materials; fuel for construction and training equipment, vehicles used during construction, training, and range maintenance and sustainment activities; and human labor. However, these commitments of resources are neither unusual nor unexpected, given the nature of the action. The proposed action would not result in the destruction of other environmental resources such that the range of potential uses of the environment would be limited, or affect the biodiversity of the region.

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5.3 Relationship Between Local Short-Term Use of the Human Environment and Maintenance and Enhancement of Long-Term Biological Productivity

NEPA requires consideration of the relationship between short-term use of the environment and the impacts that such use could have to the maintenance and enhancement of long-term productivity of the affected environment. Impacts that narrow the range of beneficial uses of the environment are of particular concern. Such impacts include the possibility that the alternative could reduce future flexibility to pursue other alternatives, or that choosing a certain use could eliminate the possibility of other uses at the site.

Implementation of the proposed action would not result in any such environmental impacts because it would not pose long-term risks to health, safety, or the general welfare of the communities surrounding the project footprint that would significantly narrow the range of future beneficial uses. In addition, biological productivity would not be affected as implementation of Alternative 1 would not result in significant direct, indirect, or cumulative impacts to any biological resources.

5.4 Any Probable Adverse Environmental Effects that Cannot be Avoided and are not Amenable to Mitigation

This EA has determined that the proposed action would not result in any significant unmitigable impacts; therefore, there are no probable adverse environmental effects that cannot be avoided or are not amenable to mitigation.

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6 List of Preparers

Lead Agency

Marine Corps
MCLB Barstow
Barstow, California
Karen Gray, Project Leader

This EA was prepared for the USMC under the direction of the Naval Facilities Engineering Command Southwest by Leidos. Leidos professional staff members who contributed to the preparation of this document are listed below.

Name	Title	Degree	Years of Experience	Project Participation
Jessica Degner	Project Manager/ Environmental Planner	B.A., Environmental Studies	13	Project Manager; Chapters 1 and 2; Quality Assurance/ Quality Control
Robert Thompson	Airspace Management Specialist	M.S., Human Resources Management	26	Airspace
Chris Crabtree	Air Quality Specialist	B.A., Environmental Studies	27	Air Quality
Tara Schoenwetter	Senior Ecologist/Biologist	Ph.D., Ecology & Conservation Biology	13	Biological Resources
Tom Mulroy	Principal Ecologist	Ph.D. Ecology and Evolutionary Biology, Univ. California, Irvine	35+	Biological Resources Quality Assurance/Quality Control
Stephen Bryne	Senior Archaeologist	M.S., Anthropology	20	Cultural Resources
Lorraine Gross	Senior Archaeologist	B.A., Anthropology M.A., Anthropology	35	Cultural Resources
Karen Foster	Project Manager/Cultural Resources Manager	Ph.D., Anthropology	16	Cultural Resources Quality Assurance/Quality Control
Mike Deacon	Environmental Scientist	B.S., Environmental Studies and Environmental Health	22	Land Use; Transportation
Jay Austin	Environmental Scientist	M.S., Environmental Science	15	Noise
Perry Russell	Geologist/Hydrogeologist	M.S., Geological Sciences	24	Topography and Geology
Catrina Gomez	Environmental Planner	MSEM, Environmental Science and Management	10	Utilities
Joel Degner	Water Resource Engineer	P.E., B.S., Hydrologic Sciences	10	Water Resources
Katherine Spence	Sr. Technical Editor	A.S.B.A., Business Administration	17	Formatting/Editing
Bonnie McClure	Production Coordinator	B.A., English	5	Word Processing
Catherine FitzGerald	Graphic Artist	A.A., Fine Arts	35	Graphic Design
Chris Woods	GIS Analyst	B.A., Geography	17	Geographic Information System

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7 Persons and Agencies Contacted

7.1 United States Government

7.1.1 United States Navy

Jesse Martinez, NAVFAC SW Project Manager

Scott Mattingly, NAVFAC SW Archaeologist

Susan Leary, NAVFAC SW Archaeologist

Rob Lovich, NAVFAC SW Biologist

7.1.2 United States Marine Corps

Major D.S. Powell, MCLB Barstow S-3 Operations Director

Karen Gray MCLB Barstow S-3 Operations

Jon Aunger, MCLB Barstow S-3 Operations

Ian Imlah, MCLB Barstow S-3 Operations

Timothy Manoogian, MCLB Barstow S-3 Operations

Major Stacey Colon, MCLB Barstow Environmental Division

Stephanie White, MCLB Barstow Environmental Division

George Ellis, MCIWEST Regional Range & Training Area Planner

Zak Likins, MCIWEST Regional NEPA Program Manager

Bill Berry, MCIWEST Regional Conservation Program Manager

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Appendix A

Applicable Federal Regulations, Instructions, and Public Law

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Applicable Federal Regulations, Instructions, and Public Law

Name	*Regulation*
National Environmental Policy Act of 1969	42 USC §§ 4321–4370h
Council on Environmental Quality Regulations for Implementing the Procedural Provisions of National Environmental Policy Act	40 CFR Parts 1500–1508
Department of the Navy Procedures for Implementing National Environmental Policy Act	32 CFR Part 775
Environmental Compliance and Protection Manual Chapter 12	Marine Corps Order P5090.2A, Change 3
National Historic Preservation Act	54 USC §300101 *et seq*
Clean Water Act	33 USC §§ 1251–1387
Clean Air Act, as amended, including 1990 General Conformity Rule	USC §§ 7401–7671q
Comprehensive Environmental Response, Compensation, and Liability Act	42 USC §§ 9601–9675
Resource Conservation and Recovery Act	42 USC §§ 6901–6992k
Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations, 11 February 1994	Executive Order 12898
Protection of Children from Environmental Health Risks and Safety Risks, 23 April 1997	Executive Order 13045
Endangered Species Act	16 USC §§ 1531–1544
Migratory Bird Treaty Act	16 USC §§ 703–712
Responsibility of Federal Agencies to Protect Migratory Birds, 11 January 2001	Executive Order 13186
Invasive Species	Executive Order 13112
Native Americans Graves Protection and Repatriation Act	25 USC §§ 3001–3013 and 40 CFR Part 10
Federal Compliance with Pollution Control Standards	Executive Order 12088
Greening the Government through Waste Prevention, Recycling, and Federal Acquisition	Executive Order 13101
Greening the Government through Efficient Energy Management	Executive Order 13123
Greening the Government through Leadership in Environmental Management	Executive Order 13148
Planning For Federal Sustainability in the Next Decade	Executive Order 13693
United Facilities Criteria for Low Impact Development	United Facilities Criteria 3-210-10
American Indian Religious Freedom Act	PL 95-341; 42 USC §§ 1996 and 1996a
Archaeological Resource Protection Act	16 USC §§ 470aa–470mm; PL 96-95 and Amendments
Federal Aviation Administration Order 7400.2	49 USC § 40103(b)
Operation Risk Management	Marine Corps Order 3500.27A
Range Regulations for Activities Scheduled by MCAS Yuma	MCAS Yuma Station Order 3710.6
Pre-mishap Plan	MCAS Yuma Station Order 3750.2

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Applicable Federal Regulations, Instructions, and Public Law

Name	*Regulation*
National Register of Historic Places	36 CFR Part 60
Operational Risk Management	Office of the Chief of Naval Operations 3500.39A
Pollution Prevention Act of 1990	42 USC §§ 13101–13109
Sikes Act	16 USC §§ 670–670f, 74 Stat. 1052, as amended, PL 86-797, approved 15 September 1960
Waste Discharge Requirements for Discharge of Storm Water Runoff Associated with Construction and Land Disturbance Activities	State of California Water Resources Control Board Order No. 2009-0009-DWQ; National Pollutant Discharge Elimination System General Permit No. CAS000002
Notes: CFR = Code of Federal Regulations; MCAS = Marine Corps Air Station; PL = Public Law; USC = United States Code.	

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Appendix B

Minimization, Mitigation, Monitoring, and Reporting (MMMR) Tracking Sheet

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MINIMIZATION, MITIGATION, MONITORING, AND REPORTING (MMMR) TRACKING SHEET ***Barstow Training and Range, MCLB Barstow***							
Number	***Minimization, Mitigation, Monitoring, Reporting Measures***	***Environmental Assessment Section***	***Implementation Procedure or Action***	***Responsible Organization***	***Deliverable/ Report***	***Compliance Schedule***	***Verification of Compliance***
1	*Fugitive Dust Control Measures.* The construction contractor would implement the following measures during all proposed ground disturbance activities: 1. Use water trucks or sprinkler systems to keep all areas of vehicle movement damp enough to prevent dust from leaving the construction area; 2. Minimize the amount of disturbed ground area at a given time; 3. Minimize traffic speeds on all unpaved roads; 4. Install gravel pads at construction area access points to prevent tracking of soil onto paved roads; 5. Suspend all soil disturbance activities when winds exceed 25 miles per hour (mph) or when visible dust plumes emanate from the site. Stabilize all disturbed areas at this time; 6. Cover truck loads that haul dirt, sand, or gravel; 7. After completion of clearing, grading, earthmoving, or excavation, treat the disturbed areas by watering, re-vegetation, or by spreading non-toxic soil binders until they are paved or otherwise developed to prevent dust generation; and 8. Designate personnel to monitor the dust control program and to order increased watering, as necessary, to prevent the transport of dust off-site. Their duties shall include holiday and weekend periods when work may not be in progress.	Section 3.2	Implement fugitive dust control measures	Construction Contractor	None	During Construction	Verified by: Date:
2	*Construction Equipment Emission Control Measures.* The construction contractor would implement the following measures during all proposed construction activities, where feasible: 1. Maintain equipment according to manufacturer specifications; 2. Restrict idling of equipment and trucks to a maximum of 5 minutes at any location; 3. Use diesel oxidation catalysts and/or catalyzed diesel particulate traps; 4. Use electricity from power poles rather than temporary diesel- or gasoline-powered generators; 5. Provide temporary traffic control, such as a flag person, to	Section 3.2	Implement construction equipment emission control measures	Construction Contractor	None	During Construction	Verified by: Date:

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MINIMIZATION, MITIGATION, MONITORING, AND REPORTING (MMMR) TRACKING SHEET ***Barstow Training and Range, MCLB Barstow***							
Number	***Minimization, Mitigation, Monitoring, Reporting Measures***	***Environmental Assessment Section***	***Implementation Procedure or Action***	***Responsible Organization***	***Deliverable/ Report***	***Compliance Schedule***	***Verification of Compliance***
	maintain smooth traffic flow; 6. Keep construction equipment and equipment staging areas away from sensitive receptors (e.g., residential areas); 7. Re-route construction trucks away from congested streets or sensitive receptors; 8. Use construction equipment with engines that meet United States Environmental Protection Agency (USEPA) Tier 3 and 4 nonroad standards; and 9. Use alternative fuel construction equipment, such as natural gas- or electric-powered.						
3	*Fugitive Dust Control Measures for Operations*. The United States Marine Corps (USMC) would implement the following measures to minimize fugitive dust generated from operations within the vehicle loading and refueling area in the Range East and Known Distance (KD) Range Complex from obscuring visibility to traffic on I-40. The level of effort needed to achieve this objective would depend on the following factors: 1) moisture content of the soil; 2) wind direction; and 3) wind speeds. 1. During conditions when winds blow dust generated by project activities toward Interstate 40 (I-40), limit activities to a level that does not result in any obscuration of visibility to traffic on I-40. 2. Apply water to areas where vehicles and equipment would operate on unpaved surfaces if these surfaces are dry. 3. Add non-toxic wetting agents to water used for dust control to improve the water retention quality of wetted surfaces, to the extent feasible. 4. Cover unpaved surfaces with gravel, if feasible. 5. Minimize on-site vehicle speeds to 15 mph. 6. Suspend vehicle movement activities when winds exceed 25 mph and transport dust generated by project activities toward I-40. 7. Prioritize use of the vehicle loading and refueling area during periods of high soil moisture (such as immediately after rainfalls or previous operations) and/or when winds blow	Section 3.2	Implement fugitive dust control measures	MCLB Barstow	None	During Operations	Verified by: Date:

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MINIMIZATION, MITIGATION, MONITORING, AND REPORTING (MMMR) TRACKING SHEET ***Barstow Training and Range, MCLB Barstow***							
Number	***Minimization, Mitigation, Monitoring, Reporting Measures***	***Environmental Assessment Section***	***Implementation Procedure or Action***	***Responsible Organization***	***Deliverable/ Report***	***Compliance Schedule***	***Verification of Compliance***
	from I-40 toward this area. 8. Designate personnel to monitor the dust control program and to order increased watering, as necessary, to prevent the obscuration of visibility to traffic on I-40.						
4	*Invasive Plant Species Control.* In an effort to control the spread of invasive (non-native) weeds, all construction equipment and vehicles originating outside of MCLB Barstow would be power-washed at designated areas before entering and exiting MCLB Barstow. While washing wheeled vehicles, the front wheels would be turned lock-to-lock to allow for exposure of surfaces that may hold soil or weed seeds.	Section 3.3	Implement invasive plant species control	Construction Contractor	None	During Construction	Verified by: Date:
5	*Restoration of Disturbed Habitats.* All areas disturbed by construction activities would be restored and monitored. Vegetation removal would be avoided to the extent feasible during training activities. Natural vegetation communities would be restored in accordance with an approved Revegetation Plan. Disturbed areas would be inspected for any infestations of non-native invasive plant species including, but not limited to, the Sahara mustard *(Brassica tournefortii)* and Russian thistle *(Salsola* spp.). If these species are detected, they should be eradicated.	Section 3.3	Restore disturbed habitats	Construction Contractor	Revegetation Plan	Restoration Plan will be submitted before construction. Restoration will occur after construction.	Verified by: Date:
6	*Vehicle Speed Limit Restrictions.* Vehicles traveling on the authorized vehicle travel routes would not exceed 15 miles per hour.	Section 3.3	Implement and enforce vehicle speed limits	MCLB Barstow	None	During Construction and Operations	Verified by: Date:
7	*MCLB Barstow Desert Tortoise Management Representative.* The MCLB Barstow Desert Tortoise Management Representative would be a qualified, USFWS-approved desert tortoise biologist that would ensure compliance with protective stipulations by all personnel within the project footprint. This representative has the authority to halt activities that may be in violation of such provisions. The MCLB Barstow Desert Tortoise Management Representative would also coordinate with the designated USFWS representative on all matters concerning desert tortoise mitigation and management responsibilities.	Section 3.3	Appoint a MCLB Barstow Desert Tortoise Management Representative Representative will ensure compliance with protective	MCLB Barstow	None	During Operations	Verified by: Date:

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	MCLB Barstow would submit the name(s) and credentials of the person(s) that would be the MCLB Barstow Desert Tortoise Management Representative or appointee(s) (appointee is defined as a person having the same qualifications as the MCLB Barstow Desert Tortoise Management Representative). Only qualified desert tortoise biologists, including the MCLB Barstow Desert Tortoise Management Representative, or appointees would handle desert tortoises.		stipulations for desert tortoise and coordinate with designated USFWS representative concerning desert tortoise mitigation and management responsibilities				
8	*Desert Tortoise Education Program.* All personnel involved in construction activities, ground and aviation training activities, and range maintenance and sustainment activities (hereafter "users") in the project footprint would participate in the existing MCLB Barstow desert tortoise education program, which would be reviewed and approved in cooperation with the USFWS. The program includes the following topics: (1) occurrence of the desert tortoise; (2) sensitivity of the species to human activities; (3) legal protection for desert tortoises; (4) penalties for violations of federal law; (5) general tortoise ecology and activity patterns; (6) reporting requirements; (7) measures to protect tortoises; (8) personal measures that users can take to promote the conservation of desert tortoises; and (9) procedures and a point of contact if a desert tortoise is observed on-site. Verification of participation in the MCLB Barstow desert tortoise education program for all personnel would be submitted to MCLB Barstow Environmental Division before construction, training, and range maintenance and sustainment activities. All users would be informed of their responsibility to report any form of take to the MCLB Barstow Desert Tortoise Management Representative.	Section 3.3	Continue to implement the desert tortoise education program	MCLB Barstow	None	During Operations	Verified by: Date:
9	*Vehicle Inspections.* All personnel operating vehicles within the project footprint would inspect areas adjacent to and underneath their parked vehicle, before moving it. If a desert tortoise is found	Section 3.3	Conduct vehicle inspections	Construction Contractor and	None	During Construction and	Verified by: Date:

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	adjacent to or beneath the vehicle and the tortoise could potentially be harmed by moving the vehicle, the MCLB Barstow Desert Tortoise Management Representative, or qualified appointee(s), would be contacted for instruction.			MCLB Barstow		Operations	
10	*Clearance Surveys during Construction and Range Maintenance and Sustainment Activities.* Clearance surveys conforming to USFWS recommendations would be followed for the construction of the LZs, LHA/LHD site, access roads, bivouac areas, vehicle loading/refueling areas, other construction areas, and range maintenance and sustainment activities. A qualified desert tortoise biologist or the MCLB Barstow Desert Tortoise Management Representative would also be on-site during construction and range maintenance and sustainment activities. 1. If construction and/or range maintenance and sustainment activities occur during a time of year when desert tortoises are active, the authorized biologist would ensure that clearance surveys have been conducted in all work areas within appropriate habitat immediately before the onset of work. MCLB Barstow Environmental Division staff would determine whether desert tortoises are likely to be active with consideration of the time of year and the weather conditions at the time and place where work is to be conducted. If desert tortoises are unlikely to be active, the clearance surveys may be conducted within 48 hours before ground disturbance or the start of range maintenance and sustainment activities. When desert tortoise burrows are found, they would be checked for desert tortoises; when desert tortoises are found, the burrows would be flagged. All unoccupied burrows would be flagged in a different manner than the occupied burrows. During the construction and range maintenance and sustainment period, an authorized biologist would re-check the burrows and remove any desert tortoises that would be endangered by construction and/or range maintenance and sustainment activities following the Desert Tortoise Council protocols (1999).	Section 3.3	Conduct clearance surveys during construction and range maintenance and sustainment activities	Construction Contractor and MCLB Barstow	None	During Construction and Range Maintenance and Sustainment Activities	

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	2. For construction and range maintenance and sustainment activities in areas of suitable habitat that support desert tortoises, the USMC would install temporary fencing around work sites to prevent entry of desert tortoises. Any desert tortoises within the fenced area would then be relocated to nearby suitable habitat, before the start of ground disturbing activities. The presence of authorized biologists on-site may be substituted for temporary fencing; MCLB Barstow Environmental Division staff would determine which protective measure is appropriate, depending on the specific circumstances. 3. The MCLB Barstow Environmental Division office would maintain a record of all observations of desert tortoises encountered at MCLB Barstow. The information gathered would include the date and time of observation; whether the desert tortoise was handled and whether it voided its bladder; general health of the desert tortoise; and, if it was moved, the locations from and to which the desert tortoise was moved. 4. The USMC would endeavor to place the remains of intact desert tortoises with educational or research institutions holding the appropriate federal and state permits per their instructions.						
11	*Desert Tortoise Monitoring during Construction and Range Maintenance and Sustainment Activities*. All personnel involved in construction of the LZs, LHA/LHD site, access roads, bivouac areas, vehicle loading/refueling areas, and range maintenance and sustainment activities would monitor 'take.' Personnel would report to the MCLB Barstow Desert Tortoise Management Representative any injured or dead tortoises located, as well as habitat damage outside of the designated area. Personnel would fill out a form after construction and range maintenance and sustainment activities, reporting any take. The MCLB Barstow Desert Tortoise Management Representative (or appointee) would be present during all construction and range maintenance and sustainment activities and available to respond to	Section 3.3	Conduct desert tortoise monitoring during construction and range maintenance and sustainment activities	Construction Contractor and MCLB Barstow	Report any take of desert tortoise to MCLB Barstow Desert Tortoise Management Representative (or appointee)	During Construction and Range Maintenance and Sustainment Activities	Verified by: Date:

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	construction and maintenance crews (who would be trained per Special Conservation Measure 8) in the event the crews observe tortoise mortality/take, habitat damage, or need to have a tortoise relocated. 1. Only biologists authorized by the USFWS would be allowed to survey for desert tortoises before proposed activities, serve as a desert tortoise monitor during construction and range maintenance and sustainment activities, and handle desert tortoises (except in circumstances in which the life of the desert tortoise is in immediate danger). 2. Desert tortoises would be moved only by an authorized biologist and solely for the purpose of moving the animals to avoid harm, unless the animal is in imminent danger. Desert tortoises would be moved the minimum distance to ensure their safety. Desert tortoises would be monitored to ensure that they do not re-enter the work area during construction or range maintenance and sustainment activities. If a tortoise is observed during construction or range maintenance and sustainment activities the MCLB Barstow Desert Tortoise Management Representative would be contacted immediately. 3. All handling of desert tortoises and their eggs and excavation of burrows would be conducted by an authorized biologist in accordance with protocols developed by the Desert Tortoise Council (1999), unless the animal was in imminent danger as noted above. 4. If the burrows of the desert tortoise cannot be avoided, they would be examined and excavated by hand, by or under the direct supervision of the authorized biologist. The authorized biologist would examine the burrow to determine whether it contains desert tortoise eggs. 5. Any time a vehicle is parked in desert tortoise habitat, the ground around and underneath the vehicle would be inspected for desert tortoises before moving the vehicle. If a desert tortoise is observed adjacent or beneath the vehicle and the tortoise could potentially be harmed by moving the vehicle, an						

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	authorized biologist would be contacted. If possible, the desert tortoise would be left to move on its own. Otherwise, the desert tortoise would be removed and relocated by the authorized biologist in accordance with the handling provisions. 6. Any excavations associated with construction and range maintenance and sustainment activities that would be left open in areas that are not being monitored would either be fenced temporarily to exclude desert tortoises, covered at the close of each work day, or provided with ramps so desert tortoises can escape. All excavations would be inspected for desert tortoises before filling.						
12	*Pet Prohibitions.* No pets would be permitted anytime within the project footprint. Authorized use of military working dogs and horses under control of their handlers would be permitted.	Section 3.3	Prohibit pets from project footprint	Construction Contractor and MCLB Barstow	None	During Construction and Operations	Verified by: Date:
13	*Waste Management.* All personnel who enter the project footprint would be required to remove all food, trash, or other waste that may attract desert tortoise predators. The MCLB Barstow Range Control Officer would be responsible for ensuring that trash is properly secured and removed regularly from the project footprint.	Section 3.3	Manage waste that may attract desert tortoise predators	MCLB Barstow	None	During Operations	Verified by: Date:
14	*MCLB Barstow Desert Tortoise Conservation Plan.* MCLB Barstow would prepare a scientifically rigorous Desert Tortoise Conservation Plan, consistent with current USFWS guidance for conservation of desert tortoise and their habitat. The plan would be approved by MCLB Barstow Environmental Division staff and the Commanding Officer. The plan would be in place before implementation of the proposed action. The plan would include but not be limited to the following: the status of the desert tortoise on MCLB Barstow (e.g. population and trend analyses such as existing data and trends in species occurrence and habitat on MCLB Barstow); results and application of recent research and studies and conceptual models for desert tortoise; identification of short-term and long-term research studies and	Section 3.3	Prepare the Desert Tortoise Conservation Plan before project initiation	MCLB Barstow	Final Desert Tortoise Conservation Plan	Before Construction and Operations	Verified by: Date:

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	conservation measures that would assist in better management of the species and habitat on MCLB Barstow; development of an ongoing monitoring program to ascertain the long-term effects of ongoing military training and range maintenance and sustainment at MCLB Barstow; development of priorities for future tortoise research on MCLB Barstow; and identification of management goals, priorities, and guidelines for specific management actions.						
15	*Annual Desert Tortoise Surveys and Reporting.* All users of the project footprint would be informed of their responsibility to report any form of take to the MCLB Barstow Desert Tortoise Management Representative. If a tortoise is found in the project footprint during construction, training, and/or range maintenance and sustainment activities, if appropriate, these activities may be modified to avoid injuring or harming desert tortoise. The MCLB Barstow Desert Tortoise Management Representative would be contacted immediately. 1. All desert tortoises observed by military personnel or workers within or adjacent to construction, training, and/or range maintenance and sustainment activities where they may be killed or injured would be reported immediately to the MCLB Barstow Desert Tortoise Management Representative. 2. Upon locating desert tortoises killed or injured by construction, training, or range maintenance and sustainment activities, initial notification within three (3) working days of their finding must be made in writing to the USFWS's Division of Law Enforcement and by telephone and writing to the Ventura Field Office. The report would include the date, time, location of the carcass, a photograph (if possible), cause of death, if known, and any other pertinent information. 3. Caution would be taken in handling injured animals to ensure effective treatment and care, and in handling dead specimens to preserve biological material in the best possible state. Injured animals would be transported to a qualified	Section 3.3	Conduct annual desert tortoise surveys and reporting	Construction Contractor and MCLB Barstow	Report take of desert tortoise to the MCLB Barstow Desert Tortoise Management Representative Submit findings to the USFWS's Division of Law and Enforcement within three (3) days of locating desert tortoise killed or injured by construction or operations. Submit annual monitoring	During Construction and Operations Notification of take must be submitted within three (3) working days of the discovery of any tortoise death or injury	Verified by: Date:

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	veterinarian or a rehabilitator licensed by the State of California. Should any treated desert tortoises survive, the USFWS would be contacted regarding the final disposition of the animals (i.e., whether it is permissible to re-release them, put them in a breeding-program, or transfer them to an alternative location). 4. The project footprint would be included in the ongoing annual surveys at MCLB Barstow. Surveys would be conducted using the USFWS-recommended methods by qualified desert tortoise biologists. The results of monitoring would be included in the annual monitoring report prepared by MCLB Barstow and delivered to the USFWS on or before 15 January of each year. Any changes in survey methodology would be reported to the USFWS in an annual monitoring report.				report to USFWS		
16	*Notify USFWS of any Take of Desert Tortoise.* The USFWS would be notified by the MCLB Barstow Desert Tortoise Management Representative within three (3) working days of the discovery of any tortoise death or injury caused by military activity. Notification would include the date, time, circumstances, and location of any injury or death. Dead animals would be left in situ. Injured animals would be taken to a USFWS-approved veterinarian.	Section 3.3	Notify USFWS of any take of desert tortoise	MCLB Barstow	Notification of take	Within three (3) working days of the discovery of any tortoise death or injury	Verified by: Date:
17	*Delineation of Desert Tortoise Critical Habitat.* The location of desert tortoise critical habitat adjacent to the project footprint would be appropriately marked and delineated to avoid intrusion onto designated critical habitat.	Section 3.3	Appropriately delineate designated desert tortoise critical habitat	MCLB Barstow	None	Before Construction and Operations	Verified by: Date:
18	*Predator Management.* In an effort to control desert tortoise predators, MCLB Barstow would implement the following measures to discourage predator settlement: 1. Public use is restricted and would continue to be restricted at MCLB Barstow, thus reducing the predator attraction toward people. 2. Range signs and fencing would be limited to a minimum,	Section 3.3	Implement the predator management plan	MCLB Barstow	None	During Construction and Operations	Verified by: Date:

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	to reduce elevated perches. 3. All personnel would be required to properly dispose of food and trash. 4. Construction activities would have appropriate trash receptacles. 5. Construction personnel, range personnel, and troops using the training areas would be educated and instructed to report any predator sightings, which would be investigated and documented by MCLB Barstow Environmental Division staff. 6. Any predator or predator nests discovered in the project footprint would be evaluated by biologists for tortoise predation. When any predator-damaged tortoise shells are found, the surrounding area would be searched for predators and predator nests. Any predators would be documented and reported to MCLB Barstow Environmental Division staff.						
19	*Wildfire Prevention.* All construction, training, and range maintenance and sustainment activities would be conducted in accordance with the MCLB Barstow Wildland Fire Management Plan and MCLB Barstow Regulations for Ranges and Training Areas and Airspace (Range Regulations).	Section 3.3	Implement wildfire prevention measures	MCLB Barstow	None	During Construction and Operations	Verified by: Date:
20	*Seasonal Avoidance for MBTA-protected Bird Species.* To the maximum extent feasible, vegetation removal would occur from 01 September to 14 February, which is outside the breeding season for nesting birds protected under the Migratory Bird Treaty Act (MBTA). Trimming or removal of vegetation during the peak breeding season (15 February to 31 August) would require a pre-activity survey by a qualified wildlife biologist, approved by MCLB Barstow Environmental Division to confirm that active nests would not be affected. The wildlife biologist must conduct the survey within three days of the start of vegetation removal.	Section 3.3	Seasonal avoidance of MBTA-protected bird species	MCLB Barstow	None	During Construction and Operations	Verified by: Date:

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21	*NRHP-eligible Site Buffer Zone*. No construction, ground training, and/or range maintenance and sustainment activities would occur within a 50-foot (15-meter) buffer zone and no aircraft training activities would occur within a 350-foot (107-meter) buffer zone around National Register of Historic Places (NRHP)-eligible sites (i.e., CA-SBR-73, CA-SBR-11840, CA-SBR-8319, and MCLB-SITE-7). For Site CA-SBR-73, the 50-foot (15-meter) and 350-foot (107-meter) buffer zones would be established around the existing fencing that protects the site.	Section 3.4	Restrict project activities within the NRHP-eligible Site Buffer Zone	MCLB Barstow	None	During Construction and Operations	Verified by: Date:
22	*Munitions Firing Restrictions*. The following ammunition restrictions would apply to training activities within the Range Main Supply Route and Yermo Stables training areas. These restrictions would avoid noise levels in excess of 104 dB peak level exceeded 15 percent of the time (PK15[met]) at noise-sensitive locations in the Nebo Annex and west of Daggett-Yermo Road. 1. Training activities using MG M2 (.50 caliber blank) ammunition would be prohibited within 100 feet (30 meters) from the northern boundary of the Range Main Supply Route training area directly south of the Desert View military housing (west of wind turbine). 2. Training activities using MG M2 (.50 caliber blank) ammunition would be prohibited within 1,050 feet (320 meters) from Daggett Yermo Road and the Yermo Stables in the Yermo Stables training area. *3.* Training activities using M240G (7.62mm blank) ammunition would be prohibited within 755 feet (230 meters) from Daggett Yermo Road and the Yermo Stables in the Yermo Stables training area.	Section 3.6	Implement munitions firing restrictions	MCLB Barstow	None	During Operations	Verified by: Date:
23	*Aircraft Flight Restrictions*. Aircrews would avoid direct overflight of the towns of Daggett and Yermo and structures west of Daggett-Yermo Road at below 500 feet (152 meters) above ground level (AGL). Direct overflight of the Yermo Stables would be avoided at less than 500 feet (152 meters) at	Section 3.6	Implement aircraft flight restrictions	MCLB Barstow	None	During Operations	Verified by: Date:

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	all times to reduce the risk of strong behavioral reactions in horses. Aircraft training activities at LZ 2 would be scheduled to the extent feasible to avoid coinciding with rodeos.						
24	*Restrictions for Construction and Training within Proximity to IR Sites*. All activities conducted in the Yermo Stables training area would be coordinated and reviewed by MCLB Barstow Environmental Division and Range Operations before initiating any ground disturbing activities to reduce potential exposure of on-site personnel to contaminated soil within and adjacent to Stratum 5A (Comprehensive Environmental Response, Compensation and Liability Act Area of Concern [CAOC] 23).	Section 3.7	Coordinate any actions in the Yermo Stables training area with MCLB Barstow Environmental Division and Range Operations	Construction Contractor and MCLB Barstow	None	During Operations	Verified by: Date:
25	*NPDES Permit Compliance*. Before construction, the construction contractor would obtain authorization from the State Water Resources Control Board for construction under the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities.	Section 3.11	Obtain NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities	Construction Contractor	NPDES Permit	Before Construction	Verified by: Date:
26	*Low-Impact Development Runoff Reduction Features*. Runoff reduction features, consisting of swales, infiltration trenches, and/or retention basins, would be constructed for the tear gas training facility and restroom facility to minimize flooding and water quality impacts. The drainage system design would be finalized before construction and would comply with Energy Independence Security Act Section 438, Unified Facilities Criteria (UFC) 3-210-10 for Low-Impact Development (LID), NPDES General Permit for Waste Discharge Requirements for Storm Water Discharges from Municipal Separate Storm Sewer Systems (Order No. 2013-0001-DWQ; NPDES No. CAS000004) design standards, and Navy, USMC, and Department of Defense (DoD) LID policies (2007, 2008, and	Section 3.11	Design low-impact development runoff reduction features for the tear gas training facility and restroom facility to minimize flooding and water quality impacts	Construction Contractor and MCLB Barstow	Design for Low-Impact Development Runoff Reduction Features	Before Construction	Verified by: Date:

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	2010). Per these requirements, the runoff reduction features would be designed and located to provide on-site stormwater retention and trap eroded soils, and to the maximum extent technically feasible infiltrate, filter, store, evaporate, and/or retain runoff close to its source.						
27	*LHA/LHD Access Road Design Requirements*. The following measures would be incorporated into the design of the LHA/LHD access road. 1. The road should be constructed outside of the desert wash floodplains to the extent practicable. 2. Road crossings of desert washes should be constructed perpendicular to the direction of flow. To avoid stream diversion into the roadbed, crossings should drop into the channel bed on the approach and rise away from the channel bed (i.e., designing the crossing as a sag vertical curve). To avoid downstream erosion impacts the roadbed at the crossing should be at grade with the channel bottom. 3. In addition, to the extent practicable, the road should be constructed with an outsloped roadway configuration to allow sheetflow from the hillsides to continue across the road without disruption. This type of drainage system avoids the construction and maintenance of ditches and other costly drainage features that further concentrate water flows.	Section 3.11	Incorporate requirements into the design of the LHA/LHD access road	Construction Contractor	Access Road Design	Before Construction	Verified by: Date:
28	*Levee Repair, Inspection, and Maintenance.* The earthen levee at the KD Range Complex would be repaired. In the short-term, the eroded section of the levee would be filled with dirt, compacted and contoured to match the existing dimensions and side bank slope of the undamaged sections of the levee. Following repair, MCLB Barstow would conduct ongoing inspections of the earthen levee at the KD Range Complex, especially following major runoff events. For longer term protection, the southeastern side of the levee could be armored with rock rip-rap.	Section 3.11	Conduct levee repair	Construction Contractor	None	During Construction	

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29	*800-yard Line Flood Wall*. A floodwall would be installed on the western edge of proposed 800-yard line to protect the berm from erosion and minimize encroachment to the floodplain. The flood wall would be designed to include a gravity or cantilevered wall constructed of concrete or gabions. Due to the proximity of the 800-yard line to the proposed Arizona crossing, the design of the Arizona crossing should consider construction of the 800 yard line flood wall immediately downstream.	Section 3.11	Install floodwall on the western edge of the proposed 800 yard line	Construction Contractor	None	During Construction	
30	*MCLB Barstow Range Regulations for Water Resources*. The following rules and regulations would be included in the MCLB Barstow Regulations for Ranges and Training Areas and Airspace (Range Regulations) to minimize impacts on water resources during training activities. VEHICLE AND EQUIPMENT MAINTENANCE 1. All vehicles and equipment would be kept in good condition and properly maintained to ensure there are no leaks. If leaks are detected, spill kits would be used immediately for cleanup. 2. Contractors would be adequately prepared to respond to and clean up accidental spills and releases of hazardous materials used or contained in equipment and heavy machinery. Spill response equipment, such as sorbent pads and containment booms, would be available in fueling and maintenance areas; 3. Construction-generated petroleum and hazardous waste (e.g., gasoline, solvents, adhesives, and paint) would be properly managed and disposed. Contractors would identify, manage, transport, and dispose of regulated wastes (solid waste, hazardous waste, recyclable waste, etc.) in accordance with Code of Federal Regulations Titles 40 and 49. 4. Contractors would remove excess hazardous materials from the site once work is completed. 5. To prevent drippage and contamination of soils and water	Section 3.11	Update MCLB Barstow Regulations for Ranges and Training Areas and Airspace (Range Regulations)	MCLB Barstow	None	Before Construction	

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	all vehicles/equipment used must be inspected daily and properly maintained to ensure that they do not leak or discharge onto the ground. Vehicles/equipment that are found to have leaks would have an appropriately anchored and sized drip pan or collection system placed under them to collect the spillage. 6. Oil or fluids from vehicles and/or equipment would not be emptied onto the ground or into any stormwater conveyance system or ditch. Oils or fluids would be contained and removed from the site and properly disposed of at an authorized disposal point. 7. Vehicle and equipment repairs would be performed in such a manner to minimize spills or excess accumulation of materials that could be discharged into any ditch, onto the ground, or into a stormwater conveyance system. FIELD WASTEWATER 8. Wastewater from field laundry and shower units (greywater) could be discharged to land areas. Earthen berms are not authorized unless approved by the MCLB Barstow Environmental Division. 9. Cleaning of weapons in field shower units or decontamination units that discharge to land areas is prohibited. 10. Greywater generated by field laundry equipment used to clean clothing or rags soiled with petroleum products would be containerized for appropriate petroleum contaminated wastewater disposal. 11. Field kitchens and temporary mess facilities would collect all food wastes and greases (blackwater) in appropriate containers for proper disposal. All blackwater would be disposed of in accordance with approved collection and removal regulations. Discharge of blackwater to the ground is prohibited. 12. Washing of vehicles and/or equipment in the training areas or parking lots is prohibited. Only the use of designated						

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MINIMIZATION, MITIGATION, MONITORING, AND REPORTING (MMMR) TRACKING SHEET ***Barstow Training and Range, MCLB Barstow***							
Number	***Minimization, Mitigation, Monitoring, Reporting Measures***	***Environmental Assessment Section***	***Implementation Procedure or Action***	***Responsible Organization***	***Deliverable/ Report***	***Compliance Schedule***	***Verification of Compliance***
	vehicle/equipment wash areas is authorized, with the exception of chemical, biological, radiological, and nuclear (CBRN) training. PORTABLE TOILETS 13. The contractor would be responsible for the off-site disposal/dumping of portable toilets. LAND DISTURBANCE 14. All training activities would limit off-road activity to that which is absolutely necessary to directly support the mission. Off-road maneuver exercises would be planned to emphasize the use of already disturbed sites. 15. Approval must be obtained from the MCLB Barstow Environmental Division before clearing land (grading) or removing any vegetation in the training areas. 16. Trenches and fighting positions would be filled to original grade and excess material leveled after each training exercise.						

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Appendix C

Air Quality Technical Data

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Appendix C-1

Air Quality Calculations

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	A	B	C	D	E	F	G
1	Table C.1-1. Emissions Source Data for KD Range Construction Activities - Year 1 - MCLB Barstow Training and Range EA (page 1 of 2).						
2	*Off-Road Equipment*						
3		*Hp*	*Average Daily*	*Number*	*Hours/*	*Total*	*Total*
4	*Activity/Equipment Type*	*Rating*	*% of Full Throttle*	*Active*	*Day*	*Work Days*	*Hp-Hrs*
5	*Live Fire Ranges Modernization*						
6	Skip Loader	105	50%	1	4	10	2,100
7	*Outdoor Classroom (Shade/Bleachers)*						
8	Skip Loader	105	50%	1	4	2	420
9	*Bivouac Areas*						
10	Grader	220	80%	1	6	7	7,392
11	Front-End-Loader / Backhoe	284	75%	1	4	7	5,964
12	*Range Compound Berm and Hydrological Road Improvements*						
13	Front-End-Loader / Backhoe	284	75%	1	6	10	12,780
14	Crawler Dozer	354	75%	1	6	10	15,930
15	Grader	220	80%	1	6	10	10,560
16	*Improve Parking Lot*						
17	Grader	220	80%	1	6	3	3,168
18	Skip Loader	105	50%	1	4	2	420
19	*Construct 700, 800, 900 Yard Firing Lines*						
20	Skip Loader	105	50%	1	4	15	3,150
21	Front-End-Loader / Backhoe	284	75%	1	6	15	19,170
22	Crawler Dozer	354	75%	1	6	15	23,895
23	*Construct Roads/Access Routes*						
24	Grader	220	80%	2	6	15	31,680
25	Crawler Dozer	354	75%	1	6	15	23,895
26	Front-End-Loader / Backhoe	284	75%	1	6	15	19,170
27	*Surveillence System Installation*						
28	Cherry Picker	80	40%	1	4	1	128
29	Skip Loader	105	50%	1	4	1	210

	A	B	C	D	E	F	G
32	Table C.1-1. Emissions Source Data for KD Range Construction Activities - Year 1 - MCLB Barstow Training and Range EA (page 2 of 2).						
33	*On-Road Trucks*						
34		*Vehicle*			*Miles per*	*Total*	*Total*
35	*Activity/Equipment Type*	*Weight*			*Round Trip*	*Trips*	*Miles*
36	*Live Fire Ranges Modernization*						
37	Concrete Truck	26,000			1	5	5
38	Pick-up Truck	5,000			1	20	20
39	Dump Truck	10,300			1	10	10
40	Water Truck	7,500			1	20	20
41	*Outdoor Classroom (Shade/Bleachers)*						
42	Concrete Truck	26,000			1	1	1
43	Dump Truck	10,300			1	4	4
44	Pick-up Truck	5,000			1	10	10
45	Water Truck	7,500			1	4	4
46	*Bivouac Areas*						
47	Dump Truck	10,300			1	14	14
48	Water Truck	7,500			1	30	30
49	Pick-up Truck	5,000			1	14	14
50	*Range Compound Berm and Hydrological Road Improvements*						
51	Water Truck	7,500			1	20	20
52	Dump Truck	10,300			1	10	10
53	Pick-up Truck	5,000			1	20	20
54	Concrete Truck	26,000			1	2	2
55	*Improve Parking Lot*						
56	Water Truck	7,500			1	6	6
57	Pick-up Truck	5,000			1	6	6
58	*700, 800, 900 Yard Line*						
59	Water Truck	7,500			1	30	30
60	Pick-up Truck	5,000			1	30	30
61	Dump Truck	10,300			1	120	120
62	Dump Truck - Import Fill for Berms	33,000			70	1,537	107,590
63	Dump Truck - Import Fill for Pistol/Shotgun Range Berms	33,000			70	129	9,030
64	*Construct Roads/Access Routes*						
65	Water Truck	7,500			4	30	120
66	Pick-up Truck	5,000			1	15	15
67	Dump Truck	10,300			1	20	20
68	*Fugitive Dust*						
69						*Total Work*	*Acres per*
70	*Activity/Equipment Type*					*Days*	*Day*
71	Disturbed Ground					15	5

	A	B	C	D	E	F	G
73	Table C.1-2. Emissions Source Data for LZs Construction Activities - Year 1 - MCLB Barstow Training and Range EA						
74	*Off-Road Equipment*						
75		*Hp*	*Average Daily*	*Number*	*Hours/*	*Total*	*Total*
76	*Activity/Equipment Type*	*Rating*	*% of Full Throttle*	*Active*	*Day*	*Work Days*	*Hp-Hrs*
77	*LZ 1 Stablization*						
78	Compactor	125	80%	1	6	1	600
79	Crawler Dozer	354	75%	1	6	5	7,965
80	Front-End-Loader / Backhoe	284	75%	1	6	5	6,390
81	*LZ 2 Stablization*						
82	Compactor	125	80%	1	6	1	600
83	Crawler Dozer	354	75%	1	6	5	7,965
84	Front-End-Loader / Backhoe	284	75%	1	6	5	6,390
85	*On-Road Trucks*						
86		*Vehicle*			*Miles per*	*Total*	*Total*
87	*Activity/Equipment Type*	*Weight*			*Round Trip*	*Trips*	*Miles*
88	*LZ 1 Stablization*						
89	Water Truck	7,500			1	10	10
90	Pick-up Truck	5,000			1	10	10
91	Dump Truck	10,300			1	5	5
92	*LZ 2 Stablization*						
93	Water Truck	7,500			1	10	10
94	Pick-up Truck	5,000			1	10	10
95	Dump Truck	10,300			1	5	5
96	*Fugitive Dust*						
97						*Total Work*	*Acres per*
98	*Activity/Equipment Type*					*Days*	*Day*
99	Disturbed Ground					10	5
100							
101	Table C.1-3. Emissions Source Data for Yermo Range Construction Activities - Year 1 - MCLB Barstow Training and Range EA						
102	*Off-Road Equipment*						
103		*Hp*	*Average Daily*	*Number*	*Hours/*	*Total*	*Total*
104	*Activity/Equipment Type*	*Rating*	*% of Full Throttle*	*Active*	*Day*	*Work Days*	*Hp-Hrs*
105	*LZ 2 Access Routes*						
106	Grader	220	80%	1	6	2	2,112
107	Crawler Dozer	354	75%	1	6	2	3,186
108	Front-End-Loader / Backhoe	284	75%	1	6	2	2,556
109	*On-Road Trucks*						
110		*Vehicle*			*Miles per*	*Daily*	*Total*
111	*Activity/Equipment Type*	*Weight*			*Round Trip*	*Trips*	*Miles*
112	*LZ 2 Access Routes*						
113	Water Truck	7,500			1	4	4
114	Pick-up Truck	5,000			1	2	2
115	*Surveillence System Installation*						
116	Pick-up Truck	5,000			1	2	2
117	*Fugitive Dust*						
118						*Total Work*	*Acres per*
119	*Activity/Equipment Type*					*Days*	*Day*
120	Disturbed Ground					2	5

	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Table C.1-4. Construction Equipment Emission Factors - MCLB Barstow Training and Range EA												
2		*Fuel*	*Emission Factors*										
3	*Project Year 2016/Source Type*	*Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*	*Units*	*References*
4	Off-Road Equipment - <15 Hp	D	0.93	4.38	4.91	0.01	0.33	0.31	568	0.115	0.000001	g/hp-hr	(1)
5	Off-Road Equipment - 16-24 Hp	D	1.04	4.34	4.97	0.01	0.36	0.34	566	0.132	0.000001	g/hp-hr	(1)
6	Off-Road Equipment - 25-50 Hp	D	1.42	5.67	5.23	0.01	0.45	0.43	563	0.155	0.000001	g/hp-hr	(1)
7	Off-Road Equipment - 51-120 Hp	D	0.64	3.81	5.50	0.01	0.42	0.39	523	0.127	0.000001	g/hp-hr	(1)
8	Off-Road Equipment - 121-175 Hp	D	0.50	3.32	5.19	0.01	0.27	0.25	523	0.123	0.000001	g/hp-hr	(1)
9	Off-Road Equipment - 176-250 Hp	D	0.38	1.58	4.74	0.01	0.17	0.16	526	0.121	0.000001	g/hp-hr	(1)
10	Off-Road Equipment - 251-500 Hp	D	0.32	2.00	4.01	0.00	0.14	0.13	518	0.127	0.000001	g/hp-hr	(1)
11	Off-Road Equipment - 501-750 Hp	D	0.29	1.49	3.61	0.00	0.12	0.12	525	0.113	0.000001	g/hp-hr	(1)
12	Off-Road Equipment - >750 Hp	D	0.35	1.53	5.18	0.00	0.15	0.14	522	0.126	0.000001	g/hp-hr	(1)
13	Heavy On-road Truck - Idle	D	3.15	12.82	67.18	0.07	0.34	0.32	7,143	0.146	0.250	g/hr	(2)
14	Heavy On-road Truck - 5 mph	D	3.94	7.11	27.17	0.03	0.45	0.43	3,438	0.183	0.050	g/mi	(2)
15	Heavy On-road Truck - 25 mph	D	0.66	2.19	10.79	0.02	0.17	0.16	1,996	0.030	0.050	g/mi	(2)
16	Heavy On-road Truck - 55 mph	D	0.24	1.00	8.05	0.01	0.17	0.16	1,545	0.011	0.050	g/mi	(2)
17	Heavy On-Road Trucks - Composite Onsite	D	1.31	3.17	14.07	0.02	0.22	0.21	2,284	0.061	0.050	g/mi	(3)
18	Heavy On-Road Trucks - Composite Offsite	D	0.50	1.55	9.56	0.02	0.18	0.18	1,730	0.023	0.050	g/mi	(4)
19													
20	On-road Pickup Truck - 5 mph	G	0.29	2.14	0.22	0.01	0.05	0.05	938	0.014	0.050	g/mi	(2)
21	On-road Pickup Truck - 25 mph	G	0.04	0.26	0.14	0.00	0.02	0.02	451	0.002	0.050	g/mi	(2)
22	On-road Pickup Truck - 55 mph	G	0.02	0.15	0.15	0.00	0.01	0.01	332	0.001	0.050	g/mi	(2)
23	On-Road Pickup Trucks - Composite Onsite	G	0.09	0.63	0.16	0.01	0.03	0.02	548	0.00	0.05	g/mi	(3)
24	Disturbed Ground - Fugitive Dust	--					27.5	2.8				lbs/acre-day	(5)

25 Notes: (1) Composites developed from Offroad emission factors obtained from CalEEMod for project year 2016 (Environ 2013).

26 (2) On-road emission factors developed from EMFAC2014 (CARB 2014) for project year 2016 for average California T7 construction truck fleet.

27 Units in grams/hr for idle mode and grams/mile for running mode. Although not shown in these calculations, emissions from 15 minutes of idling mode included

28 for each T7 truck round trip.

29 (3) Composite emission factors for onsite travel based on a trip of 80% at 25 mph and 20% at 5 mph.

30 (4) Composite emission factors for offite travel based on a trip of 75% at 55 mph, 20% at 25 mph, and 5% at 5 mph. Units in grams/mile.

31 (5) Units in lbs/acre-day from section 13.2.3 of AP-42 (USEPA 1995). Emissions reduced by 50% from uncontrolled levels to simulate

32 implementation of best management practices (BMPs) for fugitive dust control

	W	X	Y	Z	AA	AB	AC	AD	AE	AF
1	Table C.1-5. Emissions Resulting from KD Range Year 1 Construction Activities - Year 1 - MCLB Barstow Training and Range EA (page 1 of 2)									
2	*Off-Road Equipment*									
3		*Total Pounds*								
4	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
5	*Live Fire Ranges Modernization*									
6	Skip Loader	3.0	17.6	25.4	0.0	1.9	1.8	2,420	0.6	0.000
7	*Outdoor Classroom (Shade/Bleachers)*									
8	Skip Loader	0.6	3.5	5.1	0.0	0.4	0.4	484	0.1	0.000
9	Bivouac Areas									
10	Grader	6.1	25.7	77.3	0.1	2.8	2.6	8,573	2.0	0.000
11	Front-End-Loader / Backhoe	4.2	26.3	52.7	0.1	1.9	1.8	6,814	1.7	0.000
12	*Range Compound Berm and Hydrological Road Improvements*									
13	Front-End-Loader / Backhoe	9.0	56.3	112.8	0.1	4.1	3.8	14,602	3.6	0.000
14	Crawler Dozer	11.2	70.2	140.7	0.2	5.1	4.7	18,201	4.5	0.000
15	Grader	8.8	36.7	110.4	0.1	4.0	3.8	12,247	2.8	0.000
16	*Improve Parking Lot*									
17	Grader	2.6	11.0	33.1	0.0	1.2	1.1	3,674	0.8	0.000
18	Skip Loader	0.6	3.5	5.1	0.0	0.4	0.4	484	0.1	0.000
19	*Construct 700, 800, 900 Yard Firing Lines*									
20	Skip Loader	4.4	26.5	38.2	0.0	2.9	2.7	3,630	0.9	0.000
21	Front-End-Loader / Backhoe	13.5	84.5	169.3	0.2	6.1	5.7	21,902	5.4	0.000
22	Crawler Dozer	16.8	105.3	211.0	0.3	7.6	7.1	27,301	6.7	0.000
23	*Construct Roads/Access Routes*									
24	Grader	26.3	110.0	331.1	0.4	12.1	11.3	36,740	8.5	0.000
25	Crawler Dozer	16.8	105.3	211.0	0.3	7.6	7.1	27,301	6.7	0.000
26	Front-End-Loader / Backhoe	13.5	84.5	169.3	0.2	6.1	5.7	21,902	5.4	0.000
27	*Surveillence System Installation*									
28	Cherry Picker	0.2	1.1	1.6	0.0	0.1	0.1	148	0.0	0.000
29	Skip Loader	0.3	1.8	2.5	0.0	0.2	0.2	242	0.1	0.000

	W	X	Y	Z	AA	AB	AC	AD	AE	AF
32	Table C.1-5. Emissions Resulting from KD Range Year 1 Construction Activities - Year 1 - MCLB Barstow Training and Range EA (page 2 of 2)									
33	*On-Road Trucks*									
34		*Total Pounds*								
35	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
36	*Live Fire Ranges Modernization*									
37	Concrete Truck	0.2	0.7	3.9	0.0	0.0	0.0	419	0.0	0.014
38	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	24	0.0	0.002
39	Dump Truck	0.4	1.5	7.7	0.0	0.0	0.0	838	0.0	0.029
40	Water Truck	0.8	3.0	15.4	0.0	0.1	0.1	1,675	0.0	0.057
41	*Outdoor Classroom (Shade/Bleachers)*									
42	Concrete Truck	0.0	0.1	0.8	0.0	0.0	0.0	84	0.0	0.003
43	Dump Truck	0.2	0.6	3.1	0.0	0.0	0.0	335	0.0	0.011
44	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	12	0.0	0.001
45	Water Truck	0.2	0.6	3.1	0.0	0.0	0.0	335	0.0	0.011
46	*Bivouac Areas*									
47	Dump Truck	0.5	2.1	10.8	0.0	0.1	0.1	1,173	0.0	0.040
48	Water Truck	1.1	4.4	23.1	0.0	0.1	0.1	2,513	0.1	0.086
49	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	17	0.0	0.002
50	*Range Compound Berm and Hydrological Road Improvements*									
51	Water Truck	0.8	3.0	15.4	0.0	0.1	0.1	1,675	0.0	0.057
52	Dump Truck	0.4	1.5	7.7	0.0	0.0	0.0	838	0.0	0.029
53	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	24	0.0	0.002
54	Concrete Truck	0.1	0.3	1.5	0.0	0.0	0.0	168	0.0	0.006
55	*Improve Parking Lot*									
56	*Water Truck*	0.2	0.9	4.6	0.0	0.0	0.0	503	0.0	0.017
57	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	7	0.0	0.001
58	*Construct 700, 800, 900 Yard Firing Lines*									
59	Water Truck	1.1	4.4	23.1	0.0	0.1	0.1	2,513	0.1	0.086
60	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	36	0.0	0.003
61	Dump Truck	4.5	17.8	92.6	0.1	0.5	0.5	10,052	0.2	0.344
62	Dump Truck - Import Fill for Berms	173.1	969.7	4,475.0	6.3	58.9	56.3	662,837	16.9	16.1
63	Dump Truck - Import Fill for Pistol/Shotgun Range Berms	14.5	81.4	375.6	0.5	4.9	4.7	55,632	1.4	1.4
64	*Construct Roads/Access Routes*									
65	Water Truck	1.4	5.1	25.9	0.0	0.2	0.2	2,966	0.1	0.096
66	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	18	0.0	0.002
67	Dump Truck	0.8	3.0	15.4	0.0	0.1	0.1	1,675	0.0	0.057
68	*Fugitive Dust*									
69		*Total Pounds*								
70	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
71	Disturbed Ground					2,062.5	206.3			

	W	X	Y	Z	AA	AB	AC	AD	AE	AF
73	Table C.1-6. Emissions Resulting from LZs Year 1 Construction Activities - Year 1 - MCLB Barstow Training and Range EA									
74	*Off-Road Equipment*									
75		*Total Pounds*								
76	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
77	*LZ 1 Stablization*									
78	Compactor	0.7	4.4	6.9	0.0	0.4	0.3	692	0.2	0.000
79	Crawler Dozer	5.6	35.1	70.3	0.1	2.5	2.4	9,100	2.2	0.000
80	Front-End-Loader / Backhoe	4.5	28.2	56.4	0.1	2.0	1.9	7,301	1.8	0.000
81	*LZ 2 Stablization*									
82	Compactor	0.7	4.4	6.9	0.0	0.4	0.3	692	0.2	0.000
83	Crawler Dozer	5.6	35.1	70.3	0.1	2.5	2.4	9,100	2.2	0.000
84	Front-End-Loader / Backhoe	4.5	28.2	56.4	0.1	2.0	1.9	7,301	1.8	0.000
85	*On-Road Trucks*									
86		*Total Pounds*								
87	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
88	*LZ 1 Stablization*									
89	Water Truck	0.4	1.5	7.7	0.0	0.0	0.0	838	0.0	0.029
90	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	12	0.0	0.001
91	Dump Truck	0.2	0.7	3.9	0.0	0.0	0.0	419	0.0	0.014
92	*LZ 2 Stablization*									
93	Water Truck	0.4	1.5	7.7	0.0	0.0	0.0	838	0.0	0.029
94	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	12	0.0	0.001
95	Dump Truck	0.2	0.7	3.9	0.0	0.0	0.0	419	0.0	0.014
96	*Fugitive Dust*									
97		*Total Pounds*								
98	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
99	Disturbed Ground					1,375.0	137.5			

	W	X	Y	Z	AA	AB	AC	AD	AE	AF
101	Table C.1-7. Emissions Resulting from Yermo Range Year 1 Construction Activities - Year 1 - MCLB Barstow Training and Range EA									
102	*Off-Road Equipment*									
103		*Total Pounds*								
104	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
105	*LZ 2 Access Routes*									
106	Grader	1.8	7.3	22.1	0.0	0.8	0.8	2,449	0.6	0.00
107	Crawler Dozer	2.2	14.0	28.1	0.0	1.0	0.9	3,640	0.9	0.00
108	Front-End-Loader / Backhoe	1.8	11.3	22.6	0.0	0.8	0.8	2,920	0.7	0.00
109	On-Road Trucks									
110		*Total Pounds*								
111	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
112	*LZ 2 Access Routes*									
113	Water Truck	0.2	0.6	3.1	0.0	0.0	0.0	335	0.0	0.011
114	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	2	0.0	0.000
115	Surveillence System Installation									
116	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	2	0.0	0.000
117	*Fugitive Dust*									
118		*Total Pounds*								
119	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
120	Disturbed Ground					275.0	27.5			

	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS
1	Table C.1-8. Construction Emissions Summary Table - Year 1 - MCLB Barstow Training and Range EA										
2		*Tons per Year*									
3	*Activity*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*	*CO2e (mt)*
4	*KD Range Construction Activities*										
5	Live Fire Ranges Modernization	0.00	0.01	0.03	0.00	0.00	0.00	2.7	0.00	0.00	2.46
6	Outdoor Classroom (Shade/Bleachers)	0.00	0.00	0.01	0.00	0.00	0.00	0.6	0.00	0.00	0.57
7	Bivouac Areas	0.01	0.03	0.08	0.00	0.00	0.00	9.5	0.00	0.00	8.71
8	Range Compound Berm and Hydrological Road Improvements	0.02	0.08	0.19	0.00	0.01	0.01	23.9	0.01	0.00	21.77
9	Improve Parking Lot	0.00	0.01	0.02	0.00	0.00	0.00	2.3	0.00	0.00	2.13
10	Construct 700, 800, 900 Yard Firing Lines	0.11	0.64	2.69	0.00	0.04	0.04	392.0	0.02	0.01	358.32
11	Construct Roads/Access Routes	0.03	0.15	0.38	0.00	0.01	0.01	45.3	0.01	0.00	41.31
12	Surveillence System Installation	0.00	0.00	0.00	0.00	0.00	0.00	0.2	0.00	0.00	0.18
13	Disturbed Ground					1.03	0.10				
14	Subtotal	0.17	0.93	3.40	0.00	1.10	0.16	476.5	0.03	0.01	435.44
15	*LZs Construction Activities*										
16	LZ 1 Stablization	0.01	0.03	0.07	0.00	0.00	0.00	9.2	0.00	0.00	8.37
17	LZ 2 Stablization	0.01	0.03	0.07	0.00	0.00	0.00	9.2	0.00	0.00	8.37
18	Disturbed Ground					0.69	0.07				
19	Subtotal	0.01	0.07	0.15	0.00	0.69	0.07	18.4	0.00	0.00	16.75
20	*Yermo Range Construction Activities*										
21	LZ 2 Access Routes	0.00	0.02	0.04	0.00	0.00	0.00	4.67	0.00	0.00	4.26
22	Surveillence System Installation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	Disturbed Ground					0.14	0.01				
24	Subtotal	0.00	0.02	0.04	0.00	0.14	0.01	4.7	0.00	0.00	4.26
25	Total Emissions - Construction Year 1	0.18	1.02	3.58	0.00	1.93	0.25	499.6	0.04	0.01	456.45
26	Note: mt = metric tons.										

Table C.1-9. Emissions Source Data for KD Range Construction Activities - Year 2 - MCLB Barstow Training and Range EA (page 1 of 2).

Off-Road Equipment						
Activity/Equipment Type	*Hp Rating*	*Average Daily % of Full Throttle*	*Number Active*	*Hours/ Day*	*Total Work Days*	*Total Hp-Hrs*
Replace 249 (Demo & Replace building)						
Front-End-Loader / Backhoe	284	75%	1	6	2	2,556
Skip Loader	105	50%	1	6	10	3,150
Rifle Range Rest Rooms (Target Area and 600/700)						
Front-End-Loader / Backhoe	284	75%	1	6	5	6,390
Utilities (Water)						
Front-End-Loader / Backhoe	284	75%	1	6	10	12,780
Ditch Witch	64	80%	1	6	5	1,536
Utilities (Electric)						
Front-End-Loader / Backhoe	284	75%	1	6	10	12,780
Ditch Witch	64	80%	1	6	10	3,072
Communication/Data System						
Front-End-Loader / Backhoe	284	75%	1	6	10	12,780
Ditch Witch	64	80%	1	6	10	3,072
Forward Arming and Refueling Point						
Grader	220	80%	1	6	3	3,168
Front-End-Loader / Backhoe	284	75%	1	6	2	2,556
Skip Loader	105	50%	1	6	2	630
Range Operations and Training Facility (2006 EA)						
Water Well Drilling Rig	175	90%	1	8	2	2,520
Grader	220	80%	1	6	2	2,112
Front-End-Loader / Backhoe	284	75%	1	6	10	12,780
Skip Loader	105	50%	1	6	5	1,575
Gas Chamber						
Front-End-Loader / Backhoe	284	0.75	1	6	5	6,390
Skip Loader	105	50%	1	6	2	630
Ditch Witch	64	80%	1	6	2	614

Table C.1-9. Emissions Source Data for KD Range Construction Activities - Year 2 - MCLB Barstow Training and Range EA (page 2 of 2).

On-Road Trucks					
Activity/Equipment Type	*Vehicle Weight*		*Miles per Round Trip*	*Total Trips*	*Total Miles*
Replace 249 (Demo & Replace building)					
Pick-up Truck	5,000		1	10	10
Dump Truck	10,300		1	2	2
Rifle Range Rest Rooms (Target Area and 600/700)					
Pick-up Truck	5,000		1	10	10
Dump Truck	10300		1	6	6
Utilities (Water)					
Pick-up Truck	5,000		1	20	20
Water Truck	7,500		1	5	5
Concrete Truck	26,000		1	1	1
Utilities (Electric)					
Pick-up Truck	5,000		1	20	20
Water Truck	7,500		1	5	5
Communication/Data System					
Pick-up Truck	5000		1	20	20
Water Truck	7,500		1	5	5
Forward Arming and Refueling Point					
Pick-up Truck	5,000		1	6	6
Water Truck	7,500		1	4	4
Range Operations and Training Facility (2006 EA)					
Pick-up Truck	5,000		1	20	20
Water Truck	7,500		1	5	5
Concrete Truck	26000		1	1	1
Dump Truck	10,300		5	10	50
Gas Chamber					
Pick-up Truck	5,000		1	10	10
Water Truck	7500		1	5	5
Concrete Truck	26,000		1	1	1
Fugitive Dust					
Activity/Equipment Type				*Total Work Days*	*Acres per Day*
Disturbed Ground				10	5

Table C.1-10. Emissions Source Data for LZs Construction Activities - Year 2 -MCLB Barstow Training and Range EA

Off-Road Equipment						
Activity/Equipment Type	*Hp Rating*	*Average Daily % of Full Throttle*	*Number Active*	*Hours/ Day*	*Total Work Days*	*Total Hp-Hrs*
LHA/LHD Stabilization						
Crawler Dozer	354	75%	1	6	10	15,930
Compactor	125	80%	1	6	5	3,000
Front-End-Loader / Backhoe	284	75%	1	6	10	12,780
LHA/LHD Super Structure						
Container Handler	400	80%	1	6	1	1,920
Front-End-Loader / Backhoe	284	75%	1	6	2	2,556
On-Road Trucks						
Activity/Equipment Type	*Vehicle Weight*			*Miles per Round Trip*	*Daily Trips*	*Total Miles*
LHA/LHD Stabilization						
Pick-up Truck	5,000			2	20	40
Water Truck	7,500			2	20	40
Dump Truck	10,300			2	10	20
LHA/LHD Super Structure						
Pick-up truck	5,000			2	4	8
Fugitive Dust						
Activity/Equipment Type					*Total Work Days*	*Acres per Day*
Disturbed Ground					10	5

Table C.1-11. Emissions Source Data for Yermo Range Construction Activities - Year 2 - MCLB Barstow Training and Range EA

Off-Road Equipment						
	Hp	*Average Daily*	*Number*	*Hours/*	*Total*	*Total*
Activity/Equipment Type						
Utilities (Water)						
Front-End-Loader / Backhoe	284	75%	1	6	4	5,112
Ditch Witch	64	80%	1	6	2	614
Utilities (Electric)						
Front-End-Loader / Backhoe	284	75%	1	6	4	5,112
Ditch Witch	64	80%	1	6	2	614
On-Road Trucks						
Activity/Equipment Type	*Vehicle Weight*			*Miles per Round Trip*	*Total Trips*	*Total Miles*
Utilities (Water)						
Pick-up Truck	5,000			1	8	8
Water Truck	7,500			1	4	4
Utilities (Electric)						
Pick-up Truck	5,000			1	8	8
Water Truck	7,500			1	4	4
Fugitive Dust						
Activity/Equipment Type					*Total Work Days*	*Acres per Day*
Disturbed Ground					4	5

Table C.1-12. Emissions Resulting from KD Range Year 1 Construction Activities - Year 2 - MCLB Barstow Training and Range EA (page 1 of 2).

Off-Road Equipment									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Replace 249 (Demo & Replace building)									
Front-End-Loader / Backhoe	1.8	11.3	22.6	0.0	0.8	0.8	2,920.3	0.7	0.00
Skip Loader	4.4	26.5	38.2	0.0	2.9	2.7	3,630.2	0.9	0.00
Rifle Range Rest Rooms (Target Area and 600/700)									
Front-End-Loader / Backhoe	4.5	28.2	56.4	0.1	2.0	1.9	7,300.8	1.8	0.00
Utilities (Water)									
Front-End-Loader / Backhoe	9.0	56.3	112.8	0.1	4.1	3.8	14,601.7	3.6	0.00
Ditch Witch	2.2	12.9	18.6	0.0	1.4	1.3	1,770.1	0.4	0.00
Utilities (Electric)									
Front-End-Loader / Backhoe	9.0	56.3	112.8	0.1	4.1	3.8	14,601.7	3.6	0.00
Ditch Witch	4.3	25.8	37.2	0.0	2.8	2.7	3,540.3	0.9	0.00
Communication/Data System									
Front-End-Loader / Backhoe	9.0	56.3	112.8	0.1	4.1	3.8	14,601.7	3.6	0.00
Ditch Witch	4.3	25.8	37.2	0.0	2.8	2.7	3,540.3	0.9	0.00
Forward Arming and Refueling Point									
Grader	2.6	11.0	33.1	0.0	1.2	1.1	3,674.0	0.8	0.00
Front-End-Loader / Backhoe	1.8	11.3	22.6	0.0	0.8	0.8	2,920.3	0.7	0.00
Skip Loader	0.9	5.3	7.6	0.0	0.6	0.5	726.0	0.2	0.00
Range Operations and Training Facility (2006 EA)									
Water Well Drilling Rig	2.8	18.4	28.8	0.0	1.5	1.4	2,906.4	0.7	0.00
Grader	1.8	7.3	22.1	0.0	0.8	0.8	2,449.3	0.6	0.00
Front-End-Loader / Backhoe	9.0	56.3	112.8	0.1	4.1	3.8	14,601.7	3.6	0.00
Skip Loader	2.2	13.2	19.1	0.0	1.5	1.4	1,815.1	0.4	0.00
Gas Chamber									
Front-End-Loader / Backhoe	4.5	28.2	56.4	0.1	2.0	1.9	7,300.8	1.8	0.00
Skip Loader	0.9	5.3	7.6	0.0	0.6	0.5	726.0	0.2	0.00
Ditch Witch	0.9	5.2	7.4	0.0	0.6	0.5	708.1	0.2	0.00

Table C.1-12. Emissions Resulting from KD Range Year 1 Construction Activities - Year 2 - MCLB Barstow Training and Range EA (page 2 of 2).

On-Road Trucks									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Replace 249 (Demo & Replace building)									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.00
Dump Truck	0.1	0.3	1.5	0.0	0.0	0.0	167.5	0.0	0.01
Rifle Range Rest Rooms (Target Area and 600/700)									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.00
Dump Truck	0.2	0.9	4.6	0.0	0.0	0.0	502.6	0.0	0.02
Utilities (Water)									
Pick-up Truck	0.0	0.1	0.0	0.0	0.0	0.0	17.0	0.0	0.00
Water Truck	0.2	0.7	3.9	0.0	0.0	0.0	418.8	0.0	0.01
Concrete Truck	0.0	0.1	0.8	0.0	0.0	0.0	83.8	0.0	0.00
Utilities (Electric)									
Pick-up Truck	0.0	0.1	0.0	0.0	0.0	0.0	17.0	0.0	0.00
Water Truck	0.2	0.7	3.9	0.0	0.0	0.0	418.8	0.0	0.01
Communication/Data System									
Pick-up Truck	0.0	0.1	0.0	0.0	0.0	0.0	17.0	0.0	0.00
Water Truck	0.2	0.7	3.9	0.0	0.0	0.0	418.8	0.0	0.01
Forward Arming and Refueling Point									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.00
Water Truck	0.2	0.6	3.1	0.0	0.0	0.0	335.1	0.0	0.01
Range Operations and Training Facility (2006 EA)									
Pick-up Truck	0.0	0.1	0.0	0.0	0.0	0.0	17.0	0.0	0.00
Water Truck	0.2	0.7	3.9	0.0	0.0	0.0	418.8	0.0	0.01
Concrete Truck	0.0	0.1	0.8	0.0	0.0	0.0	83.8	0.0	0.00
Dump Truck	0.5	1.8	9.0	0.0	0.1	0.1	1,039.1	0.0	0.03
Gas Chamber									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.00
Water Truck	0.2	0.7	3.9	0.0	0.0	0.0	418.8	0.0	0.01
Concrete Truck	0.0	0.1	0.8	0.0	0.0	0.0	83.8	0.0	0.00
Fugitive Dust									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Disturbed Ground					1,375.0	137.5			

Table C.1-13. Emissions Resulting from LZs Year 1 Construction Activities - Year 2 - MCLB Barstow Training and Range EA

Off-Road Equipment									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
LHA/LHD Stabilization									
Crawler Dozer	11.2	70.2	140.7	0.2	5.1	4.7	18,200.7	4.5	0.00
Compactor	3.3	22.0	34.3	0.0	1.8	1.7	3,460.0	0.8	0.00
Front-End-Loader / Backhoe	10.6	44.4	133.6	0.1	4.9	4.5	14,821.1	3.4	0.00
LHA/LHD Super Structure									
Container Handler	1.4	8.5	17.0	0.0	0.6	0.6	2,193.7	0.5	0.00
Front-End-Loader / Backhoe	1.8	11.3	22.6	0.0	0.8	0.8	2,920.3	0.7	0.00
On-Road Trucks									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
LHA/LHD Stabilization									
Pick-up Truck	0.0	0.1	0.0	0.0	0.0	0.0	34.0	0.0	0.00
Water Truck	0.8	3.1	16.1	0.0	0.1	0.1	1,776.1	0.0	0.06
Dump Truck	0.4	1.6	8.0	0.0	0.0	0.0	888.1	0.0	0.03
LHA/LHD Super Structure									
Pick-up truck	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.00
Fugitive Dust									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Disturbed Ground					1,375	138			

Table C.1-14. Emissions Resulting from Yermo Range Year 1 Construction Activities - Year 2 - MCLB Barstow Training and Range EA

Off-Road Equipment									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Utilities (Water)									
Front-End-Loader / Backhoe	7.2	42.9	61.9	0.1	4.7	4.4	5,891.3	1.4	0.00
Ditch Witch	0.4	2.7	5.4	0.0	0.2	0.2	702.0	0.2	0.00
Utilities (Electric)									
Front-End-Loader / Backhoe	7.2	42.9	61.9	0.1	4.7	4.4	5,891.3	1.4	0.00
Ditch Witch	0.4	2.7	5.4	0.0	0.2	0.2	702.0	0.2	0.00
On-Road Trucks									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Utilities (Water)									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.00
Water Truck	0.2	0.6	3.1	0.0	0.0	0.0	335.1	0.0	0.01
Utilities (Electric)									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.00
Water Truck	0.2	0.6	3.1	0.0	0.0	0.0	335.1	0.0	0.01
Fugitive Dust									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Disturbed Ground					550.0	55.0			

Table C.1-15. Year 1 Construction Emissions Summary Table - Year 2 - MCLB Barstow Training and Range EA

	Total Pounds									
Activity	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*	*CO2e (mt)*
KD Range Construction Activities										
Replace 249 (Demo & Replace building)	0.00	0.02	0.03	0.00	0.00	0.00	3.3	0.00	0.00	2.99
Rifle Range Rest Rooms (Target Area and 600/700)	0.00	0.01	0.03	0.00	0.00	0.00	3.7	0.00	0.00	3.41
Utilities (Water)	0.01	0.04	0.07	0.00	0.00	0.00	8.4	0.00	0.00	7.70
Utilities (Electric)	0.01	0.04	0.08	0.00	0.00	0.00	9.3	0.00	0.00	8.51
Communication/Data System	0.01	0.04	0.08	0.00	0.00	0.00	9.3	0.00	0.00	8.47
Forward Arming and Refueling Point	0.00	0.01	0.03	0.00	0.00	0.00	3.9	0.00	0.00	3.54
Range Operations and Training Facility (2006 EA)	0.01	0.05	0.09	0.00	0.00	0.00	11.1	0.00	0.00	10.09
Gas Chamber	0.00	0.02	0.04	0.00	0.00	0.00	5.1	0.00	0.00	4.69
Disturbed Ground					0.69	0.07				
Subtotal	0.04	0.23	0.45	0.00	0.71	0.09	54.2	0.01	0.00	49.38
LZs Construction Activities										
LHA/LHD Stabilization	0.01	0.07	0.17	0.00	0.01	0.01	19.59	0.00	0.00	17.86
LHA/LHD Super Structure	0.00	0.01	0.02	0.00	0.00	0.00	2.56	0.00	0.00	2.33
Disturbed Ground					0.69	0.07				
Subtotal	0.01	0.08	0.19	0.00	0.69	0.07	22.2	0.01	0.00	20.20
Yermo Range Construction Activities										
Utilities (Water)	0.00	0.02	0.04	0.00	0.00	0.00	3.47	0.00	0.00	3.16
Utilities (Electric)	0.00	0.02	0.04	0.00	0.00	0.00	3.47	0.00	0.00	3.16
Disturbed Ground					0.28	0.03				
Subtotal	0.01	0.05	0.07	0.00	0.28	0.03	6.9	0.00	0.00	6.32
Total Emissions - Construction Year 2	0.06	0.36	0.71	0.00	1.68	0.19	83.24	0.02	0.00	75.91

Note: mt = metric tons.

	A	B	C	D	E	F	G
1	Table C.1-16. Emission Source Data for Existing Tactical Vehicles/Support Equipment - MCLB Barstow Training and Range EA						
2 3	*Source/Equipment Type*	*Number of Vehicles*	*Annual VMT*	*Miles per Gallon*	*Total Gallons*	*Hp*	*Total Hp-Hr*
4	Tactical Vehicles						
5	Medium Tactical Vehicle Replacement	36	3,600	3.85	935	250	18,701
6	High-Mobility Multipurpose Wheeled Vehicle	24	2,400	14.00	171	150	3,429
7	Logistics Vehicle System	-	-	2.00	-	445	-
8	Internally Transportable Vehicle	-	-	14.00	-	71	-
9	M60A1 Bridge Vehicle	-	-	0.33	-		
10	Light Armored Vehicle (Variants)	43	430	5.17	83	275	1,663
11	M88A2 Hercules Recovery Vehicle	-	-	0.33	-		
12	High-Mobility Artillery Rocket System	-	-	3.85	-	330	-
13	Abrams M1A1 Main Battle Tank	-	-	0.33	-		
14	Joint Assault Bridge	-	-	0.33	-		
15	Assault Breacher Vehicle	-	-	0.36	-		
16	Tactical Support Equipment						
17 18	*Source/Equipment Type*	*Number of Vehicles*	*Average Hp Output*	*Hours per Year*	*Total Hp-Hr*		
19	Medium Crawler Tractor		118		-		
20	Excavator, Combat		295		-		
21	Grader		150		-		
22	Armored Tractor		118		-		
23	D7 Bulldozer		200		-		
24	Armored Backhoe		295		-		
25	Extended Boom Forklift		150		-		
26	Light Capacity Rough Terrain Truck Forklift		110		-		
27	Tractor, Rubber Tired, Articulated Steering		185		-		
28	Notes: Horsepower ratings from LAS MCAGCC FEIS (DON 2012).						

	A	B	C	D	E	F	G
30	Table C.1-17. Emission Source Data for Proposed Tactical Vehicles/Support Equipment - MCLB Barstow Training and Range EA						
31	*Source/Equipment Type*	*Number of*	*Annual*	*Miles per*	*Total*		
32		*Vehicles*	*VMT*	*Gallon*	*Gallons*	*Hp*	*Total Hp-Hr*
33	Tactical Vehicles						
34	Medium Tactical Vehicle Replacement	240	5,760	3.85	1,496	250	29,922
35	High-Mobility Multipurpose Wheeled Vehicle	240	5,760	14.00	411	150	8,229
36	Logistics Vehicle System	120	2,880	2.00	1,440	445	28,800
37	Internally Transportable Vehicle	240	5,760	14.00	411	71	8,229
38	M60A1 Bridge Vehicle	2	160	0.33	485		
39	Light Armored Vehicle (Variants)	120	1,920	5.17	371	275	7,427
40	M88A2 Hercules Recovery Vehicle	2	160	0.33	485		
41	High-Mobility Artillery Rocket System	54	864	3.85	224	330	4,488
42	Abrams M1A1 Main Battle Tank	28	1,120	0.33	3,394		
43	Joint Assault Bridge	2	160	0.33	485		
44	Assault Breacher Vehicle	2	160	0.36	444		
45	LVTP-7 Landing Vehicle Tracked Personnel	32	1280	0.57	2,240	525	44,800
46	LVTR-7 Landing Vehicle Tracked Recovery	4	160	0.75	213	400	4,267
47	LVTC-7 Landing Vehicle Tracked Command	4	160	0.75	213	400	4,267
48	Tactical Support Equipment						
49	*Activity/Equipment Type*	*Number of*	*Average Hp*	*Hours per*	*Total*		
50		*Vehicles*	*Output*	*Year*	*Hp-Hr*		
51	Medium Crawler Tractor	8	118	896	105,728		
52	Excavator, Combat	16	295	1,792	528,640		
53	Grader	8	150	896	134,400		
54	Armored Tractor	8	118	896	105,728		
55	D7 Bulldozer	8	200	896	179,200		
56	Armored Backhoe	8	295	896	264,320		
57	Extended Boom Forklift	8	150	896	134,400		
58	Light Capacity Rough Terrain Truck Forklift	8	110	896	98,560		
59	Tractor, Rubber Tired, Articulated Steering	8	185	896	165,760		
60	Notes: Horsepower ratings from LAS MCAGCC FEIS (DON 2012).						

	I	J	K	L	M	N	O	P	Q	R	S
1	Table C.1-18. Tactical Vehicles/Support Equipment Emission Factors - MCLB Barstow Training and Range EA										
2	*Source/Equipment Type*	*Emission Factors (Pounds/1000 Gallons)*									*Reference*
3		*ROG*	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	
4	*Tank Vehicles and ABV*										
5	Abrams Tank/Bridge Vehicles	0.06	0.45	118.80	0.51	1.56	1.52	21,054	0.68	0.60	(1)
6	Assault Breacher Vehicle	14.10	101.60	170.88	13.96	1.71	1.57	21,054	0.68	0.60	(2)
7	*Other Tactical Vehicles/TSE*	*Emission Factors (Grams/Horsepower-Hour)*									
8	121-250 Hp	0.50	3.32	5.19	0.01	0.27	0.25	523	0.12	0.00	(3)
9	>250 Hp	0.38	1.58	4.74	0.01	0.17	0.16	526	0.12	0.00	(3)
10	Notes: (1) From LAS MCAGCC FEIS (DON 2012).										
11	(2) FEA for Proposed ABV Action at MCAGCC (2003).										
12	(3) Composites developed from Offroad emission factors obtained from CalEEMod for project year 2016.										
13	(4) GHG Emission Factors for (a) Tank Vehicles and ABVs from General Reporting Protocol, Tables C.3 and C.6 jet fuel (California Climate Action Registry 2009)										
14	and (b) other TV/TSE from OFFROAD2007 Model.										
15											
16	Table C.1-19. Fugative Dust Emission Factors for Tactical Vehicles/Support Equipment - Unpaved Road - MCLB Barstow Training and Range EA										
17	*Source/Equipment Type*	*Weight*	*Unpaved Emission Factor (Lb/VMT)*			*%*					
18		*(Tons)*	*PM*	*PM_{10}*	*$PM_{2.5}$*	*Unpaved Travel (1)*					
19	Tactical Vehicles										
20	Medium Tactical Vehicle Replacement	10.0	6.51	1.88	0.29	90%					
21	High-Mobility Multipurpose Wheeled Vehicle	3.0	3.79	1.09	0.17	50%					
22	Logistics Vehicle System	20.0	8.89	2.57	0.39	50%					
23	Internally Transportable Vehicle	3.5	4.06	1.17	0.18	50%					
24	M60A1 Bridge Vehicle	70.0	15.63	4.52	0.69	90%					
25	Light Armored Vehicle (Variants)	14.1	7.60	2.20	0.34	90%					
26	M88A2 Hercules Recovery Vehicle	70.0	15.63	4.52	0.69	90%					
27	High-Mobility Artillery Rocket System	12.0	7.07	2.04	0.31	50%					
28	Abrams M1A1 Main Battle Tank	70.0	15.63	4.52	0.69	90%					
29	Joint Assault Bridge	70.0	15.63	4.52	0.69	90%					
30	Assault Breacher Vehicle	55.0	14.02	4.05	0.62	90%					
31	LVTP-7 Landing Vehicle Tracked Personnel	30.6	10.77	3.11	0.48	90%					
32	LVTR-7 Landing Vehicle Tracked Recovery	30.6	10.77	3.11	0.48	90%					
33	LVTC-7 Landing Vehicle Tracked Command	30.6	10.77	3.11	0.48	90%					
34		*Daily Disturbed*	*Emission Factors lb/arcre-day*			*Operation*					
35	Tactical Support Equipment	*Acreage*	*PM*	*PM_{10}*	*$PM_{2.5}$*	*Days*					
36	Ground Disturbance (2)	1.0	110.0	55.0	5.5	365					
37	Notes: (1) Percentage of unpaved roads from LAS MCAGCC FEIS (DON 2012).										
38	(1) Total Ground Disturbance used to estimate emissions from Tactical Equipment.										

	I	J	K	L	M	N	O
40	Table C.1-20. Fugative Dust Emission Factors for Tactical Vehicles/Support Equipment - Paved Road - MCLB Barstow Training a						
41	*Source/Equipment Type*	*Weight*	*Paved Emission Factor (Lb/VMT)*			*% Paved*	
42		*(Tons)*	*PM*	*PM 10*	*PM 2.5*	*Travel (1)*	
43	Tactical Vehicles						
44	Medium Tactical Vehicle Replacement	10.0	0.07	0.01	0.002	10%	
45	High-Mobility Multipurpose Wheeled Vehicle	3.0	0.01	0.00	(0.000)	50%	
46	Logistics Vehicle System	20.0	0.20	0.04	0.006	50%	
47	Internally Transportable Vehicle	3.5	0.01	0.00	0.000	50%	
48	M60A1 Bridge Vehicle	70.0	1.32	0.26	0.038	10%	
49	Light Armored Vehicle (Variants)	14.1	0.12	0.02	0.003	10%	
50	M88A2 HERCULES Recovery Vehicle	70.0	1.32	0.26	0.038	10%	
51	High-Mobility Artillery Rocket System	12.0	0.09	0.02	0.002	50%	
52	Abrams M1A1 Main Battle Tank	70.0	1.32	0.26	0.038	10%	
53	Joint Assault Bridge	70.0	1.32	0.26	0.038	10%	
54	Assault Breacher Vehicle	55.0	0.92	0.18	0.027	10%	
55	LVTP-7 Landing Vehicle Tracked Personnel	30.6	0.38	0.07	0.011	10%	
56	LVTR-7 Landing Vehicle Tracked Recovery	30.6	0.38	0.07	0.011	10%	
57	LVTC-7 Landing Vehicle Tracked Command	30.6	0.38	0.07	0.011	10%	
58	Notes: (1) Percentage of paved roads from LAS MCAGCC FEIS (DON 2012).						
59	(2) US EPA 42 13.2.1, sL - 0.1, k(PM10) - 0.016, k(PM2.5) - 0.0024, C(PM10) - 0.00047, C(PM2.5) - 0.00036						

	U	V	W	X	Y	Z	AA	AB	AC	AD
1	Table C.1-21. Combustive Emissions Resulting from Existing Tactical Equipment - MCLB Barstow Training and Range EA									
2		*Pounds per Year*								
3	*Activity/Equipment Type*	*ROG*	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*
4	*Tactical Vehicles*									
5	Medium Tactical Vehicle Replacement	15.5	65.0	195.5	0.2	7.1	6.6	21,688	5.0	0.0
6	High-Mobility Multipurpose Wheeled Vehicle	3.8	25.1	39.2	0.0	2.0	1.9	3,954	0.9	0.0
7	Logistics Vehicle System	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
8	Internally Transportable Vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
9	M60A1 Bridge Vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
10	Light Armored Vehicle (Variants)	1.4	12.2	19.0	0.0	1.0	0.9	1,918	0.5	0.0
11	M88A2 Hercules Recovery Vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
12	High-Mobility Artillery Rocket System	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
13	Abrams M1A1 Main Battle Tank	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
14	Joint Assault Bridge	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
15	Assault Breacher Vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
16	Subtotal - Pounds	20.7	102.2	253.8	0.3	10.2	9.5	27,560	6.4	0.0
17	*Tactical Support Equipment*									
18	Medium Crawler Tractor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	Excavator, Combat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	Grader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	Armored Tractor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	D7 Bulldozer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	Armored Backhoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	Extended Boom Forklift	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	Light Capacity Rough Terrain Truck Forklift	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	Tractor, Rubber Tired, Articulated Steering, Multipurpose Vehicles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	Subtotal - Pounds	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	Total Emissions (Pounds)	20.7	102.2	253.8	0.3	10.2	9.5	27,560	6.4	0.0
29										
30	Table C.1-22. Fugitive Dust Emissions Resulting from Existing Tactical Vehicles/Support Equipment - MCLB Barstow Training and Range EA									
31		*Pounds per Year*								
32	*Activity/Equipment Type*	*PM_{10}*	*$PM_{2.5}$*							
33	Medium Tactical Vehicle Replacement	6,100	935							
34	High-Mobility Multipurpose Wheeled Vehicle	1,315	201							
35	Logistics Vehicle System	-	-							
36	Internally Transportable Vehicle	-	-							
37	M60A1 Bridge Vehicle	-	-							
38	Light Armored Vehicle (Variants)	851	130							
39	M88A2 Hercules Recovery Vehicle	-	-							
40	High-Mobility Artillery Rocket System	-	-							
41	Abrams M1A1 Main Battle Tank	-	-							
42	Joint Assault Bridge	-	-							
43	Assault Breacher Vehicle	-	-							
44	Ground Disturbance	-	-							
45	Subtotal - Pounds	8,267	1,267							

	U	V	W	X	Y	Z	AA	AB	AC	AD
47	Table C.1-23. Total Proposed Tactical Vehicles/Support Equipment Emissions - MCLB Barstow Training and Range EA									
48		*Pounds per Year*								
49	*Activity/Equipment Type*	*ROG*	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*
50	*Tactical Vehicles*									
51	Medium Tactical Vehicle Replacement	24.9	103.9	312.8	0.3	11.4	10.6	34,700	8.0	0.0
52	High-Mobility Multipurpose Wheeled Vehicle	9.1	60.2	94.2	0.1	4.9	4.6	9,490	2.2	0.0
53	Logistics Vehicle System	23.9	100.0	301.0	0.3	11.0	10.2	33,399	7.7	0.0
54	Internally Transportable Vehicle	9.1	60.2	94.2	0.1	4.9	4.6	9,490	2.2	0.0
55	M60A1 Bridge Vehicle	0.0	0.2	57.6	0.2	0.8	0.7	10,208	0.3	0.3
56	Light Armored Vehicle (Variants)	6.2	54.4	85.0	0.1	4.4	4.1	8,566	2.0	0.0
57	M88A2 Hercules Recovery Vehicle	0.0	0.2	57.6	0.2	0.8	0.7	10,208	0.3	0.3
58	High-Mobility Artillery Rocket System	3.7	15.6	46.9	0.1	1.7	1.6	5,205	1.2	0.0
59	Abrams M1A1 Main Battle Tank	0.2	1.5	403.2	1.7	5.3	5.2	71,456	2.3	2.0
60	Joint Assault Bridge	0.0	0.2	57.6	0.2	0.8	0.7	10,208	0.3	0.3
61	Assault Breacher Vehicle	6.3	45.2	75.9	6.2	0.8	0.7	9,357	0.3	0.3
62	LVTP-7 Landing Vehicle Tracked Personnel	37.2	155.6	468.3	0.5	17.1	15.9	51,954	1.5	1.3
63	LVTR-7 Landing Vehicle Tracked Recovery	3.5	14.8	44.6	0.0	1.6	1.5	4,948	0.1	0.1
64	LVTC-7 Landing Vehicle Tracked Command	3.5	14.8	44.6	0.0	1.6	1.5	4,948	0.1	0.1
65	Subtotal - Pounds	127.8	627.0	2,143.5	10.3	67.1	62.8	274,138.5	28.7	4.8
66	*Tactical Support Equipment*									
67	Medium Crawler Tractor	116.8	773.7	1,210.3	1.2	62.9	58.8	121,939	28.6	0.0
68	Excavator, Combat	439.5	1,836.3	5,525.6	6.1	202.1	188.0	613,057	141.0	0.0
69	Grader	111.7	466.9	1,404.8	1.5	51.4	47.8	155,862	35.9	0.0
70	Armored Tractor	87.9	367.3	1,105.1	1.2	40.4	37.6	122,611	28.2	0.0
71	D7 Bulldozer	149.0	622.5	1,873.1	2.1	68.5	63.7	207,816	47.8	0.0
72	Armored Backhoe	219.8	918.2	2,762.8	3.0	101.0	94.0	306,529	70.5	0.0
73	Extended Boom Forklift	148.4	983.5	1,538.5	1.5	80.0	74.8	155,007	36.4	0.0
74	Light Capacity Rough Terrain Truck Forklift	108.9	721.3	1,128.2	1.1	58.6	54.8	113,672	26.7	0.0
75	Tractor, Rubber Tired, Articulated Steering, Multipurpose Vehicles	183.1	1,213.0	1,897.5	1.9	98.6	92.2	191,176	44.8	0.0
76	Subtotal - Pounds	1,565.2	7,902.6	18,446.1	19.6	763.5	711.7	1,987,670	459.9	0.0
77	Total Emissions (Pounds)	1,693.0	8,529.6	20,589.6	29.9	830.6	774.5	2,261,809	488.6	4.8
78	*Calculation of Annual Emissions for Tactical and Support Equipment*									
79	Emission Factor (g/hp-hr) x total Hp-hrs x 1 lb/453.6 g = Annual Emissions (lb/yr)									
80	*Calculation of Abrams Tank/Bridge Vehicles and Assault Breacher Vehicle*									
81	Emission Factor (lbs/1000 gals) x Total Gals x 1 /1000 = Annual Emissions (lb/yr)									

	U	V	W	X	Y	Z	AA	AB
83	Table C.1-24. Fugitive Dust Emissions Resulting from Existing Tactical Vehicles/Support Equipment - MCLB Barstow Training and Range EA							
84		*Pounds per Year*						
85	*Activity/Equipment Type*	*PM_{10}*	*$PM_{2.5}$*					
86	Medium Tactical Vehicle Replacement	9,761	1,496					
87	High-Mobility Multipurpose Wheeled Vehicle	3,157	483					
88	Logistics Vehicle System	3,757	575					
89	Internally Transportable Vehicle	3,385	518					
90	M60A1 Bridge Vehicle	654	100					
91	Light Armored Vehicle (Variants)	3,799	582					
92	M88A2 Hercules Recovery Vehicle	654	100					
93	High-Mobility Artillery Rocket System	890	136					
94	Abrams M1A1 Main Battle Tank	4,581	702					
95	Joint Assault Bridge	654	100					
96	Assault Breacher Vehicle	586	90					
97	LVTP-7 Landing Vehicle Tracked Personnel	3,595	551					
98	LVTR-7 Landing Vehicle Tracked Recovery	449	69					
99	LVTC-7 Landing Vehicle Tracked Command	449	69					
100	Ground Disturbance	20,075	2,008					
101	Subtotal - Pounds	56,447	7,582					

	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP
1	Table C.1-25. Summary of Emissions from Tactical Vehicles/Support Equipment Emissions - MCLB Barstow Training and Range EA										
2		*Tons per Year*									
3	*Activity/Equipment Type*	*ROG*	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO2e (mt)*
4	*Current*										
5	Tactical Vehicles	0.01	0.05	0.13	0.00	0.01	0.00	13.78	0.00	0.00	12.56
6	Tactical Equipment										
7	Fugative Dust					4.13	0.63				
8	Total Current Activity	0.01	0.05	0.13	0.00	4.14	0.64	13.78	0.00	0.00	12.56
9	*Proposed Equipment*										
10	Tactical Vehicles	0.06	0.31	1.07	0.01	0.03	0.03	137.07	0.01	0.00	125.27
11	Tactical Equipment	0.78	3.95	9.22	0.01	0.38	0.36	993.84	0.23	0.00	905.79
12	Fugative Dust					28.22	3.79				
13	Total Proposed Activity	0.85	4.26	10.29	0.01	28.64	4.18	1,130.90	0.24	0.00	1,031.06
14	Note: mt = metric tons.										

Table C.1-26. On-Road Vehicle Data for Personnel/Equipment Transport - MCLB Barstow Training and Range EA

Activity/Equipment Type	*Annual # of Vehicle Round Trips*	*Miles/Round Trip (1)*	*Total Annual Miles*
On-Road Transport			
Buses	232	76	17,685
Tractor-Trailer/Convoyed Vehicles	72	76	5,489

Notes: (1) Equal to distance travelled within the MDAB. Assumes that 33/66% of the trips would originate from the Marine Corps Air Ground Combat Center (29 Palms) and the direction of Los Angeles (via I-15).

Table C.1-27. On-Road Vehicle Transport Emission Factors - MCLB Barstow Training and Range EA

Source Type/Activity	*Emission Factors (Grams/Mile)*									*Reference*
	ROG	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH4*	*N2O*	
Urban Bus										
25 MPH	0.63	2.72	13.74	0.02	0.27	0.25	2,444	0.03	0.05	(1)
55 MPH	0.33	1.47	16.64	0.01	0.14	0.13	2,444	0.01	0.05	(1)
Composite Trip (2)	0.39	1.72	16.06	0.02	0.17	0.15	2,444	0.01	0.05	(1)
Heavy Diesel Truck										
25 MPH	0.66	2.19	10.79	0.02	0.17	0.16	1,996	0.03	0.05	(1)
55 MPH	0.24	1.00	8.05	0.01	0.17	0.16	1,545	0.01	0.05	(1)
Composite Trip (2)	0.32	1.24	8.60	0.02	0.17	0.16	1,635	0.01	0.05	(1)

Notes: (1) Onroad emission factors developed from EMFAC2014 (ARB 2014). Units in gms/mile calculated for project year 2016.

(2) Composite trip emission factors based on vehicles that would travel 20% of the time at 25 mph and 80% of the time at 55 mph.

Table C.1-28. Total On-Road Vehicle Personnel/Equipment Transport Emissions - MCLB Barstow Training and Range EA

	Pounds per Year									
Equipment Type	*ROG*	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH4*	*N2O*	*CO2e (mt)*
Tactical Vehicles										
Buses	15	67	626	1	6	6	95,289	1	2	95,905
Tractor-Trailer/Convoyed Vehicles	4	15	104	0	2	2	19,788	0	1	19,980
Total Emissions (Pounds)	19	82	730	1	9	8	115,077	1	3	115,885
Total Emissions (Tons)	0.01	0.04	0.37	0.00	0.00	0.00	52.20	0.00	0.00	52.56

Note: mt = metric tons.

	A	B	C	D	E	F	G	H
1	Table C.1-29. Emission Source Data for Existing Aircraft Transit Operations - MCLB Barstow Training and Range EA							
2		*Annual*	*Cruising*	*1-Way*	*1-Way w/i*	*Fraction of Route*	*Round Trip Length*	*Round Trip*
3	*Origin/Aircraft Type*	*Sorties*	*Speed (Kts)*	*Distance (NM)*	*MDAB (NM)*	*Below 3,000' AGL*	*within MDAB (NM)*	*Duration (Hrs)*
4	*Base 4 - Dagget NTC*							
5	UH-72	96	90	42	9.10	1.00	23	0.26
6								
7	Table C.1-30. Emission Source Data for Proposed Aircraft Transit Operations - MCLB Barstow Training and Range EA							
8		*Annual*	*Cruising*	*1-Way*	*1-Way w/i*	*Fraction of Route*	*Round Trip Length*	*Round Trip*
9	*Origin/Aircraft Type*	*Sorties*	*Speed (Kts)*	*Distance (NM)*	*MDAB (NM)*	*Below 3,000' AGL*	*within MDAB (NM)*	*Duration (Hrs)*
10	*Base 1 - SELF/EAF*							
11	MV-22	269	220	76	62	-	-	-
12	CH-53	77	120	76	62	1.00	124	1.03
13	UH-1	47	90	76	62	1.00	124	1.38
14	AH-1	16	90	76	62	1.00	124	1.38
15	C-130	6	170	76	62	-	-	-
16	*Base 2 - MCAS Miramar*							
17	MV-22	269	220	140	37	-	-	-
18	CH-53	77	120	140	37	1.00	74	0.62
19	C-130	24	170	140	37	-	-	-
20	*Base 3 - MCB CPEN*							
21	MV-22	134	220	112	37	-	-	-
22	CH-53	38	120	112	37	1.00	74	0.62
23	UH-1	26	90	112	37	1.00	74	0.82
24	AH-1	9	90	112	37	1.00	74	0.82
25	C-130	6	170	112	37	-	-	-
26	*Base 4 - Dagget NTC*							
27	C-23	4	170	42	9.1	1.00	23	0.14
28	CH-47	72	120	42	9.1	1.00	23	0.19
29	UH-60	72	90	42	9.1	1.00	23	0.26
30	UH-72	96	90	42	9.1	1.00	23	0.26

	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	Table C.1-31. Aircraft Emission Factors for Cruise Mode														
2			*# of*	*Engine*	*Fuel Flow/*	*Pounds/1000 Pounds Fuel(1)*									
3	*Aircraft*	*Engine Type*	*Engines*	*Power Setting*	*Engine (Lb/Hr)*	*VOC*	*CO*	*NOx*	*SO2*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*	*Source of EF*
4	AH-1	T700-GE-401C	2	38% Q - Cruise	425.1	0.56	10.54	5.55	0.40	4.20	4.20	3,216	0.10	0.09	AESO Memo Rpt 9824B (2009)
5	C-23	PT-6A-65AR	2	Military	703.0	1.16	2.11	5.28	0.40	0.70	0.70	3,207	0.10	0.09	EDMS
6	C-130	T56-A-16	4	49% SHP	1,420.0	0.02	0.90	10.93	0.40	3.97	3.97	3,213	0.10	0.09	AESO Memo Rpt 2000-09B (2001)
7	CH-47D	T64-415	2	Military	1,916.0	0.54	2.47	19.14	0.40	1.92	1.92	3,207	0.10	0.09	EPA (1992), p. 185
8	CH-53	T64-GE-416 and -416A	3	70% Q - Cruise	1,488.0	0.15	2.13	8.08	0.40	2.21	2.21	3,096	0.10	0.09	AESO Memo Rpt 9822C (2000)
9	MV-22	T406-AD-400	2	Helo (16°) Cruise	1,530.0	0.01	0.79	11.64	0.40	1.58	1.58	3,213	0.10	0.09	AESO Memo Rpt 9946E, 1/01
10	UH-1	T400-CP-400	2	38% Q - Cruise	692.4	0.13	1.01	5.79	0.40	4.20	4.20	3,207	0.10	0.09	AESO Memo Rpt 9904B (2009)
11	UH-60	T700-GE-401C	2	65% torque	600.0	0.55	6.25	6.40	0.40	4.20	4.20	3,221	0.10	0.09	AESO Memo Rpt No. 9929 Revision A, 11
12	Notes: (1) Emission factors not available for the UH-72 so used data for the UH-1 to estimate emissions from this aircraft.														
13	GHG Emission Factors from General Reporting Protocol, Tables C.3 and C.6 jet fuel (California Climate Action Registry 2009).														

	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK
1	Table C.1-32. Existing Aircraft Transit Operations Emissions - MCLB Barstow Training and Range EA									
2		*Pounds per Year*								
3	*Origin/Aircraft Type*	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
4	*Base 4 - Dagget NTC*									
5	UH-72(1)	4.4	34.3	196.7	13.6	142.7	142.7	108,960	3.4	3.0
6	Total	4.4	34.3	196.7	13.6	142.7	142.7	108,960	3.4	3.0
7	Note: (1) No emission factors available for UH-72, UH-1 factors used as closest available alternative.									
8										
9	Table C.1-33. Proposed Aircraft Transit Operations Emissions - MCLB Barstow Training and Range EA									
10		*Pounds per Year*								
11	*Origin/Aircraft Type*	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
12	*Base 1 - SELF/EAF*									
13	MV-22	-	-	-	-	-	-	-	-	-
14	CH-53	53.3	756.5	2,869.9	142.1	785.0	785.0	1,099,717	35.7	31.1
15	UH-1	11.7	90.6	519.2	35.9	376.6	376.6	287,600	9.0	7.8
16	AH-1	10.5	197.5	104.0	7.5	78.7	78.7	60,280	1.9	1.6
17	C-130	-	-	-	-	-	-	-	-	-
18	Total	75.4	1,044.7	3,493.1	185.4	1,240.3	1,240.3	1,447,597	46.6	40.6
19	*Base 2 - MCAS Miramar*									
20	MV-22	-	-	-	-	-	-	-	-	-
21	CH-53	31.8	451.5	1,712.7	84.8	468.4	468.4	656,283	21.3	18.6
22	C-130	-	-	-	-	-	-	-	-	-
23	Total	31.8	451.5	1,712.7	84.8	468.4	468.4	656,283	21.3	18.6
24	*Base 3 - MCB CPEN*									
25	MV-22	-	-	-	-	-	-	-	-	-
26	CH-53	15.7	222.8	845.2	41.8	231.2	231.2	323,880	10.5	9.2
27	UH-1	3.8	29.9	171.4	11.8	124.3	124.3	94,945	3.0	2.6
28	AH-1	3.5	66.3	34.9	2.5	26.4	26.4	20,235	0.6	0.6
29	C-130	-	-	-	-	-	-	-	-	-
30	Total	23.1	319.0	1,051.5	56.2	381.9	381.9	439,060	14.1	12.3
31	*Base 4 - Dagget NTC*									
32	C-23	0.9	1.6	4.0	0.3	0.5	0.5	2,440	0.1	0.1
33	CH-47	28.6	130.6	1,012.2	21.2	101.5	101.5	169,601	5.3	4.6
34	UH-60	12.1	138.0	141.3	8.8	92.7	92.7	71,129	2.2	1.9
35	UH-72 (1)	4.4	34.3	196.7	13.6	142.7	142.7	108,960	3.4	3.0
36	Total	46.0	304.5	1,354.2	43.9	337.5	337.5	352,130	11.0	9.6
37	Note: (1) No emission factors available for UH-72, UH-1 factors used as closest available alternative.									

	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW
1	Table C.1-34. Summary of Emissions for Aircraft Transit Operations - MCLB Barstow Training and Range EA										
2		*Tons per Year*									
3	*Activity/Equipment Type*	VOC	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e (mt)*
4	*Current Transit Operations*										
5	Base 4 - Dagget NTC	0.00	0.02	0.10	0.01	0.07	0.07	54.48	0.00	0.00	49.86
6	Total Current Activity	0.00	0.02	0.10	0.01	0.07	0.07	54.48	0.00	0.00	49.86
7	*Proposed Transit Operations*										
8	Base 1 - SELF/EAF	0.04	0.52	1.75	0.09	0.62	0.62	723.80	0.02	0.02	662.63
9	Base 2 - MCAS Miramar	0.02	0.23	0.86	0.04	0.23	0.23	328.14	0.01	0.01	300.44
10	Base 3 - MCB CPEN	0.01	0.16	0.53	0.03	0.19	0.19	219.53	0.01	0.01	200.98
11	Base 4 - Dagget NTC	0.02	0.15	0.68	0.02	0.17	0.17	176.07	0.01	0.00	161.15
12	Total Proposed Activity	0.09	1.06	3.81	0.19	1.21	1.21	1,447.54	0.05	0.04	1,325.19
13	Note: mt = metric tons.										

	A	B	C
1	Table C.1-35. Emission Source Data for Proposed Aircraft Transport Ope		
2	*Aircraft Type/Operation*	*Annual Sorties*	
3	*UH-72*		
4	Pad Landing	96	
5			
6	Table C.1-36. Emission Source Data for Proposed Aircraft Transport Ope		
7	*Aircraft Type/Operation*	*Annual Sorties*	
8	*AH-1*		261
9	Stop and Go	96	128
10	Touch and Go	96	128
11	Pad Landing	9	12
12	FCLP	60	80
13	*UH-1*		87
14	Stop and Go	32	128
15	Touch and Go	32	128
16	Pad Landing	3	12
17	FCLP	20	80
18	*MV-22*		2496
19	Stop and Go	960	
20	Touch and Go	960	
21	Pad Landing	64	
22	FCLP	512	
23	*CH53*		732
24	Stop and Go	288	
25	Touch and Go	288	
26	Pad Landing	12	
27	FCLP	144	
28	*UH-72*		
29	Pad Landing	96	
30	*C-130*		
31	Low Level Pass/Drops	36	
32	*CH-47*		72
33	Stop and Go	25	
34	Touch and Go	25	
35	Pad Landing	8	
36	FCLP	14	
37	*UH-60*		72
38	Stop and Go	25	
39	Touch and Go	25	
40	Pad Landing	8	
41	FCLP	14	
42	*C-23*		
43	Low Level Pass/Drops	16	

	E	F	G	H	I	J	K	L	M	N	O	P
1	Table C.1-37. Aircraft Combustive Emission Factors - MCLB Barstow Training and Range EA											
2	Mission	Pounds/Opperation(1)										
3	Operation	Fuel (Lb)	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O	Source of EF
4	Aircraft: AH-1, Engines: 2 T700-GE-401C											
5	Stop and Go	61	0.04	0.79	0.32	0.02	0.26	0.26	196	0.01	0.01	AESO Memo 9961, Rev A (2009)
6	Touch and Go	46	0.03	0.54	0.25	0.02	0.19	0.19	149	0.00	0.00	AESO Memo 9961, Rev A (2009)
7	Pad Landing	60	0.03	0.69	0.32	0.02	0.25	0.25	192	0.01	0.01	AESO Memo 9961, Rev A (2009)
8	FCLP	61	0.04	0.79	0.32	0.02	0.26	0.26	196	0.01	0.01	AESO Memo 9961, Rev A (2009)
9	Aircraft: UH-1, Engines: 2 T400-CP-400											
10	Stop and Go	53	0.02	0.25	0.25	0.02	0.22	0.22	169	0.01	0.00	AESO Memo 9962, Rev A (2009)
11	Touch and Go	38	0.01	0.13	0.19	0.02	0.16	0.16	121	0.00	0.00	AESO Memo 9962, Rev A (2009)
12	Pad Landing	49	0.01	0.13	0.25	0.02	0.21	0.21	158	0.00	0.00	AESO Memo 9962, Rev A (2009)
13	FCLP	53	0.02	0.25	0.25	0.02	0.22	0.22	169	0.01	0.00	AESO Memo 9962, Rev A (2009)
14	Aircraft: MV-22, Engines: 2 T406-AD-400											
15	Stop and Go	478	0.01	0.64	5.18	0.19	0.76	0.76	1,537	0.05	0.04	AESO Memo 9965B (2001)
16	Touch and Go	280	0.00	0.19	3.57	0.11	0.44	0.44	899	0.03	0.02	AESO Memo 9965B (2001)
17	Pad Landing	592	0.01	0.29	8.87	0.24	0.94	0.94	1,899	0.06	0.05	AESO Memo 9965B (2001)
18	FCLP	349	0.00	0.22	4.61	0.14	0.55	0.55	1,119	0.04	0.03	AESO Memo 9965B (2001)
19	Aircraft: CH-53, Engines: 3 T64-GE-415											
20	Stop and Go	304	0.40	1.25	2.23	0.12	0.67	0.67	941	0.03	0.03	AESO Memo 9960B (2000)
21	Touch and Go	274	0.13	0.77	2.11	0.11	0.61	0.61	848	0.03	0.02	AESO Memo 9960B (2000)
22	Pad Landing	540	0.52	1.94	4.03	0.22	1.19	1.19	1,672	0.05	0.05	AESO Memo 9960B (2000)
23	FCLP	304	0.40	1.25	2.23	0.12	0.67	0.67	941	0.03	0.03	AESO Memo 9960B (2000)
24	Aircraft: UH-72, Engines: 2 Arriel 1E2 (2)											
25	Idle per Landing (3)	49	0.31	1.40	0.15	0.02	0.21	0.21	155.42	0.00	0.00	AESO Memo 9904, Rev B (2009)
26	Pad Landing	49	0.01	0.13	0.25	0.02	0.21	0.21	158	0.00	0.00	AESO Memo 9962, Rev A (2009)
27	Aircraft: C-130, Engines: 4 T56-A-16											
28	Low Level Pass/Drops (4)	746.67	0.35	1.55	6.09	0.30	2.96	2.96	2,399	0.08	0.07	AESO Memo 2000-10B (2001)
29	Aircraft: CH-47, Engines: 2 T64-GE-415 (5)											
30	Stop and Go	245	0.86	4.68	1.01	0.10	0.48	0.48	774	0.02	0.02	
31	Touch and Go	202	0.56	3.49	0.83	0.08	0.38	0.38	645	0.02	0.02	
32	Pad Landing	240	0.89	4.73	0.99	0.10	0.48	0.48	764	0.02	0.02	
33	FCLP	202	0.56	3.49	0.83	0.08	0.38	0.38	645	0.02	0.02	
34	Aircraft: UH-60, Engines: 2 T700-GE-401C											
35	Stop and Go	180	0.10	1.12	3.01	0.17	1.80	1.80	1,383	0.02	0.02	AESO Memo 9953B (2011)
36	Touch and Go	172	0.10	0.96	1.17	0.07	0.76	0.76	578	0.02	0.02	AESO Memo 9953B (2011)
37	Pad Landing	153	0.08	0.81	1.03	0.06	0.64	0.64	494	0.02	0.01	AESO Memo 9953B (2011)
38	FCLP (6)	181	0.10	0.91	1.23	0.07	0.76	0.76	582	0.02	0.02	AESO Memo 9953B (2011)
39	Aircraft: C-23, Engines: 2 PT-6A-65AR											
40	Low Level Pass/Drops (7)	209.67	0.24	0.67	0.91	0.07	0.13	0.13	573	0.02	0.02	
41	Notes: (1) CH4 and N2O Emission Factors from General Reporting Protocol, Tables C.3 and C.6 jet fuel (California Climate Action Registry 2009).											
42	(2) No emission factors available for UH-72, factors from UH-1 used as closest available alternative.											
43	(3) 10 extra minutes of ground idle added to UH-72 emissions per operational data.											
44	(4) Assumes 10 minutes of flight time for each operation.											
45	(5) No emission factors available for UH-47, factors from CH-46 * 2.53 (total Hp rating ratio) used as surrogates.											
46	(6) No emission factors available for FCLP, factors for mountain pad landing used as surrogates.											
47	(7) Assumes 10 minutes of flight time for each operation.											

	R	S	T	U	V	W	X	Y	Z	AA
1	Table C.1-38. Aircraft Fugitive Dust Emission Factors - MCLB Barstow Training and Range EA									
2		*Total Engine Hp*	*Rotor Diameter*	*Disturbed Area*	*U_{10} (m/s)*	*Threshold Friction*	*Friction Velocity*	*P*	*Pounds/LTO (7)*	
3	*Aircraft*	*Rating*	*(Ft) (1)*	*(m^2) (2)*	*(3)*	*Velocity u_t (m/s) (4)*	*u* (m/s) (5)*	*(Gm/m^2) (6)*	*PM10*	*PM2.5*
4	AH-1	3,380	48.0	1,513	32.26	1.70	1.710	0.24	0.41	0.06
5	CH-47	9,466	85.0	4,744	32.54	1.70	1.724	0.65	3.38	0.51
6	CH-53	7,850	79.0	4,098	32.48	1.70	1.721	0.56	2.53	0.38
7	MV-22	12,300	84.0	4,633	32.68	1.70	1.732	0.87	4.43	0.66
8	UH-1N	2,500	48.0	1,513	32.21	1.70	1.707	0.18	0.31	0.05
9	UH-60	3,780	54.0	1,915	32.26	1.70	1.710	0.24	0.52	0.08
10	UH-72	1,476	36.0	851	32.17	1.70	1.705	0.12	0.12	0.02

11 Notes: (1) Due to rotor overlap, actual diameters for CH-47 and MV-22 used in the calculations = 85' and 84', respectively.

12 (2) Equal to 3 times the rotor diameter - the area of disturbance expected from rotary wing aircraft during a desert landing and take-off.

13 (3) Wind speeds at 10 meter level (U_{10}) for the MV-22 based upon wind speeds measured at 1 meter above ground when this aircraft hovered at 20' AGL (Bell Boeing 2008).

14 Equates to equation #5 presented in AP-42 Section 13.2.5 (EPA 2006). This approach assumes that the maximum aircraft downdraft approaches the fastest mile wind speed.

15 Wind speeds for all other aircraft estimated by multiplying U_{10} for the MV-22 times the ratio of the horsepower rating of each aircraft divided by the horsepower rating of the MV-2

16 This approach was taken, as data are not available to adequately estimate the down draft wind speeds for these aircraft, yet aircraft horsepower rating is proportional to

17 potential thrust or the ability of an aircraft to generate down draft.

18 (4) Threshold friction velocity value chosen from values listed for surface types identified in Table C.1-8-3 in the WRAP Fugitive Dust Handbook (Countess Environmental 2006).

19 Data on climatic, soil, and vegetation conditions described in Archaeological and Biological surveys for proposed landing zones (LZs) and observations of

20 dust emissions generated by a CH-46 landing at the existing Canary LZ in Imperial County, CA were used in this selection process (SAIC 2011 and 2012b).

21 (5) Equates to equation #4 presented in AP-42 Section 13.2.5.

22 (6) Equates to equation #3 presented in AP-42 Section 13.2.5.

23 (7) Equal to Disturbed Area times P. These values are annual averages.

24

	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
1	Table C.1-39. Existing Aircraft Range Operations Combustive Emissions - MCLB Barstow Training and Range EA									
2	*Mission*	*Pounds per Year*								
3	*Operation*	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
4	Aircraft: UH-72, Engines: 2 Arriel 1E2									
5	Pad Landing	1.0	12.5	24.0	1.9	20.2	20.2	15,162	0.5	0.4
6	Idle	29.4	134.3	14.8	1.9	19.9	19.9	14,920	0.5	0.4
7	Landings - Fugitive Dust					11.1	1.7			
8	Total - Existing Operations	30.4	146.8	38.8	3.8	51.1	41.7	30,083	0.9	0.8

	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
11	Table C.1-40. Proposed Aircraft Range Operations Combustive Emissions - MCLB Barstow Training and Range EA									
12	*Mission*	*Pounds per Year*								
13	*Operation*	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
14	*AH-1*									
15	Stop and Go	3.8	75.8	30.7	1.9	25.0	25.0	18,775	0.6	0.5
16	Touch and Go	2.9	51.8	24.0	1.9	18.2	18.2	14,272	0.4	0.4
17	Pad Landing	0.3	6.2	2.9	0.2	2.3	2.3	1,730	0.1	0.0
18	FCLP	2.4	47.4	19.2	1.2	15.6	15.6	11,734	0.4	0.3
19	Landings - Fugitive Dust					106.4	16.0			
20	*UH-1*									
21	Stop and Go	0.6	8.0	8.0	0.6	7.0	7.0	5,396	0.2	0.1
22	Touch and Go	0.3	4.2	6.1	0.6	5.1	5.1	3,862	0.1	0.1
23	Pad Landing	0.0	0.4	0.8	0.1	0.6	0.6	474	0.0	0.0
24	FCLP	0.4	5.0	5.0	0.4	4.4	4.4	3,372	0.1	0.1
25	Landings - Fugitive Dust					26.6	4.0			
26	*MV-22*									
27	Stop and Go	9.6	614.4	4,972.8	182.4	729.6	729.6	1,475,520	46.1	40.2
28	Touch and Go	2.9	182.4	3,427.2	105.6	422.4	422.4	863,040	27.0	23.5
29	Pad Landing	0.6	18.6	567.7	15.4	60.2	60.2	121,536	3.8	3.3
30	FCLP	1.5	112.6	2,360.3	71.7	281.6	281.6	572,928	18.0	15.6
31	Landings - Fugitive Dust					11,065.1	1,659.8			
32	*CH-53*									
33	Stop and Go	115.2	360.0	642.2	34.6	193.0	193.0	271,076	8.8	7.7
34	Touch and Go	37.4	221.8	607.7	31.7	175.7	175.7	244,325	7.9	6.9
35	Pad Landing	6.2	23.3	48.4	2.6	14.3	14.3	20,063	0.7	0.6
36	FCLP	57.6	180.0	321.1	17.3	96.5	96.5	135,538	4.4	3.8
37	Landings - Fugitive Dust					1,850.2	277.5			
38	*UH-72*									
39	Pad Landing	1.0	12.5	24.0	1.9	20.2	20.2	15,162	0.5	0.4
40	Idle	29.4	134.3	14.8	1.9	19.9	19.9	14,920	0.5	0.4
41	Landings - Fugitive Dust					11.1	1.7			
42	*C-130*									
43	Low Level Pass/Drops	12.6	55.6	219.3	10.8	106.7	106.7	86,365	2.7	2.4
44	*CH-47*									
45	Stop and Go	21.5	117.0	25.3	2.5	12.0	12.0	19,355	0.6	0.5
46	Touch and Go	13.9	87.3	20.9	1.9	9.5	9.5	16,129	0.5	0.4
47	Pad Landing	7.1	37.8	7.9	0.8	3.8	3.8	6,112	0.2	0.2
48	FCLP	7.8	48.9	11.7	1.1	5.3	5.3	9,032	0.3	0.2
49	Landings - Fugitive Dust					243.3	36.5			
50	*UH-60*									
51	Stop and Go	2.5	28.0	75.3	4.3	45.0	45.0	34,575	0.5	0.4
52	Touch and Go	2.5	24.0	29.3	1.8	19.0	19.0	14,450	0.4	0.4
53	Pad Landing	0.6	6.5	8.2	0.5	5.1	5.1	3,952	0.1	0.1
54	FCLP	1.4	12.7	17.2	1.0	10.6	10.6	8,148	0.3	0.2
55	Landings - Fugitive Dust					22.0	3.3			
56	*C-23*									
57	Low Level Pass/Drops	3.9	10.7	14.6	1.1	2.1	2.1	9,162	0.3	0.3
58	Total - Proposed Operations	346	2,487	13,512	498	15,636	4,309	4,001,005	125	109

	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX
1	Table C.1-41. Summary of Emissions from Tactical Vehicles/Support Equipment Emissions - MCLB Barstow Training and Range EA										
2		*Tons per Year*									
3	*Scenario/Activity*	*ROG*	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e (mt)*
4	*Existing Range Operations*										
5	Combustive Emissions	0.02	0.07	0.02	0.00	0.02	0.02	15.04	0.00	0.00	13.8
6	Fugative Dust					0.01	0.00				
7	Total - Existing Operations	0.02	0.07	0.02	0.00	0.03	0.02	15.04	0.00	0.00	13.8
8	*Proposed Range Operations*										
9	Combustive Emissions	0.17	1.24	6.76	0.25	1.16	1.16	2,000.50	0.06	0.05	1,831.0
10	Fugative Dust					6.66	1.00				
11	Total - Proposed Operations	0.17	1.24	6.76	0.25	7.82	2.15	2,000.50	0.06	0.05	1,831.0
12	Note: mt = metric tons.										

Table C.1-42. Equipment Usage Data for Range Maintenance Activities - MCLB Barstow Training and Range EA

Off-Road Equipment						
Activity/Equipment Type	*Hp Rating*	*Average Daily % of Full Throttle*	*Number Active*	*Hours/ Day*	*Total Work Days*	*Total Hp-Hrs*
Road Maintenance						
Grader	220	80%	1	8	4	5,632
Front-End-Loader / Backhoe	284	75%	1	8	4	6,816
Utilities						
Front-End-Loader / Backhoe	284	75%	1	8	3	5,112
Berm Maintenance and Lead Removal						
Skip Loader	105	50%	1	6	2	630
Front-End-Loader / Backhoe	284	75%	1	6	4	5,112
Screening Machine	50	100%	1	6	4	1,200
Crawler Dozer	354	75%	1	6	4	6,372
Firing Line Berm Maintenance						
Crawler Dozer	354	75%	1	6	5	7,965
Front-End-Loader / Backhoe	284	75%	1	6	5	6,390
Post Range Cleaning/Monthly Clean-up						
Skip Loader	105	50%	1	4	5	1,050
Existing Parking Lot						
Grader	220	80%	1	6	2	2,112
Front-End-Loader / Backhoe	284	75%	1	6	2	2,556
Gas Chamber						
NA						
Ready Locker and Facilities						
NA						
Trash, Propane, and Rest Rooms						
NA						
Target Repair						
Cherry Picker	80	40%	1	4	2	256
Range Maintenance & Sustainability (General)						
Bobcat S850	92	50%	1	8	40	14,720
Kubota M135GX	135	50%	1	8	40	21,600
Polaris Ranger ATV	60	50%	4	8	80	76,800
Generator, 7kw	26	75%	1	5	40	3,900
Air Compressor, 25-gallon	7	75%	1	5	40	975

Table C.1-43. On-Road Vehicle Usage Data for Range Maintenance Activities - MCLB Barstow Training and Range EA

Activity/Equipment Type	*Vehicle Weight*		*Miles per Round Trip*	*Total Trips*	*Total Miles*
Road Maintenance					
Water Truck	7,500		5	8	40
Pick-up Truck	5,000		5	14	70
Utilities					
Water Truck	7,500		1	3	3
Pick-up Truck	5,000		1	6	6
Berm Maintenance and Lead Removal					
Water Truck	7,500		1	4	4
Pick-up Truck	5,000		1	8	8
Firing Line Berm Maintenance					
Water Truck	7,500		1	10	10
Pick-up Truck	5,000		1	10	10
Post Range Cleaning/Monthly Clean-up					
Pick-up Truck	5,000		5	10	50
Existing Parking Lot					
Water Truck	7,500		1	4	4
Pick-up Truck	5,000		1	4	4
Gas Chamber					
Pick-up Truck	5,000		1	4	4
Ready Locker and Facilities					
Pick-up Truck	5,000		1	10	10
Trash, Propane and Rest Rooms					
Pick-up Truck	5,000		1	10	10
Garbage Truck	36,000		1	52	52
Septic Truck	20,000		5	12	60
Target Repair					
Pick-up Truck	5,000		1	4	4
Range Maintenance & Sustainability (General)					
Pick-up Truck, 2500	7,000		20	104	2,080
Pick-up Truck, 3500	14,000		20	80	1,600
Habitat Monitoring/Maintenance					
Pick-up Truck	5,000		5	8	40

Table C.1-44. Equipment Emissions Resulting from KD Range Year 1 Construction Activities - MCLB Barstow Training and Range EA

Off-Road Equipment									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Road Maintenance									
Grader	4.7	19.6	58.9	0.1	2.2	2.0	6,531.5	1.5	0.0
Front-End-Loader / Backhoe	4.8	30.0	60.2	0.1	2.2	2.0	7,787.5	1.9	0.0
Utilities									
Front-End-Loader / Backhoe	3.6	22.5	45.1	0.1	1.6	1.5	5,840.7	1.4	0.0
Berm Maintenance and Lead Removal									
Skip Loader	0.9	5.3	7.6	0.0	0.6	0.5	726.0	0.2	0.0
Front-End-Loader / Backhoe	3.6	22.5	45.1	0.1	1.6	1.5	5,840.7	1.4	0.0
Screening Machine	1.7	10.1	14.5	0.0	1.1	1.0	1,382.9	0.3	0.0
Crawler Dozer	4.5	28.1	56.3	0.1	2.0	1.9	7,280.3	1.8	0.0
Firing Line Berm Maintenance									
Crawler Dozer	5.6	35.1	70.3	0.1	2.5	2.4	9,100.3	2.2	0.0
Front-End-Loader / Backhoe	4.5	28.2	56.4	0.1	2.0	1.9	7,300.8	1.8	0.0
Post Range Cleaning/Monthly Clean-up									
Skip Loader	1.5	8.8	12.7	0.0	1.0	0.9	1,210.1	0.3	0.0
Existing Parking Lot									
Grader	1.8	7.3	22.1	0.0	0.8	0.8	2,449.3	0.6	0.0
Front-End-Loader / Backhoe	1.8	11.3	22.6	0.0	0.8	0.8	2,920.3	0.7	0.0
Gas Chamber									
NA	-	-	-	-	-	-	-	-	-
Ready Locker and Facilities									
NA	-	-	-	-	-	-	-	-	-
Trash, Propane, and Rest Rooms									
NA	-	-	-	-	-	-	-	-	-
Target Repair									
Cherry Picker	0.4	2.2	3.1	0.0	0.2	0.2	295.0	0.1	0.0
Range Maintenance & Sustainability (General)									
Bobcat S850	20.8	123.6	178.4	0.2	13.6	12.7	16,963.9	4.1	0.0
Kubota M135GX	23.9	158.1	247.3	0.2	12.9	12.0	24,912.3	5.8	0.0
Polaris Ranger ATV	108.3	645.1	930.6	0.9	70.8	66.4	88,507.1	21.5	0.0
Generator, 7kw	12.2	48.7	44.9	0.1	3.9	3.7	4,844.5	1.3	0.0
Air Compressor, 25-gallon	2.0	9.4	10.5	0.0	0.7	0.7	1,219.9	0.2	0.0

Table C.1-45. On-Road Vehicle Emissions Resulting from KD Range Year 1 Construction Activities - MCLB Barstow Training and Range EA

	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Road Maintenance									
Water Truck	0.6	1.6	7.9	0.0	0.1	0.1	782.4	0.0	0.0
Pick-up Truck	0.0	0.3	0.0	0.0	0.0	0.0	59.6	0.0	0.0
Utilities									
Water Truck	0.1	0.5	2.4	0.0	0.0	0.0	247.6	0.0	0.0
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0
Berm Maintenance and Lead Removal									
Water Truck	0.2	0.6	3.2	0.0	0.0	0.0	330.2	0.0	0.0
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.0
Firing Line Berm Maintenance									
Water Truck	0.4	1.5	7.9	0.0	0.0	0.0	825.5	0.0	0.0
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.0
Post Range Cleaning/Monthly Clean-up									
Pick-up Truck	0.0	0.2	0.0	0.0	0.0	0.0	42.5	0.0	0.0
Existing Parking Lot									
Water Truck	0.2	0.6	3.2	0.0	0.0	0.0	330.2	0.0	0.0
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0
Gas Chamber									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0
Ready Locker and Facilities									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.0
Trash, Propane and Rest Rooms									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.0
Garbage Truck	2.2	8.0	41.1	0.0	0.2	0.2	4,292.5	0.1	0.1
Septic Truck	0.8	2.5	11.9	0.0	0.1	0.1	1,173.6	0.0	0.0
Target Repair									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0
Range Maintenance & Sustainability (General)									
Pick-up Truck, 2500	1.0	7.6	0.9	0.0	0.2	0.2	1,769.5	0.0	0.2
Pick-up Truck, 3500	10.9	20.5	80.9	0.1	1.3	1.3	6,102.4	0.1	0.2
Habitat Monitoring/Maintenance									
Pick-up Truck	0.0	1.6	7.9	0.0	0.1	0.1	782.4	0.0	0.0

Table C.1-46. Emissions from Maintenance Activities - MCLB Barstow Training and Range EA

	Annual Emissions (Tons per Year)									
Activity	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*	*CO2e (mt)*
All Ranges										
Road Maintenance	0.01	0.03	0.06	0.00	0.00	0.00	8	0.00	0.00	7
Utilities	0.00	0.01	0.02	0.00	0.00	0.00	3	0.00	0.00	3
Berm Maintenance and Lead Removal	0.01	0.03	0.06	0.00	0.00	0.00	8	0.00	0.00	7
Firing Line Berm Maintenance	0.01	0.03	0.07	0.00	0.00	0.00	9	0.00	0.00	8
Post Range Cleaning/Monthly Clean-up	0.00	0.00	0.01	0.00	0.00	0.00	1	0.00	0.00	1
Existing Parking Lot	0.00	0.01	0.02	0.00	0.00	0.00	3	0.00	0.00	3
Gas Chamber	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0
Ready Locker and Facilities	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0
Trash, Propane and Rest Rooms	0.00	0.01	0.03	0.00	0.00	0.00	3	0.00	0.00	3
Target Repair	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0
Range Maintenance & Sustainability (General)	0.09	0.51	0.75	0.00	0.05	0.05	72	0.02	0.00	66
Habitat Monitoring/Maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0
Total	0.11	0.63	1.03	0.00	0.06	0.06	106	0.02	0.00	97

Note: mt = metric tons.

Table C.1-47. Emissions from Ordnance Usages - MCLB Barstow Training and Range EA

	Annual Emissions (Pounds)									
Activity	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*	*CO2e (mt)*
Range Training Operations	-	21.1	1.3	-	2.3	1.3	21.1	0.2		23
Training Activities	0.7	96.3	2.7	-	14.6	8.5	67.3	0.7		74
Total	0.7	117.4	4.0	-	16.9	9.8	88.4	0.9	-	97
Total - Tons per Year	0.00	0.06	0.00	-	0.01	0.00	0.04	0.00	-	0.04

Note: mt = metric tons.

Table C.1-48. Summary of Existing Operational Emissions - MCLB Barstow Training and Range EA

	Annual Emissions (Tons per Year)									
Activity/Source	*VOC*	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO2e (mt)*
Tactical Equipment	0.01	0.05	0.13	0.00	4.14	0.64	13.78	0.00	0.00	12.56
Maintenance Activities										
Aircraft Transit Operations	0.00	0.02	0.10	0.01	0.07	0.07	54.48	0.00	0.00	49.86
Aircraft Range Operations	0.02	0.07	0.02	0.00	0.03	0.02	15.04	0.00	0.00	13.77
Total - Existing Operations	0.03	0.14	0.24	0.01	4.24	0.73	83.30	0.01	0.00	76.19

Note: mt = metric tons.

Table C.1-49. Summary of Proposed Construction Emissions - MCLB Barstow Training and Range EA

	Annual Emissions (Tons per Year)									
Activity/Source	*VOC*	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO2e (mt)*
Year 1										
KD Range Construction Activities	0.17	0.93	3.40	0.00	1.10	0.16	476.52	0.03	0.01	435.44
LZs Construction Activities	0.01	0.07	0.15	0.00	0.69	0.07	18.36	0.00	0.00	16.75
Yermo Range Construction Activities	0.00	0.02	0.04	0.00	0.14	0.01	4.67	0.00	0.00	4.26
Total Year 1	0.18	1.02	3.58	0.00	1.93	0.25	499.55	0.04	0.01	456.45
Year 2										
KD Range Construction Activities	0.04	0.23	0.45	0.00	0.71	0.09	54.16	0.01	0.00	49.38
LZs Construction Activities	0.01	0.08	0.19	0.00	0.69	0.07	22.15	0.01	0.00	20.20
Yermo Range Construction Activities	0.01	0.05	0.07	0.00	0.28	0.03	6.94	0.00	0.00	6.32
Total Year 2	0.06	0.36	0.71	0.00	1.68	0.19	83.24	0.02	0.00	75.91
MDAB Conformity Thresholds	25	NA	25	NA	100	NA	NA	NA	NA	NA

Note: mt = metric tons.

Table C.1-50. Summary of Proposed Operational Emissions - MCLB Barstow Training and Range EA

	Annual Emissions (Tons per Year)									
Activity/Source	*VOC*	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO2e (mt)*
Aircraft Transport Operations	0.09	1.06	3.81	0.19	1.21	1.21	1,448	0.05	0.04	1,325
Aircraft Range Operations	0.17	1.24	6.76	0.25	7.82	2.15	2,001	0.06	0.05	1,831
Maintenance Activities	0.11	0.63	1.03	0.00	0.06	0.06	106	0.02	0.00	97
Ordnance Usages	0.00	0.06	0.00	-	0.01	0.00	0.04	0.00	-	0.04
Personnel/Equipment Transport	0.01	0.04	0.37	0.00	0.00	0.00	52.20	0.00	0.00	52.56
Tactical Equipment	0.85	4.26	10.29	0.01	28.64	4.18	1,131	0.24	0.00	1,031
Total - Proposed Operations	1.23	7.30	22.25	0.45	37.74	7.61	4,737.13	0.38	0.10	4,337
Total - Existing Operations	0.03	0.14	0.24	0.01	4.24	0.73	83	0.01	0.00	76
Proposed minus Existing Operations	1.20	7.16	22.01	0.44	33.51	6.88	4,654	0.37	0.10	4,260
MDAB Conformity Thresholds	25	NA	25	NA	100	NA	NA	NA	NA	NA

Note: mt = metric tons.

Appendix C-2

Record of Non-Applicability

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DRAFT

NAVY RECORD OF NON-APPLICABILITY
FOR CLEAN AIR ACT CONFORMITY

BARSTOW TRAINING AND RANGE
MARINE CORPS LOGISTICS BASE BARSTOW, CALIFORNIA

Prepared for:

U.S. Marine Corps
Marine Corps Logistics Base Barstow, California

Prepared by:
Leidos

November 2015

RECORD OF NON-APPLICABILITY (RONA) FOR CLEAN AIR ACT CONFORMITY

The proposed action falls under the Record of Non-Applicability (RONA) category and is documented with this RONA.

PROPOSED ACTION

Action Proponent: Commander, Marine Corps Logistics Base (MCLB) Barstow

Location: MCLB Barstow, California

Proposed Action Name: Barstow Training and Range

BACKGROUND

The United States Environmental Protection Agency (USEPA) published "Determining Conformity of General Federal Actions to State or Federal Implementation Plans; Final Rule" in the 30 November 1993 Federal Register (FR) (40 Code of Federal Regulations [CFR] Parts 6, 51, and 93). In 2006, the USEPA revised the General Conformity Rule to include de minimis emission levels for particulate matter with a diameter equal to or less than 2.5 microns ($PM_{2.5}$) and its precursors. On 5 April 2010, USEPA finalized more wide-sweeping revisions to the General Conformity Rule (75 FR 17253–17279). The United States Navy (U.S. Navy) published "Clean Air Act General Conformity Guidance" in Appendix F, OPNAVINST 5090.1C dated 30 October 2007. These publications provide guidance on how to document Clean Air Act (CAA) conformity requirements.

Federal regulations state that no department, agency, or instrumentality of the federal government shall engage in, support in any way or provide financial assistance for, license to permit, or approve any activity that does not conform to an applicable State Implementation Plan (SIP). It is the responsibility of the federal agency to determine whether a federal action conforms to the applicable SIP before the action is taken (40 CFR Part 1 51.850[a]).

Federal actions may be exempt from conformity determinations if they do not exceed designated *de minimis* levels for criteria pollutants (40 CFR Part 51.853[b][i]). *De minimis* levels (in tons/year) for the portion of the Mojave Desert Air Basin that encompasses the region affected by the proposed action are listed in Table 1.

Table 1
Conformity De Minimis Levels - Mojave Desert Air Basin Project Region

Criteria Pollutant	De Minimis Level (tons/year)
PM10	100
VOC	25
NOx	25

Notes: PM10 = particulate matter less than 10 microns in diameter
VOC = volatile organic compounds
NOx = nitrogen oxides

Proposed Action and Emissions Summary

Proposed Action Summary: The United States Marine Corps (USMC) proposes to enhance and update operational capabilities of existing training ranges and areas on MCLB Barstow to support combat readiness of USMC operating forces, including tenant, unit, and Marine Air-Ground Task Force-level training, for the First Marine Expeditionary Force. These actions would occur on 1,306 acres (528 hectares) at MCLB Barstow.

The proposed action would include: (1) construction and operation of a Simulated Flight Deck (Landing Helicopter Assault [LHA]/Landing Helicopter Dock [LHD]) and superstructure, construction of a new access road, and improvements to an existing trail to provide access to the LHA/LHD site in the Range West training area; (2) establishment of a rotary wing/tilt-rotor aircraft Landing Zone (LZ) and access roads, new firing lines (700-, 800-, and 900-yard lines) at the Known Distance (KD) Rifle Range, modernization/upgrades to the KD Rifle Range and 100-yard shotgun range, establishment of three designated bivouac areas, a forward arming and refueling point site, and vehicle loading and refueling area, construction of a new tear gas training facility, and upgrades and/or replacement of existing KD Range Complex support facilities within the Range East and KD Range Complex training area; (3) establishment of a vehicle loading and refueling area near the West Gate in the Range Main Supply Route training area; and (4) establishment of a new LZ and access roads and installation of permanent fencing at the Yermo Stables training area. All ground and

aviation training activities would occur on land managed by the USMC within general aviation, unrestricted (Class G) airspace.

Air Emissions Summary: An emissions analysis was conducted as part of the environmental assessment for the proposed action (MCLB Barstow 2015) (documented as Enclosure 1 of this RONA). The results of this analysis show that annual emissions from proposed construction and operational activities would be less than their applicable General Conformity *de minimis* levels (Table 3). Therefore, emissions from the proposed action would show conformity under the CAA, as amended.

Table 3
Estimated Annual Air Pollutant Emissions - General Conformity

Year	Activity	Annual Air Pollutant Emissions (tons/year)		
		VOC	**NOx**	**PM10**
2016	Construction	0.16	3.58	1.93
2017	Construction	0.06	0.71	1.68
2018	Proposed Operations	1.23	22.25	37.74
	Existing Operations	0.03	0.24	4.24
	Proposed minus Existing Operations	**1.20**	**22.01**	**33.51**
General Conformity *de minimis* Level		25	25	100
Exceed Threshold?		No	No	No
Note: Totals may not add due to rounding.				

Affected Air Basin: Mojave Desert Air Basin

Date RONA Prepared: 18 November 2015

Proposed Action Exemptions: The proposed action is exempt because the calculated total emissions are below the *de minimis* levels set forth in the CAA General Conformity Rule.

Attainment Area Status and Emissions Evaluation Conclusion

The proposed action would occur within the portion of the Mojave Desert Air Basin (MDAB) that encompasses MCLB Barstow. This portion of the MDAB is currently classified as in severe nonattainment of the 8-hour ozone (O_3) National Ambient Air

Quality Standard (NAAQS) and in moderate nonattainment for the respirable particulates (PM_{10}) NAAQS. The MDAB is in attainment of the NAAQS for all other criteria pollutants. Therefore, only project emissions of PM_{10} and O_3 (or its precursors, volatile organic compounds [VOCs] and oxides of nitrogen [NO_x]) were analyzed in reference for conformity rule applicability. The annual de minimis threshold levels for this region are 100 tons of PM_{10} and 25 tons of VOC and NO_x.

The USMC concludes that *de minimis* limits for applicable criteria pollutants would not be exceeded due to implementation of the proposed action. Therefore, the USMC concludes that further formal Conformity Determination procedures are not required, resulting in this RONA.

RONA APPROVAL:

Colonel Sekou S. Karega
U.S. Marine Corps
Commanding Officer
Marine Corps Logistics Base Barstow

Date

1. REFERENCES

Marine Corps Logistics Base (MCLB) Barstow. 2015. Public Draft Environmental Assessment Barstow Training and Range, Marine Corps Logistics Base Barstow. November.

United States Department of the Navy (U.S. Navy) - Chief of Naval Operations (CNO). 2007. OPNAVINST 5090.1C CH-3, Appendix F, Clean Air Act General Conformity Guidance. 30 October.

United States Environmental Protection Agency (USEPA). 2015. General Conformity Website: http://www3.epa.gov/airquality/genconform/index.html.

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RONA
ENCLOSURE 1

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Appendix C.1 - Air Emission Calculations - MCLB Barstow Training and Range EA

Table Enc.1-1. Emissions Source Data for KD Range Construction Activities - Year 1 - MCLB Barstow Training and Range EA (page 1 of 2).
Table Enc.1-1. Emissions Source Data for KD Range Construction Activities - Year 1 - MCLB Barstow Training and Range EA (page 2 of 2).
Table Enc.1-2. Emissions Source Data for LZs Construction Activities - Year 1 - MCLB Barstow Training and Range EA
Table Enc.1-3. Emissions Source Data for Yermo Range Construction Activities - Year 1 - MCLB Barstow Training and Range EA
Table Enc.1-4. Construction Equipment Emission Factors - MCLB Barstow Training and Range EA
Table Enc.1-5. Emissions Resulting from KD Range Year 1 Construction Activities - Year 1 - MCLB Barstow Training and Range EA (page 1 of 2)
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Table Enc.1-13. Emissions Resulting from LZs Year 1 Construction Activities - Year 2 - MCLB Barstow Training and Range EA
Table Enc.1-14. Emissions Resulting from Yermo Range Year 1 Construction Activities - Year 2 - MCLB Barstow Training and Range EA
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Table Enc.1-16. Emission Source Data for Existing Tactical Vehicles/Support Equipment - MCLB Barstow Training and Range EA
Table Enc.1-17. Emission Source Data for Proposed Tactical Vehicles/Support Equipment - MCLB Barstow Training and Range EA
Table Enc.1-18. Tactical Vehicles/Support Equipment Emission Factors - MCLB Barstow Training and Range EA
Table Enc.1-19. Fugative Dust Emission Factors for Tactical Vehicles/Support Equipment - Unpaved Road - MCLB Barstow Training and Range EA
Table Enc.1-20. Fugative Dust Emission Factors for Tactical Vehicles/Support Equipment - Paved Road - MCLB Barstow Training and Range EA

Table Enc.1-21. Combustive Emissions Resulting from Existing Tactical Equipment - MCLB Barstow Training and Range EA
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Table Enc.1-48. Summary of Existing Operational Emissions - MCLB Barstow Training and Range EA
Table Enc.1-49. Summary of Proposed Construction Emissions - MCLB Barstow Training and Range EA
Table Enc.1-50. Summary of Proposed Operational Emissions - MCLB Barstow Training and Range EA

	A	B	C	D	E	F	G
1	Table Enc.1-1. Emissions Source Data for KD Range Construction Activities - Year 1 - MCLB Barstow Training and Range EA (page 1 of 2).						
2	*Off-Road Equipment*						
3		*Hp*	*Average Daily*	*Number*	*Hours/*	*Total*	*Total*
4	*Activity/Equipment Type*	*Rating*	*% of Full Throttle*	*Active*	*Day*	*Work Days*	*Hp-Hrs*
5	*Live Fire Ranges Modernization*						
6	Skip Loader	105	50%	1	4	10	2,100
7	*Outdoor Classroom (Shade/Bleachers)*						
8	Skip Loader	105	50%	1	4	2	420
9	*Bivouac Areas*						
10	Grader	220	80%	1	6	7	7,392
11	Front-End-Loader / Backhoe	284	75%	1	4	7	5,964
12	*Range Compound Berm and Hydrological Road Improvements*						
13	Front-End-Loader / Backhoe	284	75%	1	6	10	12,780
14	Crawler Dozer	354	75%	1	6	10	15,930
15	Grader	220	80%	1	6	10	10,560
16	*Improve Parking Lot*						
17	Grader	220	80%	1	6	3	3,168
18	Skip Loader	105	50%	1	4	2	420
19	*Construct 700, 800, 900 Yard Firing Lines*						
20	Skip Loader	105	50%	1	4	15	3,150
21	Front-End-Loader / Backhoe	284	75%	1	6	15	19,170
22	Crawler Dozer	354	75%	1	6	15	23,895
23	*Construct Roads/Access Routes*						
24	Grader	220	80%	2	6	15	31,680
25	Crawler Dozer	354	75%	1	6	15	23,895
26	Front-End-Loader / Backhoe	284	75%	1	6	15	19,170
27	*Surveillence System Installation*						
28	Cherry Picker	80	40%	1	4	1	128
29	Skip Loader	105	50%	1	4	1	210

	A	B	C	D	E	F	G
32	Table Enc.1-1. Emissions Source Data for KD Range Construction Activities - Year 1 - MCLB Barstow Training and Range EA (page 2 of 2).						
33	*On-Road Trucks*						
34		*Vehicle*			*Miles per*	*Total*	*Total*
35	*Activity/Equipment Type*	*Weight*			*Round Trip*	*Trips*	*Miles*
36	*Live Fire Ranges Modernization*						
37	Concrete Truck	26,000			1	5	5
38	Pick-up Truck	5,000			1	20	20
39	Dump Truck	10,300			1	10	10
40	Water Truck	7,500			1	20	20
41	*Outdoor Classroom (Shade/Bleachers)*						
42	Concrete Truck	26,000			1	1	1
43	Dump Truck	10,300			1	4	4
44	Pick-up Truck	5,000			1	10	10
45	Water Truck	7,500			1	4	4
46	*Bivouac Areas*						
47	Dump Truck	10,300			1	14	14
48	Water Truck	7,500			1	30	30
49	Pick-up Truck	5,000			1	14	14
50	*Range Compound Berm and Hydrological Road Improvements*						
51	Water Truck	7,500			1	20	20
52	Dump Truck	10,300			1	10	10
53	Pick-up Truck	5,000			1	20	20
54	Concrete Truck	26,000			1	2	2
55	*Improve Parking Lot*						
56	Water Truck	7,500			1	6	6
57	Pick-up Truck	5,000			1	6	6
58	*700, 800, 900 Yard Line*						
59	Water Truck	7,500			1	30	30
60	Pick-up Truck	5,000			1	30	30
61	Dump Truck	10,300			1	120	120
62	Dump Truck - Import Fill for Berms	33,000			70	1,537	107,590
63	Dump Truck - Import Fill for Pistol/Shotgun Range Berms	33,000			70	129	9,030
64	*Construct Roads/Access Routes*						
65	Water Truck	7,500			4	30	120
66	Pick-up Truck	5,000			1	15	15
67	Dump Truck	10,300			1	20	20
68	*Fugitive Dust*						
69						*Total Work*	*Acres per*
70	*Activity/Equipment Type*					*Days*	*Day*
71	Disturbed Ground					15	5

	A	B	C	D	E	F	G
73	Table Enc.1-2. Emissions Source Data for LZs Construction Activities - Year 1 - MCLB Barstow Training and Range EA						
74	*Off-Road Equipment*						
75		*Hp*	*Average Daily*	*Number*	*Hours/*	*Total*	*Total*
76	*Activity/Equipment Type*	*Rating*	*% of Full Throttle*	*Active*	*Day*	*Work Days*	*Hp-Hrs*
77	*LZ 1 Stablization*						
78	Compactor	125	80%	1	6	1	600
79	Crawler Dozer	354	75%	1	6	5	7,965
80	Front-End-Loader / Backhoe	284	75%	1	6	5	6,390
81	*LZ 2 Stablization*						
82	Compactor	125	80%	1	6	1	600
83	Crawler Dozer	354	75%	1	6	5	7,965
84	Front-End-Loader / Backhoe	284	75%	1	6	5	6,390
85	*On-Road Trucks*						
86		*Vehicle*			*Miles per*	*Total*	*Total*
87	*Activity/Equipment Type*	*Weight*			*Round Trip*	*Trips*	*Miles*
88	*LZ 1 Stablization*						
89	Water Truck	7,500			1	10	10
90	Pick-up Truck	5,000			1	10	10
91	Dump Truck	10,300			1	5	5
92	*LZ 2 Stablization*						
93	Water Truck	7,500			1	10	10
94	Pick-up Truck	5,000			1	10	10
95	Dump Truck	10,300			1	5	5
96	*Fugitive Dust*						
97						*Total Work*	*Acres per*
98	*Activity/Equipment Type*					*Days*	*Day*
99	Disturbed Ground					10	5
100							
101	Table Enc.1-3. Emissions Source Data for Yermo Range Construction Activities - Year 1 - MCLB Barstow Training and Range EA						
102	*Off-Road Equipment*						
103		*Hp*	*Average Daily*	*Number*	*Hours/*	*Total*	*Total*
104	*Activity/Equipment Type*	*Rating*	*% of Full Throttle*	*Active*	*Day*	*Work Days*	*Hp-Hrs*
105	*LZ 2 Access Routes*						
106	Grader	220	80%	1	6	2	2,112
107	Crawler Dozer	354	75%	1	6	2	3,186
108	Front-End-Loader / Backhoe	284	75%	1	6	2	2,556
109	*On-Road Trucks*						
110		*Vehicle*			*Miles per*	*Daily*	*Total*
111	*Activity/Equipment Type*	*Weight*			*Round Trip*	*Trips*	*Miles*
112	*LZ 2 Access Routes*						
113	Water Truck	7,500			1	4	4
114	Pick-up Truck	5,000			1	2	2
115	*Surveillence System Installation*						
116	Pick-up Truck	5,000			1	2	2
117	*Fugitive Dust*						
118						*Total Work*	*Acres per*
119	*Activity/Equipment Type*					*Days*	*Day*
120	Disturbed Ground					2	5

	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Table Enc.1-4. Construction Equipment Emission Factors - MCLB Barstow Training and Range EA												
2		*Fuel*	*Emission Factors*										
3	*Project Year 2016/Source Type*	*Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*	*Units*	*References*
4	Off-Road Equipment - <15 Hp	D	0.93	4.38	4.91	0.01	0.33	0.31	568	0.115	0.000001	g/hp-hr	(1)
5	Off-Road Equipment - 16-24 Hp	D	1.04	4.34	4.97	0.01	0.36	0.34	566	0.132	0.000001	g/hp-hr	(1)
6	Off-Road Equipment - 25-50 Hp	D	1.42	5.67	5.23	0.01	0.45	0.43	563	0.155	0.000001	g/hp-hr	(1)
7	Off-Road Equipment - 51-120 Hp	D	0.64	3.81	5.50	0.01	0.42	0.39	523	0.127	0.000001	g/hp-hr	(1)
8	Off-Road Equipment - 121-175 Hp	D	0.50	3.32	5.19	0.01	0.27	0.25	523	0.123	0.000001	g/hp-hr	(1)
9	Off-Road Equipment - 176-250 Hp	D	0.38	1.58	4.74	0.01	0.17	0.16	526	0.121	0.000001	g/hp-hr	(1)
10	Off-Road Equipment - 251-500 Hp	D	0.32	2.00	4.01	0.00	0.14	0.13	518	0.127	0.000001	g/hp-hr	(1)
11	Off-Road Equipment - 501-750 Hp	D	0.29	1.49	3.61	0.00	0.12	0.12	525	0.113	0.000001	g/hp-hr	(1)
12	Off-Road Equipment - >750 Hp	D	0.35	1.53	5.18	0.00	0.15	0.14	522	0.126	0.000001	g/hp-hr	(1)
13	Heavy On-road Truck - Idle	D	3.15	12.82	67.18	0.07	0.34	0.32	7,143	0.146	0.250	g/hr	(2)
14	Heavy On-road Truck - 5 mph	D	3.94	7.11	27.17	0.03	0.45	0.43	3,438	0.183	0.050	g/mi	(2)
15	Heavy On-road Truck - 25 mph	D	0.66	2.19	10.79	0.02	0.17	0.16	1,996	0.030	0.050	g/mi	(2)
16	Heavy On-road Truck - 55 mph	D	0.24	1.00	8.05	0.01	0.17	0.16	1,545	0.011	0.050	g/mi	(2)
17	Heavy On-Road Trucks - Composite Onsite	D	1.31	3.17	14.07	0.02	0.22	0.21	2,284	0.061	0.050	g/mi	(3)
18	Heavy On-Road Trucks - Composite Offsite	D	0.50	1.55	9.56	0.02	0.18	0.18	1,730	0.023	0.050	g/mi	(4)
19													
20	On-road Pickup Truck - 5 mph	G	0.29	2.14	0.22	0.01	0.05	0.05	938	0.014	0.050	g/mi	(2)
21	On-road Pickup Truck - 25 mph	G	0.04	0.26	0.14	0.00	0.02	0.02	451	0.002	0.050	g/mi	(2)
22	On-road Pickup Truck - 55 mph	G	0.02	0.15	0.15	0.00	0.01	0.01	332	0.001	0.050	g/mi	(2)
23	On-Road Pickup Trucks - Composite Onsite	G	0.09	0.63	0.16	0.01	0.03	0.02	548	0.00	0.05	g/mi	(3)
24	Disturbed Ground - Fugitive Dust	--					27.5	2.8				lbs/acre-day	(5)

25 Notes: (1) Composites developed from Offroad emission factors obtained from CalEEMod for project year 2016 (Environ 2013).

26 (2) On-road emission factors developed from EMFAC2014 (CARB 2014) for project year 2016 for average California T7 construction truck fleet.

27 Units in grams/hr for idle mode and grams/mile for running mode. Although not shown in these calculations, emissions from 15 minutes of idling mode included

28 for each T7 truck round trip.

29 (3) Composite emission factors for onsite travel based on a trip of 80% at 25 mph and 20% at 5 mph.

30 (4) Composite emission factors for offite travel based on a trip of 75% at 55 mph, 20% at 25 mph, and 5% at 5 mph. Units in grams/mile.

31 (5) Units in lbs/acre-day from section 13.2.3 of AP-42 (USEPA 1995). Emissions reduced by 50% from uncontrolled levels to simulate

32 implementation of best management practices (BMPs) for fugitive dust control

	W	X	Y	Z	AA	AB	AC	AD	AE	AF
1	Table Enc.1-5. Emissions Resulting from KD Range Year 1 Construction Activities - Year 1 - MCLB Barstow Training and Range EA (page 1 of 2)									
2	*Off-Road Equipment*									
3		*Total Pounds*								
4	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
5	*Live Fire Ranges Modernization*									
6	Skip Loader	3.0	17.6	25.4	0.0	1.9	1.8	2,420	0.6	0.000
7	*Outdoor Classroom (Shade/Bleachers)*									
8	Skip Loader	0.6	3.5	5.1	0.0	0.4	0.4	484	0.1	0.000
9	Bivouac Areas									
10	Grader	6.1	25.7	77.3	0.1	2.8	2.6	8,573	2.0	0.000
11	Front-End-Loader / Backhoe	4.2	26.3	52.7	0.1	1.9	1.8	6,814	1.7	0.000
12	*Range Compound Berm and Hydrological Road Improvements*									
13	Front-End-Loader / Backhoe	9.0	56.3	112.8	0.1	4.1	3.8	14,602	3.6	0.000
14	Crawler Dozer	11.2	70.2	140.7	0.2	5.1	4.7	18,201	4.5	0.000
15	Grader	8.8	36.7	110.4	0.1	4.0	3.8	12,247	2.8	0.000
16	*Improve Parking Lot*									
17	Grader	2.6	11.0	33.1	0.0	1.2	1.1	3,674	0.8	0.000
18	Skip Loader	0.6	3.5	5.1	0.0	0.4	0.4	484	0.1	0.000
19	*Construct 700, 800, 900 Yard Firing Lines*									
20	Skip Loader	4.4	26.5	38.2	0.0	2.9	2.7	3,630	0.9	0.000
21	Front-End-Loader / Backhoe	13.5	84.5	169.3	0.2	6.1	5.7	21,902	5.4	0.000
22	Crawler Dozer	16.8	105.3	211.0	0.3	7.6	7.1	27,301	6.7	0.000
23	*Construct Roads/Access Routes*									
24	Grader	26.3	110.0	331.1	0.4	12.1	11.3	36,740	8.5	0.000
25	Crawler Dozer	16.8	105.3	211.0	0.3	7.6	7.1	27,301	6.7	0.000
26	Front-End-Loader / Backhoe	13.5	84.5	169.3	0.2	6.1	5.7	21,902	5.4	0.000
27	*Surveillence System Installation*									
28	Cherry Picker	0.2	1.1	1.6	0.0	0.1	0.1	148	0.0	0.000
29	Skip Loader	0.3	1.8	2.5	0.0	0.2	0.2	242	0.1	0.000

	W	X	Y	Z	AA	AB	AC	AD	AE	AF
32	Table Enc.1-5. Emissions Resulting from KD Range Year 1 Construction Activities - Year 1 - MCLB Barstow Training and Range EA (page 2 of 2)									
33	*On-Road Trucks*									
34		*Total Pounds*								
35	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
36	*Live Fire Ranges Modernization*									
37	Concrete Truck	0.2	0.7	3.9	0.0	0.0	0.0	419	0.0	0.014
38	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	24	0.0	0.002
39	Dump Truck	0.4	1.5	7.7	0.0	0.0	0.0	838	0.0	0.029
40	Water Truck	0.8	3.0	15.4	0.0	0.1	0.1	1,675	0.0	0.057
41	*Outdoor Classroom (Shade/Bleachers)*									
42	Concrete Truck	0.0	0.1	0.8	0.0	0.0	0.0	84	0.0	0.003
43	Dump Truck	0.2	0.6	3.1	0.0	0.0	0.0	335	0.0	0.011
44	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	12	0.0	0.001
45	Water Truck	0.2	0.6	3.1	0.0	0.0	0.0	335	0.0	0.011
46	*Bivouac Areas*									
47	Dump Truck	0.5	2.1	10.8	0.0	0.1	0.1	1,173	0.0	0.040
48	Water Truck	1.1	4.4	23.1	0.0	0.1	0.1	2,513	0.1	0.086
49	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	17	0.0	0.002
50	*Range Compound Berm and Hydrological Road Improvements*									
51	Water Truck	0.8	3.0	15.4	0.0	0.1	0.1	1,675	0.0	0.057
52	Dump Truck	0.4	1.5	7.7	0.0	0.0	0.0	838	0.0	0.029
53	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	24	0.0	0.002
54	Concrete Truck	0.1	0.3	1.5	0.0	0.0	0.0	168	0.0	0.006
55	*Improve Parking Lot*									
56	*Water Truck*	0.2	0.9	4.6	0.0	0.0	0.0	503	0.0	0.017
57	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	7	0.0	0.001
58	*Construct 700, 800, 900 Yard Firing Lines*									
59	Water Truck	1.1	4.4	23.1	0.0	0.1	0.1	2,513	0.1	0.086
60	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	36	0.0	0.003
61	Dump Truck	4.5	17.8	92.6	0.1	0.5	0.5	10,052	0.2	0.344
62	Dump Truck - Import Fill for Berms	173.1	969.7	4,475.0	6.3	58.9	56.3	662,837	16.9	16.1
63	Dump Truck - Import Fill for Pistol/Shotgun Range Berms	14.5	81.4	375.6	0.5	4.9	4.7	55,632	1.4	1.4
64	*Construct Roads/Access Routes*									
65	Water Truck	1.4	5.1	25.9	0.0	0.2	0.2	2,966	0.1	0.096
66	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	18	0.0	0.002
67	Dump Truck	0.8	3.0	15.4	0.0	0.1	0.1	1,675	0.0	0.057
68	*Fugitive Dust*									
69		*Total Pounds*								
70	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
71	Disturbed Ground					2,062.5	206.3			

	W	X	Y	Z	AA	AB	AC	AD	AE	AF
73	Table Enc.1-6. Emissions Resulting from LZs Year 1 Construction Activities - Year 1 - MCLB Barstow Training and Range EA									
74	*Off-Road Equipment*									
75		*Total Pounds*								
76	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
77	*LZ 1 Stablization*									
78	Compactor	0.7	4.4	6.9	0.0	0.4	0.3	692	0.2	0.000
79	Crawler Dozer	5.6	35.1	70.3	0.1	2.5	2.4	9,100	2.2	0.000
80	Front-End-Loader / Backhoe	4.5	28.2	56.4	0.1	2.0	1.9	7,301	1.8	0.000
81	*LZ 2 Stablization*									
82	Compactor	0.7	4.4	6.9	0.0	0.4	0.3	692	0.2	0.000
83	Crawler Dozer	5.6	35.1	70.3	0.1	2.5	2.4	9,100	2.2	0.000
84	Front-End-Loader / Backhoe	4.5	28.2	56.4	0.1	2.0	1.9	7,301	1.8	0.000
85	*On-Road Trucks*									
86		*Total Pounds*								
87	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
88	*LZ 1 Stablization*									
89	Water Truck	0.4	1.5	7.7	0.0	0.0	0.0	838	0.0	0.029
90	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	12	0.0	0.001
91	Dump Truck	0.2	0.7	3.9	0.0	0.0	0.0	419	0.0	0.014
92	*LZ 2 Stablization*									
93	Water Truck	0.4	1.5	7.7	0.0	0.0	0.0	838	0.0	0.029
94	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	12	0.0	0.001
95	Dump Truck	0.2	0.7	3.9	0.0	0.0	0.0	419	0.0	0.014
96	*Fugitive Dust*									
97		*Total Pounds*								
98	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
99	Disturbed Ground					1,375.0	137.5			

	W	X	Y	Z	AA	AB	AC	AD	AE	AF
101	Table Enc.1-7. Emissions Resulting from Yermo Range Year 1 Construction Activities - Year 1 - MCLB Barstow Training and Range EA									
102	*Off-Road Equipment*									
103		*Total Pounds*								
104	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
105	*LZ 2 Access Routes*									
106	Grader	1.8	7.3	22.1	0.0	0.8	0.8	2,449	0.6	0.00
107	Crawler Dozer	2.2	14.0	28.1	0.0	1.0	0.9	3,640	0.9	0.00
108	Front-End-Loader / Backhoe	1.8	11.3	22.6	0.0	0.8	0.8	2,920	0.7	0.00
109	On-Road Trucks									
110		*Total Pounds*								
111	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
112	*LZ 2 Access Routes*									
113	Water Truck	0.2	0.6	3.1	0.0	0.0	0.0	335	0.0	0.011
114	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	2	0.0	0.000
115	Surveillence System Installation									
116	Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	2	0.0	0.000
117	*Fugitive Dust*									
118		*Total Pounds*								
119	*Activity/Equipment Type*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
120	Disturbed Ground					275.0	27.5			

	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS
1	Table Enc.1-8. Construction Emissions Summary Table - Year 1 - MCLB Barstow Training and Range EA										
2		*Tons per Year*									
3	*Activity*	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*	*CO2e (mt)*
4	*KD Range Construction Activities*										
5	Live Fire Ranges Modernization	0.00	0.01	0.03	0.00	0.00	0.00	2.7	0.00	0.00	2.46
6	Outdoor Classroom (Shade/Bleachers)	0.00	0.00	0.01	0.00	0.00	0.00	0.6	0.00	0.00	0.57
7	Bivouac Areas	0.01	0.03	0.08	0.00	0.00	0.00	9.5	0.00	0.00	8.71
8	Range Compound Berm and Hydrological Road Improvements	0.02	0.08	0.19	0.00	0.01	0.01	23.9	0.01	0.00	21.77
9	Improve Parking Lot	0.00	0.01	0.02	0.00	0.00	0.00	2.3	0.00	0.00	2.13
10	Construct 700, 800, 900 Yard Firing Lines	0.11	0.64	2.69	0.00	0.04	0.04	392.0	0.02	0.01	358.32
11	Construct Roads/Access Routes	0.03	0.15	0.38	0.00	0.01	0.01	45.3	0.01	0.00	41.31
12	Surveillence System Installation	0.00	0.00	0.00	0.00	0.00	0.00	0.2	0.00	0.00	0.18
13	Disturbed Ground					1.03	0.10				
14	Subtotal	0.17	0.93	3.40	0.00	1.10	0.16	476.5	0.03	0.01	435.44
15	*LZs Construction Activities*										
16	LZ 1 Stablization	0.01	0.03	0.07	0.00	0.00	0.00	9.2	0.00	0.00	8.37
17	LZ 2 Stablization	0.01	0.03	0.07	0.00	0.00	0.00	9.2	0.00	0.00	8.37
18	Disturbed Ground					0.69	0.07				
19	Subtotal	0.01	0.07	0.15	0.00	0.69	0.07	18.4	0.00	0.00	16.75
20	*Yermo Range Construction Activities*										
21	LZ 2 Access Routes	0.00	0.02	0.04	0.00	0.00	0.00	4.67	0.00	0.00	4.26
22	Surveillence System Installation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	Disturbed Ground					0.14	0.01				
24	Subtotal	0.00	0.02	0.04	0.00	0.14	0.01	4.7	0.00	0.00	4.26
25	Total Emissions - Construction Year 1	0.18	1.02	3.58	0.00	1.93	0.25	499.6	0.04	0.01	456.45
26	Note: mt = metric tons.										

Table Enc.1-9. Emissions Source Data for KD Range Construction Activities - Year 2 - MCLB Barstow Training and Range EA (page 1 of 2).

Off-Road Equipment						
Activity/Equipment Type	*Hp Rating*	*Average Daily % of Full Throttle*	*Number Active*	*Hours/ Day*	*Total Work Days*	*Total Hp-Hrs*
Replace 249 (Demo & Replace building)						
Front-End-Loader / Backhoe	284	75%	1	6	2	2,556
Skip Loader	105	50%	1	6	10	3,150
Rifle Range Rest Rooms (Target Area and 600/700)						
Front-End-Loader / Backhoe	284	75%	1	6	5	6,390
Utilities (Water)						
Front-End-Loader / Backhoe	284	75%	1	6	10	12,780
Ditch Witch	64	80%	1	6	5	1,536
Utilities (Electric)						
Front-End-Loader / Backhoe	284	75%	1	6	10	12,780
Ditch Witch	64	80%	1	6	10	3,072
Communication/Data System						
Front-End-Loader / Backhoe	284	75%	1	6	10	12,780
Ditch Witch	64	80%	1	6	10	3,072
Forward Arming and Refueling Point						
Grader	220	80%	1	6	3	3,168
Front-End-Loader / Backhoe	284	75%	1	6	2	2,556
Skip Loader	105	50%	1	6	2	630
Range Operations and Training Facility (2006 EA)						
Water Well Drilling Rig	175	90%	1	8	2	2,520
Grader	220	80%	1	6	2	2,112
Front-End-Loader / Backhoe	284	75%	1	6	10	12,780
Skip Loader	105	50%	1	6	5	1,575
Gas Chamber						
Front-End-Loader / Backhoe	284	0.75	1	6	5	6,390
Skip Loader	105	50%	1	6	2	630
Ditch Witch	64	80%	1	6	2	614

Table Enc.1-9. Emissions Source Data for KD Range Construction Activities - Year 2 - MCLB Barstow Training and Range EA (page 2 of 2).

On-Road Trucks					
Activity/Equipment Type	*Vehicle Weight*		*Miles per Round Trip*	*Total Trips*	*Total Miles*
Replace 249 (Demo & Replace building)					
Pick-up Truck	5,000		1	10	10
Dump Truck	10,300		1	2	2
Rifle Range Rest Rooms (Target Area and 600/700)					
Pick-up Truck	5,000		1	10	10
Dump Truck	10300		1	6	6
Utilities (Water)					
Pick-up Truck	5,000		1	20	20
Water Truck	7,500		1	5	5
Concrete Truck	26,000		1	1	1
Utilities (Electric)					
Pick-up Truck	5,000		1	20	20
Water Truck	7,500		1	5	5
Communication/Data System					
Pick-up Truck	5000		1	20	20
Water Truck	7,500		1	5	5
Forward Arming and Refueling Point					
Pick-up Truck	5,000		1	6	6
Water Truck	7,500		1	4	4
Range Operations and Training Facility (2006 EA)					
Pick-up Truck	5,000		1	20	20
Water Truck	7,500		1	5	5
Concrete Truck	26000		1	1	1
Dump Truck	10,300		5	10	50
Gas Chamber					
Pick-up Truck	5,000		1	10	10
Water Truck	7500		1	5	5
Concrete Truck	26,000		1	1	1
Fugitive Dust					
Activity/Equipment Type				*Total Work Days*	*Acres per Day*
Disturbed Ground				10	5

Table Enc.1-10. Emissions Source Data for LZs Construction Activities - Year 2 -MCLB Barstow Training and Range EA

Off-Road Equipment						
Activity/Equipment Type	*Hp Rating*	*Average Daily % of Full Throttle*	*Number Active*	*Hours/ Day*	*Total Work Days*	*Total Hp-Hrs*
LHA/LHD Stabilization						
Crawler Dozer	354	75%	1	6	10	15,930
Compactor	125	80%	1	6	5	3,000
Front-End-Loader / Backhoe	284	75%	1	6	10	12,780
LHA/LHD Super Structure						
Container Handler	400	80%	1	6	1	1,920
Front-End-Loader / Backhoe	284	75%	1	6	2	2,556
On-Road Trucks						
Activity/Equipment Type	*Vehicle Weight*			*Miles per Round Trip*	*Daily Trips*	*Total Miles*
LHA/LHD Stabilization						
Pick-up Truck	5,000			2	20	40
Water Truck	7,500			2	20	40
Dump Truck	10,300			2	10	20
LHA/LHD Super Structure						
Pick-up truck	5,000			2	4	8
Fugitive Dust						
Activity/Equipment Type					*Total Work Days*	*Acres per Day*
Disturbed Ground					10	5

Table Enc.1-11. Emissions Source Data for Yermo Range Construction Activities - Year 2 - MCLB Barstow Training and Range EA

Off-Road Equipment						
	Hp	*Average Daily*	*Number*	*Hours/*	*Total*	*Total*
Activity/Equipment Type						
Utilities (Water)						
Front-End-Loader / Backhoe	284	75%	1	6	4	5,112
Ditch Witch	64	80%	1	6	2	614
Utilities (Electric)						
Front-End-Loader / Backhoe	284	75%	1	6	4	5,112
Ditch Witch	64	80%	1	6	2	614
On-Road Trucks						
Activity/Equipment Type	*Vehicle Weight*			*Miles per Round Trip*	*Total Trips*	*Total Miles*
Utilities (Water)						
Pick-up Truck	5,000			1	8	8
Water Truck	7,500			1	4	4
Utilities (Electric)						
Pick-up Truck	5,000			1	8	8
Water Truck	7,500			1	4	4
Fugitive Dust						
Activity/Equipment Type					*Total Work Days*	*Acres per Day*
Disturbed Ground					4	5

Table Enc.1-12. Emissions Resulting from KD Range Year 1 Construction Activities - Year 2 - MCLB Barstow Training and Range EA (page 1 of 2)

Off-Road Equipment									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Replace 249 (Demo & Replace building)									
Front-End-Loader / Backhoe	1.8	11.3	22.6	0.0	0.8	0.8	2,920.3	0.7	0.00
Skip Loader	4.4	26.5	38.2	0.0	2.9	2.7	3,630.2	0.9	0.00
Rifle Range Rest Rooms (Target Area and 600/700)									
Front-End-Loader / Backhoe	4.5	28.2	56.4	0.1	2.0	1.9	7,300.8	1.8	0.00
Utilities (Water)									
Front-End-Loader / Backhoe	9.0	56.3	112.8	0.1	4.1	3.8	14,601.7	3.6	0.00
Ditch Witch	2.2	12.9	18.6	0.0	1.4	1.3	1,770.1	0.4	0.00
Utilities (Electric)									
Front-End-Loader / Backhoe	9.0	56.3	112.8	0.1	4.1	3.8	14,601.7	3.6	0.00
Ditch Witch	4.3	25.8	37.2	0.0	2.8	2.7	3,540.3	0.9	0.00
Communication/Data System									
Front-End-Loader / Backhoe	9.0	56.3	112.8	0.1	4.1	3.8	14,601.7	3.6	0.00
Ditch Witch	4.3	25.8	37.2	0.0	2.8	2.7	3,540.3	0.9	0.00
Forward Arming and Refueling Point									
Grader	2.6	11.0	33.1	0.0	1.2	1.1	3,674.0	0.8	0.00
Front-End-Loader / Backhoe	1.8	11.3	22.6	0.0	0.8	0.8	2,920.3	0.7	0.00
Skip Loader	0.9	5.3	7.6	0.0	0.6	0.5	726.0	0.2	0.00
Range Operations and Training Facility (2006 EA)									
Water Well Drilling Rig	2.8	18.4	28.8	0.0	1.5	1.4	2,906.4	0.7	0.00
Grader	1.8	7.3	22.1	0.0	0.8	0.8	2,449.3	0.6	0.00
Front-End-Loader / Backhoe	9.0	56.3	112.8	0.1	4.1	3.8	14,601.7	3.6	0.00
Skip Loader	2.2	13.2	19.1	0.0	1.5	1.4	1,815.1	0.4	0.00
Gas Chamber									
Front-End-Loader / Backhoe	4.5	28.2	56.4	0.1	2.0	1.9	7,300.8	1.8	0.00
Skip Loader	0.9	5.3	7.6	0.0	0.6	0.5	726.0	0.2	0.00
Ditch Witch	0.9	5.2	7.4	0.0	0.6	0.5	708.1	0.2	0.00

Table Enc.1-12. Emissions Resulting from KD Range Year 1 Construction Activities - Year 2 - MCLB Barstow Training and Range EA (page 2 of 2)

On-Road Trucks									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Replace 249 (Demo & Replace building)									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.00
Dump Truck	0.1	0.3	1.5	0.0	0.0	0.0	167.5	0.0	0.01
Rifle Range Rest Rooms (Target Area and 600/700)									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.00
Dump Truck	0.2	0.9	4.6	0.0	0.0	0.0	502.6	0.0	0.02
Utilities (Water)									
Pick-up Truck	0.0	0.1	0.0	0.0	0.0	0.0	17.0	0.0	0.00
Water Truck	0.2	0.7	3.9	0.0	0.0	0.0	418.8	0.0	0.01
Concrete Truck	0.0	0.1	0.8	0.0	0.0	0.0	83.8	0.0	0.00
Utilities (Electric)									
Pick-up Truck	0.0	0.1	0.0	0.0	0.0	0.0	17.0	0.0	0.00
Water Truck	0.2	0.7	3.9	0.0	0.0	0.0	418.8	0.0	0.01
Communication/Data System									
Pick-up Truck	0.0	0.1	0.0	0.0	0.0	0.0	17.0	0.0	0.00
Water Truck	0.2	0.7	3.9	0.0	0.0	0.0	418.8	0.0	0.01
Forward Arming and Refueling Point									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.00
Water Truck	0.2	0.6	3.1	0.0	0.0	0.0	335.1	0.0	0.01
Range Operations and Training Facility (2006 EA)									
Pick-up Truck	0.0	0.1	0.0	0.0	0.0	0.0	17.0	0.0	0.00
Water Truck	0.2	0.7	3.9	0.0	0.0	0.0	418.8	0.0	0.01
Concrete Truck	0.0	0.1	0.8	0.0	0.0	0.0	83.8	0.0	0.00
Dump Truck	0.5	1.8	9.0	0.0	0.1	0.1	1,039.1	0.0	0.03
Gas Chamber									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.00
Water Truck	0.2	0.7	3.9	0.0	0.0	0.0	418.8	0.0	0.01
Concrete Truck	0.0	0.1	0.8	0.0	0.0	0.0	83.8	0.0	0.00
Fugitive Dust									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Disturbed Ground					1,375.0	137.5			

Table Enc.1-13. Emissions Resulting from LZs Year 1 Construction Activities - Year 2 - MCLB Barstow Training and Range EA

Off-Road Equipment									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
LHA/LHD Stabilization									
Crawler Dozer	11.2	70.2	140.7	0.2	5.1	4.7	18,200.7	4.5	0.00
Compactor	3.3	22.0	34.3	0.0	1.8	1.7	3,460.0	0.8	0.00
Front-End-Loader / Backhoe	10.6	44.4	133.6	0.1	4.9	4.5	14,821.1	3.4	0.00
LHA/LHD Super Structure									
Container Handler	1.4	8.5	17.0	0.0	0.6	0.6	2,193.7	0.5	0.00
Front-End-Loader / Backhoe	1.8	11.3	22.6	0.0	0.8	0.8	2,920.3	0.7	0.00
On-Road Trucks									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
LHA/LHD Stabilization									
Pick-up Truck	0.0	0.1	0.0	0.0	0.0	0.0	34.0	0.0	0.00
Water Truck	0.8	3.1	16.1	0.0	0.1	0.1	1,776.1	0.0	0.06
Dump Truck	0.4	1.6	8.0	0.0	0.0	0.0	888.1	0.0	0.03
LHA/LHD Super Structure									
Pick-up truck	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.00
Fugitive Dust									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Disturbed Ground					1,375	138			

Table Enc.1-14. Emissions Resulting from Yermo Range Year 1 Construction Activities - Year 2 - MCLB Barstow Training and Range EA

Off-Road Equipment									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Utilities (Water)									
Front-End-Loader / Backhoe	7.2	42.9	61.9	0.1	4.7	4.4	5,891.3	1.4	0.00
Ditch Witch	0.4	2.7	5.4	0.0	0.2	0.2	702.0	0.2	0.00
Utilities (Electric)									
Front-End-Loader / Backhoe	7.2	42.9	61.9	0.1	4.7	4.4	5,891.3	1.4	0.00
Ditch Witch	0.4	2.7	5.4	0.0	0.2	0.2	702.0	0.2	0.00
On-Road Trucks									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Utilities (Water)									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.00
Water Truck	0.2	0.6	3.1	0.0	0.0	0.0	335.1	0.0	0.01
Utilities (Electric)									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.00
Water Truck	0.2	0.6	3.1	0.0	0.0	0.0	335.1	0.0	0.01
Fugitive Dust									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Disturbed Ground					550.0	55.0			

Table Enc.1-15. Year 1 Construction Emissions Summary Table - Year 2 - MCLB Barstow Training and Range EA

	Total Pounds									
Activity	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*	*CO2e (mt)*
KD Range Construction Activities										
Replace 249 (Demo & Replace building)	0.00	0.02	0.03	0.00	0.00	0.00	3.3	0.00	0.00	2.99
Rifle Range Rest Rooms (Target Area and 600/700)	0.00	0.01	0.03	0.00	0.00	0.00	3.7	0.00	0.00	3.41
Utilities (Water)	0.01	0.04	0.07	0.00	0.00	0.00	8.4	0.00	0.00	7.70
Utilities (Electric)	0.01	0.04	0.08	0.00	0.00	0.00	9.3	0.00	0.00	8.51
Communication/Data System	0.01	0.04	0.08	0.00	0.00	0.00	9.3	0.00	0.00	8.47
Forward Arming and Refueling Point	0.00	0.01	0.03	0.00	0.00	0.00	3.9	0.00	0.00	3.54
Range Operations and Training Facility (2006 EA)	0.01	0.05	0.09	0.00	0.00	0.00	11.1	0.00	0.00	10.09
Gas Chamber	0.00	0.02	0.04	0.00	0.00	0.00	5.1	0.00	0.00	4.69
Disturbed Ground					0.69	0.07				
Subtotal	0.04	0.23	0.45	0.00	0.71	0.09	54.2	0.01	0.00	49.38
LZs Construction Activities										
LHA/LHD Stabilization	0.01	0.07	0.17	0.00	0.01	0.01	19.59	0.00	0.00	17.86
LHA/LHD Super Structure	0.00	0.01	0.02	0.00	0.00	0.00	2.56	0.00	0.00	2.33
Disturbed Ground					0.69	0.07				
Subtotal	0.01	0.08	0.19	0.00	0.69	0.07	22.2	0.01	0.00	20.20
Yermo Range Construction Activities										
Utilities (Water)	0.00	0.02	0.04	0.00	0.00	0.00	3.47	0.00	0.00	3.16
Utilities (Electric)	0.00	0.02	0.04	0.00	0.00	0.00	3.47	0.00	0.00	3.16
Disturbed Ground					0.28	0.03				
Subtotal	0.01	0.05	0.07	0.00	0.28	0.03	6.9	0.00	0.00	6.32
Total Emissions - Construction Year 2	0.06	0.36	0.71	0.00	1.68	0.19	83.24	0.02	0.00	75.91

Note: mt = metric tons.

	A	B	C	D	E	F	G
1	Table Enc.1-16. Emission Source Data for Existing Tactical Vehicles/Support Equipment - MCLB Barstow Training and Range EA						
2	*Source/Equipment Type*	*Number of*	*Annual*	*Miles per*	*Total*		
3		*Vehicles*	*VMT*	*Gallon*	*Gallons*	*Hp*	*Total Hp-Hr*
4	Tactical Vehicles						
5	Medium Tactical Vehicle Replacement	36	3,600	3.85	935	250	18,701
6	High-Mobility Multipurpose Wheeled Vehicle	24	2,400	14.00	171	150	3,429
7	Logistics Vehicle System	-	-	2.00	-	445	-
8	Internally Transportable Vehicle	-	-	14.00	-	71	-
9	M60A1 Bridge Vehicle	-	-	0.33	-		
10	Light Armored Vehicle (Variants)	43	430	5.17	83	275	1,663
11	M88A2 Hercules Recovery Vehicle	-	-	0.33	-		
12	High-Mobility Artillery Rocket System	-	-	3.85	-	330	-
13	Abrams M1A1 Main Battle Tank	-	-	0.33	-		
14	Joint Assault Bridge	-	-	0.33	-		
15	Assault Breacher Vehicle	-	-	0.36	-		
16	Tactical Support Equipment						
17	*Source/Equipment Type*	*Number of*	*Average Hp*	*Hours per*	*Total*		
18		*Vehicles*	*Output*	*Year*	*Hp-Hr*		
19	Medium Crawler Tractor		118		-		
20	Excavator, Combat		295		-		
21	Grader		150		-		
22	Armored Tractor		118		-		
23	D7 Bulldozer		200		-		
24	Armored Backhoe		295		-		
25	Extended Boom Forklift		150		-		
26	Light Capacity Rough Terrain Truck Forklift		110		-		
27	Tractor, Rubber Tired, Articulated Steering		185		-		
28	Notes: Horsepower ratings from LAS MCAGCC FEIS (DON 2012).						

	A	B	C	D	E	F	G
30	Table Enc.1-17. Emission Source Data for Proposed Tactical Vehicles/Support Equipment - MCLB Barstow Training and Range EA						
31	*Source/Equipment Type*	*Number of*	*Annual*	*Miles per*	*Total*		
32		*Vehicles*	*VMT*	*Gallon*	*Gallons*	*Hp*	*Total Hp-Hr*
33	Tactical Vehicles						
34	Medium Tactical Vehicle Replacement	240	5,760	3.85	1,496	250	29,922
35	High-Mobility Multipurpose Wheeled Vehicle	240	5,760	14.00	411	150	8,229
36	Logistics Vehicle System	120	2,880	2.00	1,440	445	28,800
37	Internally Transportable Vehicle	240	5,760	14.00	411	71	8,229
38	M60A1 Bridge Vehicle	2	160	0.33	485		
39	Light Armored Vehicle (Variants)	120	1,920	5.17	371	275	7,427
40	M88A2 Hercules Recovery Vehicle	2	160	0.33	485		
41	High-Mobility Artillery Rocket System	54	864	3.85	224	330	4,488
42	Abrams M1A1 Main Battle Tank	28	1,120	0.33	3,394		
43	Joint Assault Bridge	2	160	0.33	485		
44	Assault Breacher Vehicle	2	160	0.36	444		
45	LVTP-7 Landing Vehicle Tracked Personnel	32	1280	0.57	2,240	525	44,800
46	LVTR-7 Landing Vehicle Tracked Recovery	4	160	0.75	213	400	4,267
47	LVTC-7 Landing Vehicle Tracked Command	4	160	0.75	213	400	4,267
48	Tactical Support Equipment						
49	*Activity/Equipment Type*	*Number of*	*Average Hp*	*Hours per*	*Total*		
50		*Vehicles*	*Output*	*Year*	*Hp-Hr*		
51	Medium Crawler Tractor	8	118	896	105,728		
52	Excavator, Combat	16	295	1,792	528,640		
53	Grader	8	150	896	134,400		
54	Armored Tractor	8	118	896	105,728		
55	D7 Bulldozer	8	200	896	179,200		
56	Armored Backhoe	8	295	896	264,320		
57	Extended Boom Forklift	8	150	896	134,400		
58	Light Capacity Rough Terrain Truck Forklift	8	110	896	98,560		
59	Tractor, Rubber Tired, Articulated Steering	8	185	896	165,760		
60	Notes: Horsepower ratings from LAS MCAGCC FEIS (DON 2012).						

	I	J	K	L	M	N	O	P	Q	R	S
1	Table Enc.1-18. Tactical Vehicles/Support Equipment Emission Factors - MCLB Barstow Training and Range EA										
2	*Source/Equipment Type*	*Emission Factors (Pounds/1000 Gallons)*									*Reference*
3		*ROG*	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	
4	*Tank Vehicles and ABV*										
5	Abrams Tank/Bridge Vehicles	0.06	0.45	118.80	0.51	1.56	1.52	21,054	0.68	0.60	(1)
6	Assault Breacher Vehicle	14.10	101.60	170.88	13.96	1.71	1.57	21,054	0.68	0.60	(2)
7	*Other Tactical Vehicles/TSE*	*Emission Factors (Grams/Horsepower-Hour)*									
8	121-250 Hp	0.50	3.32	5.19	0.01	0.27	0.25	523	0.12	0.00	(3)
9	>250 Hp	0.38	1.58	4.74	0.01	0.17	0.16	526	0.12	0.00	(3)
10	Notes: (1) From LAS MCAGCC FEIS (DON 2012).										
11	(2) FEA for Proposed ABV Action at MCAGCC (2003).										
12	(3) Composites developed from Offroad emission factors obtained from CalEEMod for project year 2016.										
13	(4) GHG Emission Factors for (a) Tank Vehicles and ABVs from General Reporting Protocol, Tables C.3 and C.6 jet fuel (California Climate Action Registry 2009)										
14	and (b) other TV/TSE from OFFROAD2007 Model.										
15											
16	Table Enc.1-19. Fugative Dust Emission Factors for Tactical Vehicles/Support Equipment - Unpaved Road - MCLB Barstow Training and Range EA										
17	*Source/Equipment Type*	*Weight*	*Unpaved Emission Factor (Lb/VMT)*			*%*					
18		*(Tons)*	*PM*	*PM_{10}*	*$PM_{2.5}$*	*Unpaved Travel (1)*					
19	Tactical Vehicles										
20	Medium Tactical Vehicle Replacement	10.0	6.51	1.88	0.29	90%					
21	High-Mobility Multipurpose Wheeled Vehicle	3.0	3.79	1.09	0.17	50%					
22	Logistics Vehicle System	20.0	8.89	2.57	0.39	50%					
23	Internally Transportable Vehicle	3.5	4.06	1.17	0.18	50%					
24	M60A1 Bridge Vehicle	70.0	15.63	4.52	0.69	90%					
25	Light Armored Vehicle (Variants)	14.1	7.60	2.20	0.34	90%					
26	M88A2 Hercules Recovery Vehicle	70.0	15.63	4.52	0.69	90%					
27	High-Mobility Artillery Rocket System	12.0	7.07	2.04	0.31	50%					
28	Abrams M1A1 Main Battle Tank	70.0	15.63	4.52	0.69	90%					
29	Joint Assault Bridge	70.0	15.63	4.52	0.69	90%					
30	Assault Breacher Vehicle	55.0	14.02	4.05	0.62	90%					
31	LVTP-7 Landing Vehicle Tracked Personnel	30.6	10.77	3.11	0.48	90%					
32	LVTR-7 Landing Vehicle Tracked Recovery	30.6	10.77	3.11	0.48	90%					
33	LVTC-7 Landing Vehicle Tracked Command	30.6	10.77	3.11	0.48	90%					
34		*Daily Disturbed*	*Emission Factors lb/arcre-day*			*Operation*					
35	Tactical Support Equipment	*Acreage*	*PM*	*PM_{10}*	*$PM_{2.5}$*	*Days*					
36	Ground Disturbance (2)	1.0	110.0	55.0	5.5	365					
37	Notes: (1) Percentage of unpaved roads from LAS MCAGCC FEIS (DON 2012).										
38	(1) Total Ground Disturbance used to estimate emissions from Tactical Equipment.										

	I	J	K	L	M	N	O
40	Table Enc.1-20. Fugative Dust Emission Factors for Tactical Vehicles/Support Equipment - Paved Road - MCLB Barstow Training						
41	*Source/Equipment Type*	*Weight*	*Paved Emission Factor (Lb/VMT)*			*% Paved*	
42		*(Tons)*	*PM*	*PM_{10}*	*$PM_{2.5}$*	*Travel (1)*	
43	Tactical Vehicles						
44	Medium Tactical Vehicle Replacement	10.0	0.07	0.01	0.002	10%	
45	High-Mobility Multipurpose Wheeled Vehicle	3.0	0.01	0.00	(0.000)	50%	
46	Logistics Vehicle System	20.0	0.20	0.04	0.006	50%	
47	Internally Transportable Vehicle	3.5	0.01	0.00	0.000	50%	
48	M60A1 Bridge Vehicle	70.0	1.32	0.26	0.038	10%	
49	Light Armored Vehicle (Variants)	14.1	0.12	0.02	0.003	10%	
50	M88A2 HERCULES Recovery Vehicle	70.0	1.32	0.26	0.038	10%	
51	High-Mobility Artillery Rocket System	12.0	0.09	0.02	0.002	50%	
52	Abrams M1A1 Main Battle Tank	70.0	1.32	0.26	0.038	10%	
53	Joint Assault Bridge	70.0	1.32	0.26	0.038	10%	
54	Assault Breacher Vehicle	55.0	0.92	0.18	0.027	10%	
55	LVTP-7 Landing Vehicle Tracked Personnel	30.6	0.38	0.07	0.011	10%	
56	LVTR-7 Landing Vehicle Tracked Recovery	30.6	0.38	0.07	0.011	10%	
57	LVTC-7 Landing Vehicle Tracked Command	30.6	0.38	0.07	0.011	10%	
58	Notes: (1) Percentage of paved roads from LAS MCAGCC FEIS (DON 2012).						
59	(2) US EPA 42 13.2.1, sL - 0.1, k(PM10) - 0.016, k(PM2.5) - 0.0024, C(PM10) - 0.00047, C(PM2.5) - 0.00036						

	U	V	W	X	Y	Z	AA	AB	AC	AD
1	Table Enc.1-21. Combustive Emissions Resulting from Existing Tactical Equipment - MCLB Barstow Training and Range EA									
2		*Pounds per Year*								
3	*Activity/Equipment Type*	*ROG*	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*
4	*Tactical Vehicles*									
5	Medium Tactical Vehicle Replacement	15.5	65.0	195.5	0.2	7.1	6.6	21,688	5.0	0.0
6	High-Mobility Multipurpose Wheeled Vehicle	3.8	25.1	39.2	0.0	2.0	1.9	3,954	0.9	0.0
7	Logistics Vehicle System	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
8	Internally Transportable Vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
9	M60A1 Bridge Vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
10	Light Armored Vehicle (Variants)	1.4	12.2	19.0	0.0	1.0	0.9	1,918	0.5	0.0
11	M88A2 Hercules Recovery Vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
12	High-Mobility Artillery Rocket System	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
13	Abrams M1A1 Main Battle Tank	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
14	Joint Assault Bridge	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
15	Assault Breacher Vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
16	Subtotal - Pounds	20.7	102.2	253.8	0.3	10.2	9.5	27,560	6.4	0.0
17	*Tactical Support Equipment*									
18	Medium Crawler Tractor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	Excavator, Combat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	Grader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	Armored Tractor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	D7 Bulldozer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	Armored Backhoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	Extended Boom Forklift	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	Light Capacity Rough Terrain Truck Forklift	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	Tractor, Rubber Tired, Articulated Steering, Multipurpose Vehicles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	Subtotal - Pounds	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	Total Emissions (Pounds)	20.7	102.2	253.8	0.3	10.2	9.5	27,560	6.4	0.0
29										
30	Table Enc.1-22. Fugitive Dust Emissions Resulting from Existing Tactical Vehicles/Support Equipment - MCLB Barstow Training and Range EA									
31		*Pounds per Year*								
32	*Activity/Equipment Type*	*PM_{10}*	*$PM_{2.5}$*							
33	Medium Tactical Vehicle Replacement	6,100	935							
34	High-Mobility Multipurpose Wheeled Vehicle	1,315	201							
35	Logistics Vehicle System	-	-							
36	Internally Transportable Vehicle	-	-							
37	M60A1 Bridge Vehicle	-	-							
38	Light Armored Vehicle (Variants)	851	130							
39	M88A2 Hercules Recovery Vehicle	-	-							
40	High-Mobility Artillery Rocket System	-	-							
41	Abrams M1A1 Main Battle Tank	-	-							
42	Joint Assault Bridge	-	-							
43	Assault Breacher Vehicle	-	-							
44	Ground Disturbance	-	-							
45	Subtotal - Pounds	8,267	1,267							

	U	V	W	X	Y	Z	AA	AB	AC	AD
47	Table Enc.1-23. Total Proposed Tactical Vehicles/Support Equipment Emissions - MCLB Barstow Training and Range EA									
48		*Pounds per Year*								
49	*Activity/Equipment Type*	*ROG*	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*
50	*Tactical Vehicles*									
51	Medium Tactical Vehicle Replacement	24.9	103.9	312.8	0.3	11.4	10.6	34,700	8.0	0.0
52	High-Mobility Multipurpose Wheeled Vehicle	9.1	60.2	94.2	0.1	4.9	4.6	9,490	2.2	0.0
53	Logistics Vehicle System	23.9	100.0	301.0	0.3	11.0	10.2	33,399	7.7	0.0
54	Internally Transportable Vehicle	9.1	60.2	94.2	0.1	4.9	4.6	9,490	2.2	0.0
55	M60A1 Bridge Vehicle	0.0	0.2	57.6	0.2	0.8	0.7	10,208	0.3	0.3
56	Light Armored Vehicle (Variants)	6.2	54.4	85.0	0.1	4.4	4.1	8,566	2.0	0.0
57	M88A2 Hercules Recovery Vehicle	0.0	0.2	57.6	0.2	0.8	0.7	10,208	0.3	0.3
58	High-Mobility Artillery Rocket System	3.7	15.6	46.9	0.1	1.7	1.6	5,205	1.2	0.0
59	Abrams M1A1 Main Battle Tank	0.2	1.5	403.2	1.7	5.3	5.2	71,456	2.3	2.0
60	Joint Assault Bridge	0.0	0.2	57.6	0.2	0.8	0.7	10,208	0.3	0.3
61	Assault Breacher Vehicle	6.3	45.2	75.9	6.2	0.8	0.7	9,357	0.3	0.3
62	LVTP-7 Landing Vehicle Tracked Personnel	37.2	155.6	468.3	0.5	17.1	15.9	51,954	1.5	1.3
63	LVTR-7 Landing Vehicle Tracked Recovery	3.5	14.8	44.6	0.0	1.6	1.5	4,948	0.1	0.1
64	LVTC-7 Landing Vehicle Tracked Command	3.5	14.8	44.6	0.0	1.6	1.5	4,948	0.1	0.1
65	Subtotal - Pounds	127.8	627.0	2,143.5	10.3	67.1	62.8	274,138.5	28.7	4.8
66	*Tactical Support Equipment*									
67	Medium Crawler Tractor	116.8	773.7	1,210.3	1.2	62.9	58.8	121,939	28.6	0.0
68	Excavator, Combat	439.5	1,836.3	5,525.6	6.1	202.1	188.0	613,057	141.0	0.0
69	Grader	111.7	466.9	1,404.8	1.5	51.4	47.8	155,862	35.9	0.0
70	Armored Tractor	87.9	367.3	1,105.1	1.2	40.4	37.6	122,611	28.2	0.0
71	D7 Bulldozer	149.0	622.5	1,873.1	2.1	68.5	63.7	207,816	47.8	0.0
72	Armored Backhoe	219.8	918.2	2,762.8	3.0	101.0	94.0	306,529	70.5	0.0
73	Extended Boom Forklift	148.4	983.5	1,538.5	1.5	80.0	74.8	155,007	36.4	0.0
74	Light Capacity Rough Terrain Truck Forklift	108.9	721.3	1,128.2	1.1	58.6	54.8	113,672	26.7	0.0
75	Tractor, Rubber Tired, Articulated Steering, Multipurpose Vehicles	183.1	1,213.0	1,897.5	1.9	98.6	92.2	191,176	44.8	0.0
76	Subtotal - Pounds	1,565.2	7,902.6	18,446.1	19.6	763.5	711.7	1,987,670	459.9	0.0
77	Total Emissions (Pounds)	1,693.0	8,529.6	20,589.6	29.9	830.6	774.5	2,261,809	488.6	4.8
78	*Calculation of Annual Emissions for Tactical and Support Equipment*									
79	Emission Factor (g/hp-hr) x total Hp-hrs x 1 lb/453.6 g = Annual Emissions (lb/yr)									
80	*Calculation of Abrams Tank/Bridge Vehicles and Assault Breacher Vehicle*									
81	Emission Factor (lbs/1000 gals) x Total Gals x 1 /1000 = Annual Emissions (lb/yr)									

	U	V	W	X	Y	Z	AA	AB
83	Table Enc.1-24. Fugitive Dust Emissions Resulting from Existing Tactical Vehicles/Support Equipment - MCLB Barstow Training and Range EA							
84		*Pounds per Year*						
85	*Activity/Equipment Type*	*PM_{10}*	*$PM_{2.5}$*					
86	Medium Tactical Vehicle Replacement	9,761	1,496					
87	High-Mobility Multipurpose Wheeled Vehicle	3,157	483					
88	Logistics Vehicle System	3,757	575					
89	Internally Transportable Vehicle	3,385	518					
90	M60A1 Bridge Vehicle	654	100					
91	Light Armored Vehicle (Variants)	3,799	582					
92	M88A2 Hercules Recovery Vehicle	654	100					
93	High-Mobility Artillery Rocket System	890	136					
94	Abrams M1A1 Main Battle Tank	4,581	702					
95	Joint Assault Bridge	654	100					
96	Assault Breacher Vehicle	586	90					
97	LVTP-7 Landing Vehicle Tracked Personnel	3,595	551					
98	LVTR-7 Landing Vehicle Tracked Recovery	449	69					
99	LVTC-7 Landing Vehicle Tracked Command	449	69					
100	Ground Disturbance	20,075	2,008					
101	Subtotal - Pounds	56,447	7,582					

	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP
1	Table Enc.1-25. Summary of Emissions from Tactical Vehicles/Support Equipment Emissions - MCLB Barstow Training and Range EA										
2		*Tons per Year*									
3	*Activity/Equipment Type*	*ROG*	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO2e (mt)*
4	*Current*										
5	Tactical Vehicles	0.01	0.05	0.13	0.00	0.01	0.00	13.78	0.00	0.00	12.56
6	Tactical Equipment										
7	Fugative Dust					4.13	0.63				
8	Total Current Activity	0.01	0.05	0.13	0.00	4.14	0.64	13.78	0.00	0.00	12.56
9	*Proposed Equipment*										
10	Tactical Vehicles	0.06	0.31	1.07	0.01	0.03	0.03	137.07	0.01	0.00	125.27
11	Tactical Equipment	0.78	3.95	9.22	0.01	0.38	0.36	993.84	0.23	0.00	905.79
12	Fugative Dust					28.22	3.79				
13	Total Proposed Activity	0.85	4.26	10.29	0.01	28.64	4.18	1,130.90	0.24	0.00	1,031.06
14	Note: mt = metric tons.										

Table Enc.1-26. On-Road Vehicle Data for Personnel/Equipment Transport - MCLB Barstow Training and Range EA

Activity/Equipment Type	*Annual # of Vehicle Round Trips*	*Miles/Round Trip (1)*	*Total Annual Miles*
On-Road Transport			
Buses	232	76	17,685
Tractor-Trailer/Convoyed Vehicles	72	76	5,489

Notes: (1) Equal to distance travelled within the MDAB. Assumes that 33/66% of the trips would originate from the Marine Corps Air Ground Combat Center (29 Palms) and the direction of Los Angeles (via I-15).

Table Enc.1-27. On-Road Vehicle Transport Emission Factors - MCLB Barstow Training and Range EA

Source Type/Activity	*Emission Factors (Grams/Mile)*									*Reference*
	ROG	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH4*	*N2O*	
Urban Bus										
25 MPH	0.63	2.72	13.74	0.02	0.27	0.25	2,444	0.03	0.05	(1)
55 MPH	0.33	1.47	16.64	0.01	0.14	0.13	2,444	0.01	0.05	(1)
Composite Trip (2)	0.39	1.72	16.06	0.02	0.17	0.15	2,444	0.01	0.05	(1)
Heavy Diesel Truck										
25 MPH	0.66	2.19	10.79	0.02	0.17	0.16	1,996	0.03	0.05	(1)
55 MPH	0.24	1.00	8.05	0.01	0.17	0.16	1,545	0.01	0.05	(1)
Composite Trip (2)	0.32	1.24	8.60	0.02	0.17	0.16	1,635	0.01	0.05	(1)

Notes: (1) Onroad emission factors developed from EMFAC2014 (ARB 2014). Units in gms/mile calculated for project year 2016.

(2) Composite trip emission factors based on vehicles that would travel 20% of the time at 25 mph and 80% of the time at 55 mph.

Table Enc.1-28. Total On-Road Vehicle Personnel/Equipment Transport Emissions - MCLB Barstow Training and Range EA

	Pounds per Year									
Equipment Type	*ROG*	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH4*	*N2O*	*CO2e (mt)*
Tactical Vehicles										
Buses	15	67	626	1	6	6	95,289	1	2	95,905
Tractor-Trailer/Convoyed Vehicles	4	15	104	0	2	2	19,788	0	1	19,980
Total Emissions (Pounds)	19	82	730	1	9	8	115,077	1	3	115,885
Total Emissions (Tons)	0.01	0.04	0.37	0.00	0.00	0.00	52.20	0.00	0.00	52.56

Note: mt = metric tons.

	A	B	C	D	E	F	G	H
1	Table Enc.1-29. Emission Source Data for Existing Aircraft Transit Operations - MCLB Barstow Training and Range EA							
2		*Annual*	*Cruising*	*1-Way*	*1-Way w/i*	*Fraction of Route*	*Round Trip Length*	*Round Trip*
3	*Origin/Aircraft Type*	*Sorties*	*Speed (Kts)*	*Distance (NM)*	*MDAB (NM)*	*Below 3,000' AGL*	*within MDAB (NM)*	*Duration (Hrs)*
4	*Base 4 - Dagget NTC*							
5	UH-72	96	90	42	9.10	1.00	23	0.26
6								
7	Table Enc.1-30. Emission Source Data for Proposed Aircraft Transit Operations - MCLB Barstow Training and Range EA							
8		*Annual*	*Cruising*	*1-Way*	*1-Way w/i*	*Fraction of Route*	*Round Trip Length*	*Round Trip*
9	*Origin/Aircraft Type*	*Sorties*	*Speed (Kts)*	*Distance (NM)*	*MDAB (NM)*	*Below 3,000' AGL*	*within MDAB (NM)*	*Duration (Hrs)*
10	*Base 1 - SELF/EAF*							
11	MV-22	269	220	76	62	-	-	-
12	CH-53	77	120	76	62	1.00	124	1.03
13	UH-1	47	90	76	62	1.00	124	1.38
14	AH-1	16	90	76	62	1.00	124	1.38
15	C-130	6	170	76	62	-	-	-
16	*Base 2 - MCAS Miramar*							
17	MV-22	269	220	140	37	-	-	-
18	CH-53	77	120	140	37	1.00	74	0.62
19	C-130	24	170	140	37	-	-	-
20	*Base 3 - MCB CPEN*							
21	MV-22	134	220	112	37	-	-	-
22	CH-53	38	120	112	37	1.00	74	0.62
23	UH-1	26	90	112	37	1.00	74	0.82
24	AH-1	9	90	112	37	1.00	74	0.82
25	C-130	6	170	112	37	-	-	-
26	*Base 4 - Dagget NTC*							
27	C-23	4	170	42	9.1	1.00	23	0.14
28	CH-47	72	120	42	9.1	1.00	23	0.19
29	UH-60	72	90	42	9.1	1.00	23	0.26
30	UH-72	96	90	42	9.1	1.00	23	0.26

	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	Table Enc.1-31. Aircraft Emission Factors for Cruise Mode														
2			*# of*	*Engine*	*Fuel Flow/*	*Pounds/1000 Pounds Fuel(1)*									
3	*Aircraft*	*Engine Type*	*Engines*	*Power Setting*	*Engine (Lb/Hr)*	*VOC*	*CO*	*NOx*	*SO2*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*	*Source of EF*
4	AH-1	T700-GE-401C	2	38% Q - Cruise	425.1	0.56	10.54	5.55	0.40	4.20	4.20	3,216	0.10	0.09	AESO Memo Rpt 9824B (2009)
5	C-23	PT-6A-65AR	2	Military	703.0	1.16	2.11	5.28	0.40	0.70	0.70	3,207	0.10	0.09	EDMS
6	C-130	T56-A-16	4	49% SHP	1,420.0	0.02	0.90	10.93	0.40	3.97	3.97	3,213	0.10	0.09	AESO Memo Rpt 2000-09B (2001)
7	CH-47D	T64-415	2	Military	1,916.0	0.54	2.47	19.14	0.40	1.92	1.92	3,207	0.10	0.09	EPA (1992), p. 185
8	CH-53	T64-GE-416 and -416A	3	70% Q - Cruise	1,488.0	0.15	2.13	8.08	0.40	2.21	2.21	3,096	0.10	0.09	AESO Memo Rpt 9822C (2000)
9	MV-22	T406-AD-400	2	Helo (16°) Cruise	1,530.0	0.01	0.79	11.64	0.40	1.58	1.58	3,213	0.10	0.09	AESO Memo Rpt 9946E, 1/01
10	UH-1	T400-CP-400	2	38% Q - Cruise	692.4	0.13	1.01	5.79	0.40	4.20	4.20	3,207	0.10	0.09	AESO Memo Rpt 9904B (2009)
11	UH-60	T700-GE-401C	2	65% torque	600.0	0.55	6.25	6.40	0.40	4.20	4.20	3,221	0.10	0.09	AESO Memo Rpt No. 9929 Revision A, 11
12	Notes: (1) Emission factors not available for the UH-72 so used data for the UH-1 to estimate emissions from this aircraft.														
13	GHG Emission Factors from General Reporting Protocol, Tables C.3 and C.6 jet fuel (California Climate Action Registry 2009).														

	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK
1	Table Enc.1-32. Existing Aircraft Transit Operations Emissions - MCLB Barstow Training and Range EA									
2		*Pounds per Year*								
3	*Origin/Aircraft Type*	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
4	*Base 4 - Dagget NTC*									
5	UH-72(1)	4.4	34.3	196.7	13.6	142.7	142.7	108,960	3.4	3.0
6	Total	4.4	34.3	196.7	13.6	142.7	142.7	108,960	3.4	3.0
7	Note: (1) No emission factors available for UH-72, UH-1 factors used as closest available alternative.									
8										
9	Table Enc.1-33. Proposed Aircraft Transit Operations Emissions - MCLB Barstow Training and Range EA									
10		*Pounds per Year*								
11	*Origin/Aircraft Type*	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
12	*Base 1 - SELF/EAF*									
13	MV-22	-	-	-	-	-	-	-	-	-
14	CH-53	53.3	756.5	2,869.9	142.1	785.0	785.0	1,099,717	35.7	31.1
15	UH-1	11.7	90.6	519.2	35.9	376.6	376.6	287,600	9.0	7.8
16	AH-1	10.5	197.5	104.0	7.5	78.7	78.7	60,280	1.9	1.6
17	C-130	-	-	-	-	-	-	-	-	-
18	Total	75.4	1,044.7	3,493.1	185.4	1,240.3	1,240.3	1,447,597	46.6	40.6
19	*Base 2 - MCAS Miramar*									
20	MV-22	-	-	-	-	-	-	-	-	-
21	CH-53	31.8	451.5	1,712.7	84.8	468.4	468.4	656,283	21.3	18.6
22	C-130	-	-	-	-	-	-	-	-	-
23	Total	31.8	451.5	1,712.7	84.8	468.4	468.4	656,283	21.3	18.6
24	*Base 3 - MCB CPEN*									
25	MV-22	-	-	-	-	-	-	-	-	-
26	CH-53	15.7	222.8	845.2	41.8	231.2	231.2	323,880	10.5	9.2
27	UH-1	3.8	29.9	171.4	11.8	124.3	124.3	94,945	3.0	2.6
28	AH-1	3.5	66.3	34.9	2.5	26.4	26.4	20,235	0.6	0.6
29	C-130	-	-	-	-	-	-	-	-	-
30	Total	23.1	319.0	1,051.5	56.2	381.9	381.9	439,060	14.1	12.3
31	*Base 4 - Dagget NTC*									
32	C-23	0.9	1.6	4.0	0.3	0.5	0.5	2,440	0.1	0.1
33	CH-47	28.6	130.6	1,012.2	21.2	101.5	101.5	169,601	5.3	4.6
34	UH-60	12.1	138.0	141.3	8.8	92.7	92.7	71,129	2.2	1.9
35	UH-72 (1)	4.4	34.3	196.7	13.6	142.7	142.7	108,960	3.4	3.0
36	Total	46.0	304.5	1,354.2	43.9	337.5	337.5	352,130	11.0	9.6
37	Note: (1) No emission factors available for UH-72, UH-1 factors used as closest available alternative.									

	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW
1	Table Enc.1-34. Summary of Emissions for Aircraft Transit Operations - MCLB Barstow Training and Range EA										
2		*Tons per Year*									
3	*Activity/Equipment Type*	VOC	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e (mt)*
4	*Current Transit Operations*										
5	Base 4 - Dagget NTC	0.00	0.02	0.10	0.01	0.07	0.07	54.48	0.00	0.00	49.86
6	Total Current Activity	0.00	0.02	0.10	0.01	0.07	0.07	54.48	0.00	0.00	49.86
7	*Proposed Transit Operations*										
8	Base 1 - SELF/EAF	0.04	0.52	1.75	0.09	0.62	0.62	723.80	0.02	0.02	662.63
9	Base 2 - MCAS Miramar	0.02	0.23	0.86	0.04	0.23	0.23	328.14	0.01	0.01	300.44
10	Base 3 - MCB CPEN	0.01	0.16	0.53	0.03	0.19	0.19	219.53	0.01	0.01	200.98
11	Base 4 - Dagget NTC	0.02	0.15	0.68	0.02	0.17	0.17	176.07	0.01	0.00	161.15
12	Total Proposed Activity	0.09	1.06	3.81	0.19	1.21	1.21	1,447.54	0.05	0.04	1,325.19
13	Note: mt = metric tons.										

	A	B	C
1	Table Enc.1-35. Emission Source Data for Proposed Aircraft Transport O		
2	*Aircraft Type/Operation*	*Annual Sorties*	
3	*UH-72*		
4	Pad Landing	96	
5			
6	Table Enc.1-36. Emission Source Data for Proposed Aircraft Transport O		
7	*Aircraft Type/Operation*	*Annual Sorties*	
8	*AH-1*		261
9	Stop and Go	96	128
10	Touch and Go	96	128
11	Pad Landing	9	12
12	FCLP	60	80
13	*UH-1*		87
14	Stop and Go	32	128
15	Touch and Go	32	128
16	Pad Landing	3	12
17	FCLP	20	80
18	*MV-22*		2496
19	Stop and Go	960	
20	Touch and Go	960	
21	Pad Landing	64	
22	FCLP	512	
23	*CH53*		732
24	Stop and Go	288	
25	Touch and Go	288	
26	Pad Landing	12	
27	FCLP	144	
28	*UH-72*		
29	Pad Landing	96	
30	*C-130*		
31	Low Level Pass/Drops	36	
32	*CH-47*		72
33	Stop and Go	25	
34	Touch and Go	25	
35	Pad Landing	8	
36	FCLP	14	
37	*UH-60*		72
38	Stop and Go	25	
39	Touch and Go	25	
40	Pad Landing	8	
41	FCLP	14	
42	*C-23*		
43	Low Level Pass/Drops	16	

	E	F	G	H	I	J	K	L	M	N	O	P
1	Table Enc.1-37. Aircraft Combustive Emission Factors - MCLB Barstow Training and Range EA											
2	Mission	Pounds/Opperation(1)										
3	Operation	Fuel (Lb)	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O	Source of EF
4	Aircraft: AH-1, Engines: 2 T700-GE-401C											
5	Stop and Go	61	0.04	0.79	0.32	0.02	0.26	0.26	196	0.01	0.01	AESO Memo 9961, Rev A (2009)
6	Touch and Go	46	0.03	0.54	0.25	0.02	0.19	0.19	149	0.00	0.00	AESO Memo 9961, Rev A (2009)
7	Pad Landing	60	0.03	0.69	0.32	0.02	0.25	0.25	192	0.01	0.01	AESO Memo 9961, Rev A (2009)
8	FCLP	61	0.04	0.79	0.32	0.02	0.26	0.26	196	0.01	0.01	AESO Memo 9961, Rev A (2009)
9	Aircraft: UH-1, Engines: 2 T400-CP-400											
10	Stop and Go	53	0.02	0.25	0.25	0.02	0.22	0.22	169	0.01	0.00	AESO Memo 9962, Rev A (2009)
11	Touch and Go	38	0.01	0.13	0.19	0.02	0.16	0.16	121	0.00	0.00	AESO Memo 9962, Rev A (2009)
12	Pad Landing	49	0.01	0.13	0.25	0.02	0.21	0.21	158	0.00	0.00	AESO Memo 9962, Rev A (2009)
13	FCLP	53	0.02	0.25	0.25	0.02	0.22	0.22	169	0.01	0.00	AESO Memo 9962, Rev A (2009)
14	Aircraft: MV-22, Engines: 2 T406-AD-400											
15	Stop and Go	478	0.01	0.64	5.18	0.19	0.76	0.76	1,537	0.05	0.04	AESO Memo 9965B (2001)
16	Touch and Go	280	0.00	0.19	3.57	0.11	0.44	0.44	899	0.03	0.02	AESO Memo 9965B (2001)
17	Pad Landing	592	0.01	0.29	8.87	0.24	0.94	0.94	1,899	0.06	0.05	AESO Memo 9965B (2001)
18	FCLP	349	0.00	0.22	4.61	0.14	0.55	0.55	1,119	0.04	0.03	AESO Memo 9965B (2001)
19	Aircraft: CH-53, Engines: 3 T64-GE-415											
20	Stop and Go	304	0.40	1.25	2.23	0.12	0.67	0.67	941	0.03	0.03	AESO Memo 9960B (2000)
21	Touch and Go	274	0.13	0.77	2.11	0.11	0.61	0.61	848	0.03	0.02	AESO Memo 9960B (2000)
22	Pad Landing	540	0.52	1.94	4.03	0.22	1.19	1.19	1,672	0.05	0.05	AESO Memo 9960B (2000)
23	FCLP	304	0.40	1.25	2.23	0.12	0.67	0.67	941	0.03	0.03	AESO Memo 9960B (2000)
24	Aircraft: UH-72, Engines: 2 Arriel 1E2 (2)											
25	Idle per Landing (3)	49	0.31	1.40	0.15	0.02	0.21	0.21	155.42	0.00	0.00	AESO Memo 9904, Rev B (2009)
26	Pad Landing	49	0.01	0.13	0.25	0.02	0.21	0.21	158	0.00	0.00	AESO Memo 9962, Rev A (2009)
27	Aircraft: C-130, Engines: 4 T56-A-16											
28	Low Level Pass/Drops (4)	746.67	0.35	1.55	6.09	0.30	2.96	2.96	2,399	0.08	0.07	AESO Memo 2000-10B (2001)
29	Aircraft: CH-47, Engines: 2 T64-GE-415 (5)											
30	Stop and Go	245	0.86	4.68	1.01	0.10	0.48	0.48	774	0.02	0.02	
31	Touch and Go	202	0.56	3.49	0.83	0.08	0.38	0.38	645	0.02	0.02	
32	Pad Landing	240	0.89	4.73	0.99	0.10	0.48	0.48	764	0.02	0.02	
33	FCLP	202	0.56	3.49	0.83	0.08	0.38	0.38	645	0.02	0.02	
34	Aircraft: UH-60, Engines: 2 T700-GE-401C											
35	Stop and Go	180	0.10	1.12	3.01	0.17	1.80	1.80	1,383	0.02	0.02	AESO Memo 9953B (2011)
36	Touch and Go	172	0.10	0.96	1.17	0.07	0.76	0.76	578	0.02	0.02	AESO Memo 9953B (2011)
37	Pad Landing	153	0.08	0.81	1.03	0.06	0.64	0.64	494	0.02	0.01	AESO Memo 9953B (2011)
38	FCLP (6)	181	0.10	0.91	1.23	0.07	0.76	0.76	582	0.02	0.02	AESO Memo 9953B (2011)
39	Aircraft: C-23, Engines: 2 PT-6A-65AR											
40	Low Level Pass/Drops (7)	209.67	0.24	0.67	0.91	0.07	0.13	0.13	573	0.02	0.02	
41	Notes: (1) CH4 and N2O Emission Factors from General Reporting Protocol, Tables C.3 and C.6 jet fuel (California Climate Action Registry 2009).											
42	(2) No emission factors available for UH-72, factors from UH-1 used as closest available alternative.											
43	(3) 10 extra minutes of ground idle added to UH-72 emissions per operational data.											
44	(4) Assumes 10 minutes of flight time for each operation.											
45	(5) No emission factors available for UH-47, factors from CH-46 * 2.53 (total Hp rating ratio) used as surrogates.											
46	(6) No emission factors available for FCLP, factors for mountain pad landing used as surrogates.											
47	(7) Assumes 10 minutes of flight time for each operation.											

	R	S	T	U	V	W	X	Y	Z	AA
1	Table Enc.1-38. Aircraft Fugitive Dust Emission Factors - MCLB Barstow Training and Range EA									
2		*Total Engine Hp*	*Rotor Diameter*	*Disturbed Area*	*U_{10} (m/s)*	*Threshold Friction*	*Friction Velocity*	*P*	*Pounds/LTO (7)*	
3	*Aircraft*	*Rating*	*(Ft) (1)*	*(m^2) (2)*	*(3)*	*Velocity u_t (m/s) (4)*	*u* (m/s) (5)*	*(Gm/m^2) (6)*	*PM10*	*PM2.5*
4	AH-1	3,380	48.0	1,513	32.26	1.70	1.710	0.24	0.41	0.06
5	CH-47	9,466	85.0	4,744	32.54	1.70	1.724	0.65	3.38	0.51
6	CH-53	7,850	79.0	4,098	32.48	1.70	1.721	0.56	2.53	0.38
7	MV-22	12,300	84.0	4,633	32.68	1.70	1.732	0.87	4.43	0.66
8	UH-1N	2,500	48.0	1,513	32.21	1.70	1.707	0.18	0.31	0.05
9	UH-60	3,780	54.0	1,915	32.26	1.70	1.710	0.24	0.52	0.08
10	UH-72	1,476	36.0	851	32.17	1.70	1.705	0.12	0.12	0.02

11 Notes: (1) Due to rotor overlap, actual diameters for CH-47 and MV-22 used in the calculations = 85' and 84', respectively.

12 (2) Equal to 3 times the rotor diameter - the area of disturbance expected from rotary wing aircraft during a desert landing and take-off.

13 (3) Wind speeds at 10 meter level (U_{10}) for the MV-22 based upon wind speeds measured at 1 meter above ground when this aircraft hovered at 20' AGL (Bell Boeing 2008).

14 Equates to equation #5 presented in AP-42 Section 13.2.5 (EPA 2006). This approach assumes that the maximum aircraft downdraft approaches the fastest mile wind speed.

15 Wind speeds for all other aircraft estimated by multiplying U_{10} for the MV-22 times the ratio of the horsepower rating of each aircraft divided by the horsepower rating of the MV-2

16 This approach was taken, as data are not available to adequately estimate the down draft wind speeds for these aircraft, yet aircraft horsepower rating is proportional to

17 potential thrust or the ability of an aircraft to generate down draft.

18 (4) Threshold friction velocity value chosen from values listed for surface types identified in Table 8-3 in the WRAP Fugitive Dust Handbook (Countess Environmental 2006).

19 Data on climatic, soil, and vegetation conditions described in Archaeological and Biological surveys for proposed landing zones (LZs) and observations of

20 dust emissions generated by a CH-46 landing at the existing Canary LZ in Imperial County, CA were used in this selection process (SAIC 2011 and 2012b).

21 (5) Equates to equation #4 presented in AP-42 Section 13.2.5.

22 (6) Equates to equation #3 presented in AP-42 Section 13.2.5.

23 (7) Equal to Disturbed Area times P. These values are annual averages.

24

	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
1	Table Enc.1-39. Existing Aircraft Range Operations Combustive Emissions - MCLB Barstow Training and Range EA									
2	*Mission*	*Pounds per Year*								
3	*Operation*	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
4	Aircraft: UH-72, Engines: 2 Arriel 1E2									
5	Pad Landing	1.0	12.5	24.0	1.9	20.2	20.2	15,162	0.5	0.4
6	Idle	29.4	134.3	14.8	1.9	19.9	19.9	14,920	0.5	0.4
7	Landings - Fugitive Dust					11.1	1.7			
8	Total - Existing Operations	30.4	146.8	38.8	3.8	51.1	41.7	30,083	0.9	0.8

	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
11	Table Enc.1-40. Proposed Aircraft Range Operations Combustive Emissions - MCLB Barstow Training and Range EA									
12	*Mission*	*Pounds per Year*								
13	*Operation*	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
14	*AH-1*									
15	Stop and Go	3.8	75.8	30.7	1.9	25.0	25.0	18,775	0.6	0.5
16	Touch and Go	2.9	51.8	24.0	1.9	18.2	18.2	14,272	0.4	0.4
17	Pad Landing	0.3	6.2	2.9	0.2	2.3	2.3	1,730	0.1	0.0
18	FCLP	2.4	47.4	19.2	1.2	15.6	15.6	11,734	0.4	0.3
19	Landings - Fugitive Dust					106.4	16.0			
20	*UH-1*									
21	Stop and Go	0.6	8.0	8.0	0.6	7.0	7.0	5,396	0.2	0.1
22	Touch and Go	0.3	4.2	6.1	0.6	5.1	5.1	3,862	0.1	0.1
23	Pad Landing	0.0	0.4	0.8	0.1	0.6	0.6	474	0.0	0.0
24	FCLP	0.4	5.0	5.0	0.4	4.4	4.4	3,372	0.1	0.1
25	Landings - Fugitive Dust					26.6	4.0			
26	*MV-22*									
27	Stop and Go	9.6	614.4	4,972.8	182.4	729.6	729.6	1,475,520	46.1	40.2
28	Touch and Go	2.9	182.4	3,427.2	105.6	422.4	422.4	863,040	27.0	23.5
29	Pad Landing	0.6	18.6	567.7	15.4	60.2	60.2	121,536	3.8	3.3
30	FCLP	1.5	112.6	2,360.3	71.7	281.6	281.6	572,928	18.0	15.6
31	Landings - Fugitive Dust					11,065.1	1,659.8			
32	*CH-53*									
33	Stop and Go	115.2	360.0	642.2	34.6	193.0	193.0	271,076	8.8	7.7
34	Touch and Go	37.4	221.8	607.7	31.7	175.7	175.7	244,325	7.9	6.9
35	Pad Landing	6.2	23.3	48.4	2.6	14.3	14.3	20,063	0.7	0.6
36	FCLP	57.6	180.0	321.1	17.3	96.5	96.5	135,538	4.4	3.8
37	Landings - Fugitive Dust					1,850.2	277.5			
38	*UH-72*									
39	Pad Landing	1.0	12.5	24.0	1.9	20.2	20.2	15,162	0.5	0.4
40	Idle	29.4	134.3	14.8	1.9	19.9	19.9	14,920	0.5	0.4
41	Landings - Fugitive Dust					11.1	1.7			
42	*C-130*									
43	Low Level Pass/Drops	12.6	55.6	219.3	10.8	106.7	106.7	86,365	2.7	2.4
44	*CH-47*									
45	Stop and Go	21.5	117.0	25.3	2.5	12.0	12.0	19,355	0.6	0.5
46	Touch and Go	13.9	87.3	20.9	1.9	9.5	9.5	16,129	0.5	0.4
47	Pad Landing	7.1	37.8	7.9	0.8	3.8	3.8	6,112	0.2	0.2
48	FCLP	7.8	48.9	11.7	1.1	5.3	5.3	9,032	0.3	0.2
49	Landings - Fugitive Dust					243.3	36.5			
50	*UH-60*									
51	Stop and Go	2.5	28.0	75.3	4.3	45.0	45.0	34,575	0.5	0.4
52	Touch and Go	2.5	24.0	29.3	1.8	19.0	19.0	14,450	0.4	0.4
53	Pad Landing	0.6	6.5	8.2	0.5	5.1	5.1	3,952	0.1	0.1
54	FCLP	1.4	12.7	17.2	1.0	10.6	10.6	8,148	0.3	0.2
55	Landings - Fugitive Dust					22.0	3.3			
56	*C-23*									
57	Low Level Pass/Drops	3.9	10.7	14.6	1.1	2.1	2.1	9,162	0.3	0.3
58	Total - Proposed Operations	346	2,487	13,512	498	15,636	4,309	4,001,005	125	109

	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX
1	Table Enc.1-41. Summary of Emissions from Tactical Vehicles/Support Equipment Emissions - MCLB Barstow Training and Range EA										
2		*Tons per Year*									
3	*Scenario/Activity*	*ROG*	*CO*	*NO_X*	*SO_X*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e (mt)*
4	*Existing Range Operations*										
5	Combustive Emissions	0.02	0.07	0.02	0.00	0.02	0.02	15.04	0.00	0.00	13.8
6	Fugative Dust					0.01	0.00				
7	Total - Existing Operations	0.02	0.07	0.02	0.00	0.03	0.02	15.04	0.00	0.00	13.8
8	*Proposed Range Operations*										
9	Combustive Emissions	0.17	1.24	6.76	0.25	1.16	1.16	2,000.50	0.06	0.05	1,831.0
10	Fugative Dust					6.66	1.00				
11	Total - Proposed Operations	0.17	1.24	6.76	0.25	7.82	2.15	2,000.50	0.06	0.05	1,831.0
12	Note: mt = metric tons.										

Table Enc.1-42. Equipment Usage Data for Range Maintenance Activities - MCLB Barstow Training and Range EA

Off-Road Equipment						
Activity/Equipment Type	*Hp Rating*	*Average Daily % of Full Throttle*	*Number Active*	*Hours/ Day*	*Total Work Days*	*Total Hp-Hrs*
Road Maintenance						
Grader	220	80%	1	8	4	5,632
Front-End-Loader / Backhoe	284	75%	1	8	4	6,816
Utilities						
Front-End-Loader / Backhoe	284	75%	1	8	3	5,112
Berm Maintenance and Lead Removal						
Skip Loader	105	50%	1	6	2	630
Front-End-Loader / Backhoe	284	75%	1	6	4	5,112
Screening Machine	50	100%	1	6	4	1,200
Crawler Dozer	354	75%	1	6	4	6,372
Firing Line Berm Maintenance						
Crawler Dozer	354	75%	1	6	5	7,965
Front-End-Loader / Backhoe	284	75%	1	6	5	6,390
Post Range Cleaning/Monthly Clean-up						
Skip Loader	105	50%	1	4	5	1,050
Existing Parking Lot						
Grader	220	80%	1	6	2	2,112
Front-End-Loader / Backhoe	284	75%	1	6	2	2,556
Gas Chamber						
NA						
Ready Locker and Facilities						
NA						
Trash, Propane, and Rest Rooms						
NA						
Target Repair						
Cherry Picker	80	40%	1	4	2	256
Range Maintenance & Sustainability (General)						
Bobcat S850	92	50%	1	8	40	14,720
Kubota M135GX	135	50%	1	8	40	21,600
Polaris Ranger ATV	60	50%	4	8	80	76,800
Generator, 7kw	26	75%	1	5	40	3,900
Air Compressor, 25-gallon	7	75%	1	5	40	975

Table Enc.1-43. On-Road Vehicle Usage Data for Range Maintenance Activities - MCLB Barstow Training and Range EA

Activity/Equipment Type	*Vehicle Weight*		*Miles per Round Trip*	*Total Trips*	*Total Miles*
Road Maintenance					
Water Truck	7,500		5	8	40
Pick-up Truck	5,000		5	14	70
Utilities					
Water Truck	7,500		1	3	3
Pick-up Truck	5,000		1	6	6
Berm Maintenance and Lead Removal					
Water Truck	7,500		1	4	4
Pick-up Truck	5,000		1	8	8
Firing Line Berm Maintenance					
Water Truck	7,500		1	10	10
Pick-up Truck	5,000		1	10	10
Post Range Cleaning/Monthly Clean-up					
Pick-up Truck	5,000		5	10	50
Existing Parking Lot					
Water Truck	7,500		1	4	4
Pick-up Truck	5,000		1	4	4
Gas Chamber					
Pick-up Truck	5,000		1	4	4
Ready Locker and Facilities					
Pick-up Truck	5,000		1	10	10
Trash, Propane and Rest Rooms					
Pick-up Truck	5,000		1	10	10
Garbage Truck	36,000		1	52	52
Septic Truck	20,000		5	12	60
Target Repair					
Pick-up Truck	5,000		1	4	4
Range Maintenance & Sustainability (General)					
Pick-up Truck, 2500	7,000		20	104	2,080
Pick-up Truck, 3500	14,000		20	80	1,600
Habitat Monitoring/Maintenance					
Pick-up Truck	5,000		5	8	40

Table Enc.1-44. Equipment Emissions Resulting from KD Range Year 1 Construction Activities - MCLB Barstow Training and Range EA

Off-Road Equipment									
	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Road Maintenance									
Grader	4.7	19.6	58.9	0.1	2.2	2.0	6,531.5	1.5	0.0
Front-End-Loader / Backhoe	4.8	30.0	60.2	0.1	2.2	2.0	7,787.5	1.9	0.0
Utilities									
Front-End-Loader / Backhoe	3.6	22.5	45.1	0.1	1.6	1.5	5,840.7	1.4	0.0
Berm Maintenance and Lead Removal									
Skip Loader	0.9	5.3	7.6	0.0	0.6	0.5	726.0	0.2	0.0
Front-End-Loader / Backhoe	3.6	22.5	45.1	0.1	1.6	1.5	5,840.7	1.4	0.0
Screening Machine	1.7	10.1	14.5	0.0	1.1	1.0	1,382.9	0.3	0.0
Crawler Dozer	4.5	28.1	56.3	0.1	2.0	1.9	7,280.3	1.8	0.0
Firing Line Berm Maintenance									
Crawler Dozer	5.6	35.1	70.3	0.1	2.5	2.4	9,100.3	2.2	0.0
Front-End-Loader / Backhoe	4.5	28.2	56.4	0.1	2.0	1.9	7,300.8	1.8	0.0
Post Range Cleaning/Monthly Clean-up									
Skip Loader	1.5	8.8	12.7	0.0	1.0	0.9	1,210.1	0.3	0.0
Existing Parking Lot									
Grader	1.8	7.3	22.1	0.0	0.8	0.8	2,449.3	0.6	0.0
Front-End-Loader / Backhoe	1.8	11.3	22.6	0.0	0.8	0.8	2,920.3	0.7	0.0
Gas Chamber									
NA	-	-	-	-	-	-	-	-	-
Ready Locker and Facilities									
NA	-	-	-	-	-	-	-	-	-
Trash, Propane, and Rest Rooms									
NA	-	-	-	-	-	-	-	-	-
Target Repair									
Cherry Picker	0.4	2.2	3.1	0.0	0.2	0.2	295.0	0.1	0.0
Range Maintenance & Sustainability (General)									
Bobcat S850	20.8	123.6	178.4	0.2	13.6	12.7	16,963.9	4.1	0.0
Kubota M135GX	23.9	158.1	247.3	0.2	12.9	12.0	24,912.3	5.8	0.0
Polaris Ranger ATV	108.3	645.1	930.6	0.9	70.8	66.4	88,507.1	21.5	0.0
Generator, 7kw	12.2	48.7	44.9	0.1	3.9	3.7	4,844.5	1.3	0.0
Air Compressor, 25-gallon	2.0	9.4	10.5	0.0	0.7	0.7	1,219.9	0.2	0.0

Table Enc.1-45. On-Road Vehicle Emissions Resulting from KD Range Year 1 Construction Activities - MCLB Barstow Training and Range EA

	Total Pounds								
Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*
Road Maintenance									
Water Truck	0.6	1.6	7.9	0.0	0.1	0.1	782.4	0.0	0.0
Pick-up Truck	0.0	0.3	0.0	0.0	0.0	0.0	59.6	0.0	0.0
Utilities									
Water Truck	0.1	0.5	2.4	0.0	0.0	0.0	247.6	0.0	0.0
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0
Berm Maintenance and Lead Removal									
Water Truck	0.2	0.6	3.2	0.0	0.0	0.0	330.2	0.0	0.0
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.0
Firing Line Berm Maintenance									
Water Truck	0.4	1.5	7.9	0.0	0.0	0.0	825.5	0.0	0.0
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.0
Post Range Cleaning/Monthly Clean-up									
Pick-up Truck	0.0	0.2	0.0	0.0	0.0	0.0	42.5	0.0	0.0
Existing Parking Lot									
Water Truck	0.2	0.6	3.2	0.0	0.0	0.0	330.2	0.0	0.0
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0
Gas Chamber									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0
Ready Locker and Facilities									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.0
Trash, Propane and Rest Rooms									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.0
Garbage Truck	2.2	8.0	41.1	0.0	0.2	0.2	4,292.5	0.1	0.1
Septic Truck	0.8	2.5	11.9	0.0	0.1	0.1	1,173.6	0.0	0.0
Target Repair									
Pick-up Truck	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0
Range Maintenance & Sustainability (General)									
Pick-up Truck, 2500	1.0	7.6	0.9	0.0	0.2	0.2	1,769.5	0.0	0.2
Pick-up Truck, 3500	10.9	20.5	80.9	0.1	1.3	1.3	6,102.4	0.1	0.2
Habitat Monitoring/Maintenance									
Pick-up Truck	0.0	1.6	7.9	0.0	0.1	0.1	782.4	0.0	0.0

Table Enc.1-46. Emissions from Maintenance Activities - MCLB Barstow Training and Range EA

	Annual Emissions (Tons per Year)									
Activity	*VOC*	*CO*	*NOx*	*SOx*	*PM10*	*PM2.5*	*CO2*	*CH4*	*N2O*	*CO2e (mt)*
All Ranges										
Road Maintenance	0.01	0.03	0.06	0.00	0.00	0.00	8	0.00	0.00	7
Utilities	0.00	0.01	0.02	0.00	0.00	0.00	3	0.00	0.00	3
Berm Maintenance and Lead Removal	0.01	0.03	0.06	0.00	0.00	0.00	8	0.00	0.00	7
Firing Line Berm Maintenance	0.01	0.03	0.07	0.00	0.00	0.00	9	0.00	0.00	8
Post Range Cleaning/Monthly Clean-up	0.00	0.00	0.01	0.00	0.00	0.00	1	0.00	0.00	1
Existing Parking Lot	0.00	0.01	0.02	0.00	0.00	0.00	3	0.00	0.00	3
Gas Chamber	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0
Ready Locker and Facilities	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0
Trash, Propane and Rest Rooms	0.00	0.01	0.03	0.00	0.00	0.00	3	0.00	0.00	3
Target Repair	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0
Range Maintenance & Sustainability (General)	0.09	0.51	0.75	0.00	0.05	0.05	72	0.02	0.00	66
Habitat Monitoring/Maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0
Total	0.11	0.63	1.03	0.00	0.06	0.06	106	0.02	0.00	97

Note: mt = metric tons.

Appendix D

Biological Resources

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Appendix D-1

Biological Resources Survey Report

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FINAL
Biological Resources Survey Report for Barstow Training and Range Environmental Assessment
Marine Corps Logistics Base Barstow
San Bernardino County, California

Prepared for:
Marine Corps Logistics Base
Barstow, California

Prepared by:
Leidos
5464 Carpinteria Ave., Suite K
Carpinteria, California 93013

June 2015

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Final Biological Resources Survey Report for Barstow Training and Range Environmental Assessment, Marines Corps Logistics Base Barstow, San Bernardino County, California

Prepared for:

Marine Corps Logistics Base
Barstow, CA

Under Contract to:

U.S. Department of the Navy
Naval Facilities Engineering Command Southwest
1220 Pacific Highway, Building 1 CIPT San
Diego, CA 92132-5190
Phone: (619) 532-3844
Point of Contact: Jesse Martinez

Prepared by:

5464 Carpinteria Avenue, Suite K
Carpinteria, California 93013

June 2015

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Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
CalIPC	California Invasive Plant Council
CDFW	California Department of Fish and Wildlife
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CRPR	California Rare Plant Rank
EA	Environmental Assessment
GPS	Global Positioning System
I MEF	First Marine Expeditionary Force
KD	Known Distance
LHA	Landing Helicopter Assault
LHA/LHD	Simulated Flight Deck
LHD	Landing Helicopter Dock
LZ	Landing Zone
MAGTF	Marine Air-Ground Task Force
MCLB	Marine Corps Logistics Base
NEPA	National Environmental Policy Act
ROW	right-of-way
U.S.	United States
USFWS	United States Fish and Wildlife Service
USMC	United States Marine Corps

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1 Introduction

1.1 Overview

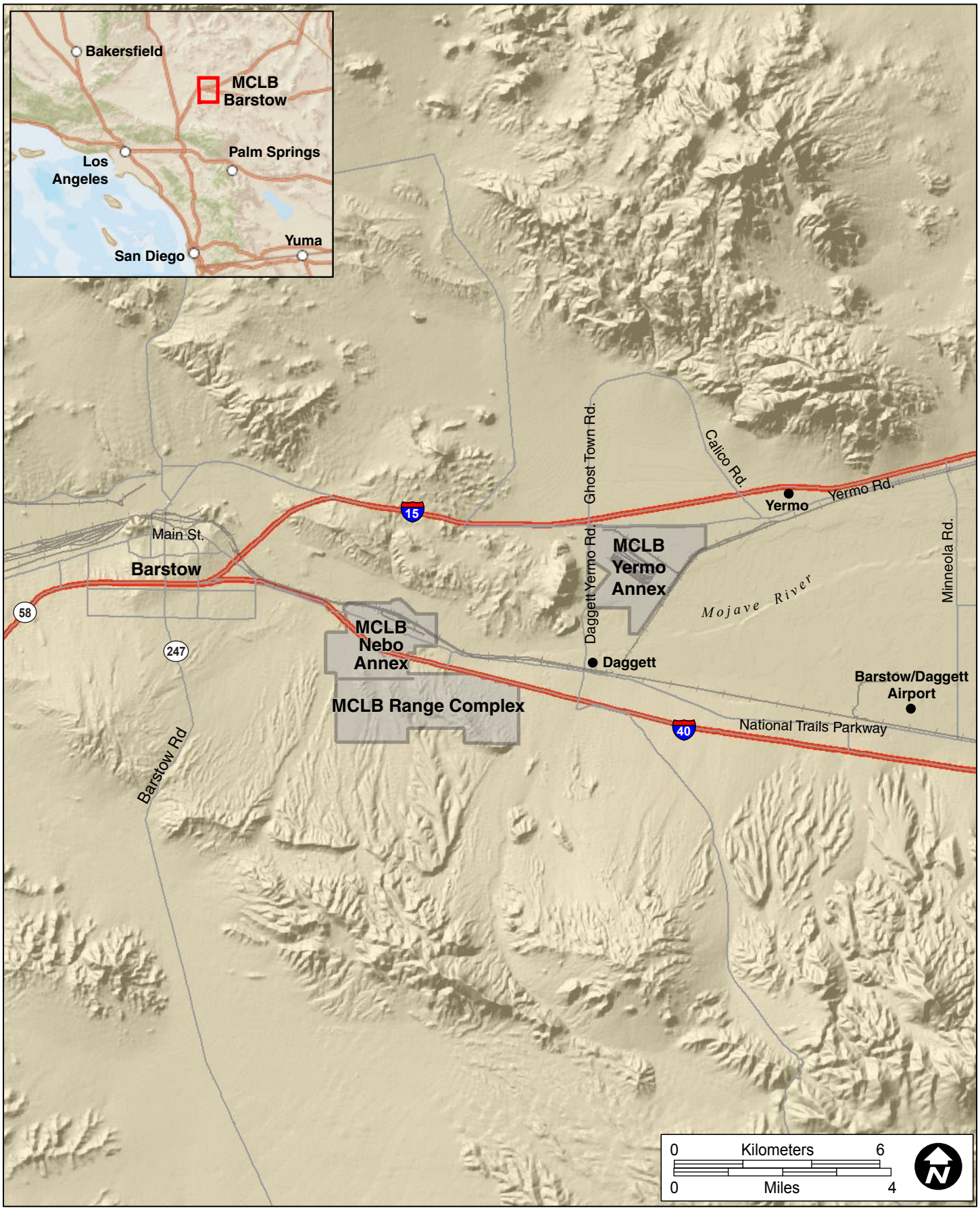
Leidos scientists conducted botanical and general wildlife surveys in October 2013, April 2014, December 2014, and April 2015, in support of the National Environmental Policy Act (NEPA) and Endangered Species Act (ESA) compliance for the Barstow Training and Range Environmental Assessment (EA), Marine Corps Logistics Base (MCLB) Barstow, California (hereinafter "proposed action"). The proposed action is located on MCLB Barstow, which is in western San Bernardino County, California, approximately 3.5 miles (6 kilometers) east of the City of Barstow (Figure 1.1). MCLB Barstow encompasses approximately 5,400 acres (2,185 hectares) and is separated into three parcels: Nebo Annex; Range Complex; and Yermo Annex. The project footprint is located on the Range Complex and Yermo Annex.

The United States Marine Corps (USMC) is proposing to enhance and update operational capabilities of existing training ranges and areas, including establishing general aviation maneuver areas and designating rotary wing/tilt-rotor Landing Zones (LZs) and a Simulated Flight Deck (Landing Helicopter Assault [LHA] or Landing Helicopter Dock [LHD]) site to accommodate components of regional Marine Air-Ground Task Force (MAGTF) training activities (Figure 1.1). The project footprint is located in the western plain of the Mojave Desert and has elevations ranging from 1,970 to 2,464 feet (601 to 751 meters) above mean sea level. The total survey area is approximately 1,306 acres (528 hectares). The botanical and wildlife surveys were conducted on 1 to 4 October 2013, 21 to 23 April 2014, 9 to 11 December 2014, 27 April to 1 May 2015, and 26 to 30 May 2015. The following report presents the results of the surveys, and focuses on general habitat assessments and identification of the potential for special interest plants and wildlife species and their habitat.

MCLB Barstow is known to support sensitive wildlife species, which includes Agassiz's desert tortoise (*Gopherus agassizii* [federally listed as threatened]) (Walde 2007, 2012). Historically, the desert tortoise has been documented on MCLB Barstow and is currently known to have the highest densities on the Range Complex (Walde 2007, 2012). Desert tortoise critical habitat occurs along the southern boundary of the Range Complex (refer to Section 4.5.2 for additional information on desert tortoise). Willow flycatchers have been documented on the Nebo Annex in riparian habitat (Lovio 2006); however, they were not verified to be southwestern willow flycatcher *(Empidonax traillii extimus* [federally listed as endangered]) and evidence of local breeding was inconclusive (Lovio 2006). The state of California considers any subspecies of willow flycatcher (*Empidonax traillii*) to be endangered. No federally listed plant species are known to occur on MCLB Barstow.

1.2 Organization of the Report

This report is organized to provide both a summary of the overall results and detailed information specific to each survey area. Section 2 presents a brief project description. Section 3 details the pre-survey data search and methodology followed for botanical and wildlife surveys and the vegetation and wildlife habitat assessment. Section 4 discusses the overall results and findings for all areas surveyed. Section 5 presents a site-by-site description of the survey areas, including a habitat assessment, identification of the presence or potential for sensitive plant species and wildlife species, other regulatory considerations, and photographs. Section 6 provides summary and general conclusions. The appendices include comprehensive lists of plant (Appendix A) and wildlife species (Appendix B) observed during the surveys, tables of special status plants (Appendix C) and special status wildlife species (Appendix D) that could potentially occur within the survey area, lists of reptiles and amphibians for MCLB Barstow Centro (Appendix E), a United States Fish and Wildlife Service (USFWS) letter, *Species List Request for Threatened or Endangered Species that Occur within the Boundaries of the U.S. Marine Corps Logistics Base, Barstow, San Bernardino County, California* (Appendix F), and the Federal Noxious Weed List (Appendix G).



Location of Marine Corps Logistics Base Barstow
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE 1.1

2 Project Description and Survey Area

2.1 Project Description

The proposed action would enhance and integrate independent and combined ground and aviation training on MCLB Barstow, California. The proposed action would update operational capabilities of existing training areas and ranges on MCLB Barstow to support combat readiness of USMC operating forces, including tenant, unit, and MAGTF-level training, in support of the First Marine Expeditionary Force (I MEF). Depending on the specific mission, ground training could range from a single company commander conducting maneuvers with three infantry platoons to battalion or larger headquarters/command post training (300 personnel), with integrated air and logistics support. All the training ranges and areas would support general aviation maneuver areas and designated LZs, including an LHA/LHD site. Aircraft would be allowed to land anywhere within the general aviation areas.

Three new aircraft landing areas – two proposed LZs and an LHA/LHD – and access routes/trails and roads to these landing areas would be established to support aviation training operations. The designated LZs would consist of an approximately 300-foot by 300-foot (91-meter by 91-meter) (i.e., 90,000-square-foot [8,361-square-meter]) landing area (i.e., where the aircraft would physically land). The proposed LZs would be rough graded/leveled and stabilized (e.g., application of dust palliatives [e.g., polymer emulsion or synthetic fluid]) to reduce impacts from dust and debris. The LHA/LHD would be constructed as an approximately 850-foot by 150-foot (259-meter by 46-meter) landing platform that would resemble an amphibious assault ship deck. All LZs and the LHA/LHD would include a 350-foot (107-meter) buffer area to account for aircraft rotor wash.

Proposed improvements to existing access routes/trails and construction of new access roads to the LZs and LHA/LHD site would be required to support tactical aviation and ground training activities. All new access roads would be 12-feet to 18-feet (3.7-meters to 5.5-meters) wide and rough-graded and leveled. Ground disturbance (i.e., digging) associated with the new access roads would not exceed 18 inches (46 centimeters). Inspection and maintenance of all access roads/routes in the project footprint would occur twice a year (i.e., before and after the rainy season) and on an as needed, emergency basis to fix any issues.

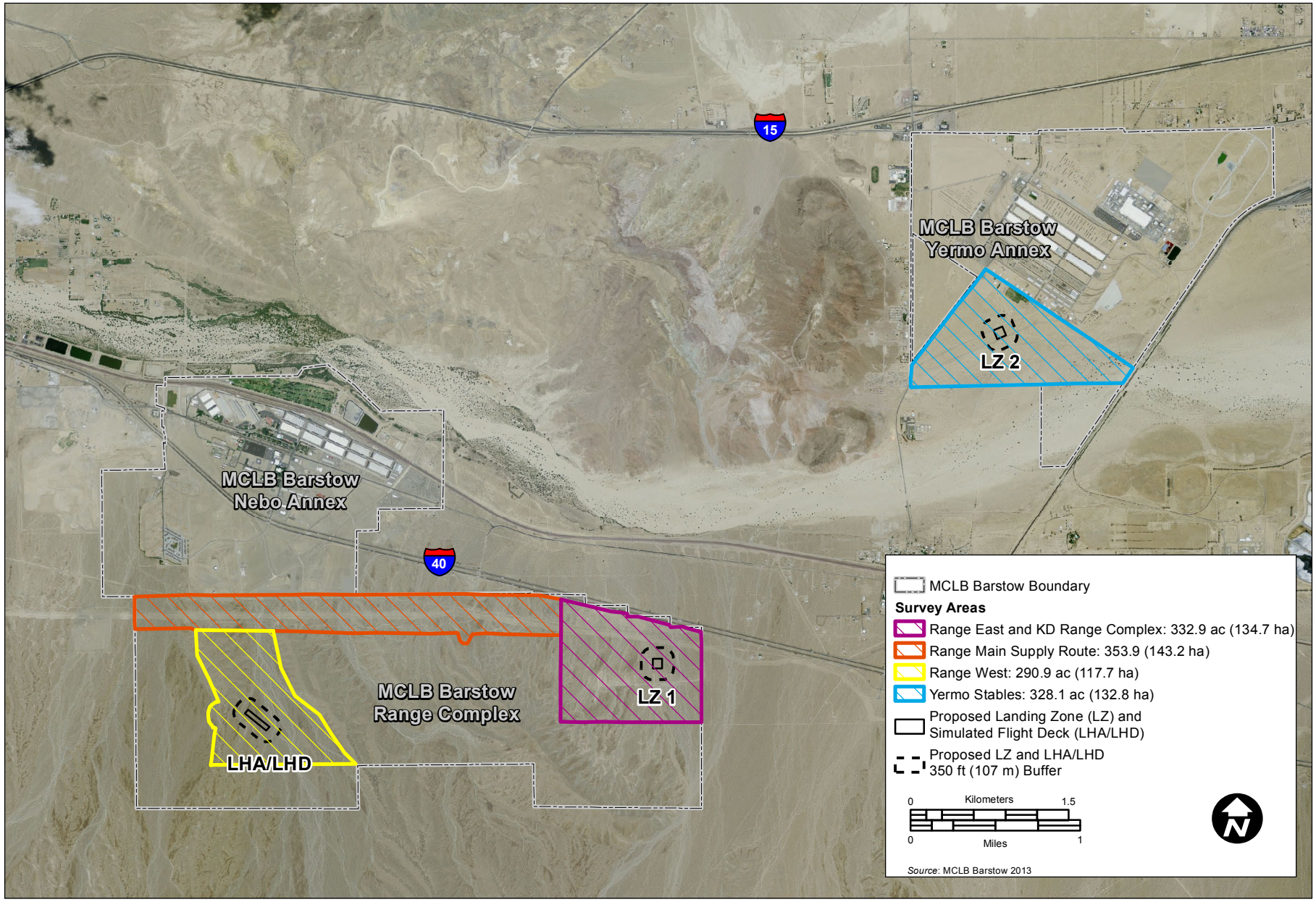
2.2 Survey Area

For the purpose of this report, the project footprint is separated into four survey areas: (1) Range West; (2) Range East and KD Range Complex; (3) Range Main Supply Route; and (4) Yermo Stables (Table 2.1 and Figure 2.1). Table 2.1 provides the elevation and size for each survey area.

Table 2.1. Elevation and Size of Survey Area on Marine Corps Logistics Base, Barstow

Survey Area	Elevation minimum (feet [meters])*	Elevation maximum (feet [meters])*	Size (acres [hectares])
Range East and KD Range Complex	2,118 (646)	2,262 (689)	333 (135)
Range West	2,236 (682)	2,464 (751)	291 (118)
Range Main Supply Route	2,102 (640)	2,358 (719)	354 (143)
Yermo Stables	1,970 (721)	1,984 (605)	328 (133)

Notes:
* Elevation above mean sea level.



Biological Survey Area
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
2.1

3 Methods

3.1 Data Search

Prior to conducting field surveys, California Natural Diversity Database (CNDDB) queries were performed by United States Geological Survey (USGS) quadrangle using RareFind 5, a computerized inventory from the California Department of Fish and Wildlife (CDFW) of California's rare species and natural habitats that is updated monthly (CDFW 2015). The CNDDB data query includes sensitive species listed under the ESA and/or the State of California Endangered Species Act (CESA) that have been documented within a 5-mile (8-kilometer) radius of the survey area. The California Native Plant Society (CNPS 2015) and CalFlora (CalFlora 2015) websites were also accessed for information on plant species of interest, such as life-form, habitat, elevation, and blooming season. Natural history accounts for special status species of interest and wildlife species were obtained from various websites, including the CDFW (2015a, 2015b, 2015c), NatureServe (NatureServe 2015), and CalHerps (2015). A recent list of herpetofauna expected to occur on MCLB Barstow was reviewed (personal communication Lovich 2013 [refer to Appendix E]). A letter was also sent to the USFWS requesting information on federally listed endangered and threatened species, as well as proposed and candidate species and critical habitat that may occur within the vicinity of the survey area (Appendix F). Additional information was obtained from the MCLB Barstow baseline desert tortoise survey reports (Walde 2007, 2012).

3.2 Floristic Surveys

Floristic surveys were conducted on the survey area by Leidos botanists Tom Mulroy, Ph.D., Tara Schoenwetter, Ph.D., Lauren Brown, and Joel Degner on 1 to 4 October 2013, 22 to 25 April 2014, 9 to 11 December 2014, and 21 to 24 April 2015. Additional incidental surveys were conducted on 27 April to 1 May 2015 and 26 to 31 May 2015. The areas were surveyed by walking systematic meandering transects throughout the survey area. Biologists walked at an equal distance apart (approximately 50 feet [15 meters]) for complete visual coverage. Individuals walked parallel transects and meandered from the transect line to check out points of interest (e.g., potential habitat for sensitive species, burrows, nests, and unknown plants or wildlife species). Surveys were conducted during daylight hours from approximately 0700 to 1800.

During the floristic surveys, each species encountered was identified to a taxonomic level necessary to determine if it was a species of interest. Surveys were not always conducted during the optimal time to capture spring flowering annual plants in bloom, but any suitable habitat for special status plants was documented. Summer flowering plants were evident and identifiable at the time of the October 2013 survey, and few fall or summer annuals were evident during the April 2014 and December 2014 surveys (likely due to drought conditions in 2013 – 2014). In 2015, some spring annuals were evident though the vegetation was very dry due to the drought conditions.

To obtain more detailed information on the habitats within the survey area, data were collected on the spatial distribution and diversity of plants across different geomorphic (i.e., landform) types in Spring 2014 and 2015. Within the survey area vegetation data were collected using quadrats 65 feet by 65 feet (20 meters by 20 meters). A total of 14 quadrats were randomly chosen with an emphasis on choosing different geomorphic settings that provide potential suitable habitat for desert tortoise, which generally include areas within Creosote bush–white bursage scrub. Three quadrats within each geomorphic setting (e.g., rocky hillslope, low terrace, desert wash, and desert pavement) were inventoried. Twelve quadrats were located on the Range Complex and two within Yermo Stables. At each quadrat data collected included: soil type; aspect of quadrat; visual estimate of percent cover of shrubs, annuals, and bare ground; species composition (shrubs and annual species present); total number of

shrubs present (for each species); shrub height; shrub width;, and other notable observations. Data analyses included shrub density per hectare, shrub height, shrub width, and number of species (= species richness) for shrubs and annual plants within different geomorphic settings.

Field data were collected using the hand-held Trimble GeoXT 2005 Global Positioning System (GPS) with sub-meter accuracy. Plant nomenclature follows *The Jepson Manual: Vascular Plants of California, Second Edition* (Baldwin et al. 2012). Vegetation categories follow *A Manual of California Vegetation* (Sawyer et al. 2009). An alternative category defined by Leidos was assigned to those areas that could not be described according to the Sawyer et al. (2009) classification system. This additional classification system was based on topographic features and disturbance patterns, and used similar techniques and categories as Malusa (2012), which incorporates topographic and landscape features when defining vegetation categories.

3.3 Wildlife Reconnaissance Surveys

Wildlife surveys were conducted in the Range East and KD Range Complex, Range West, Range Main Supply Route, and Yermo Stables survey areas. Each area was surveyed in conjunction with the vegetation surveys and followed the same methodology for walking systematic, meandering transects and recording field data. In addition, nighttime surveys were conducted on 1 and 3 October 2013, which consisted of driving one of the existing utility right-of-way (ROW) access routes in the Range Main Supply Route and dirt roads within Yermo Stables after dark and using spotlights to locate any wildlife species. Temperature and wind speed were recorded at the start and end of each survey. Subsequent nighttime surveys were not completed in April and December 2014 because nighttime temperatures were too cold (i.e., below 70 degrees Fahrenheit (°F), (21 Celsius [°C]). Nighttime surveys were not conducted in 2015 due to Basewide herpetological and mammal inventories being conducted by Tierra Data (personal communication, Stephanie White 2015). All species or species signs (e.g., scat, burrow, carcass, tracks, and nest) encountered were identified to determine their association with an animal species of interest, and any suitable habitat for animal species of special status was documented.

Protocol surveys for special status wildlife species were not conducted during these surveys. For those areas where suitable habitat for special status wildlife species was identified, subsequent protocol surveys for desert tortoise were conducted in October 2013, April 2015, and May 2015. The results of these surveys are provided in a separate report (Leidos 2014, 2015a).

4 Results: Description of Study Area

This section presents general information about the project footprint. Detailed descriptions of the biological resources at each survey area are presented in Section 5.

4.1 Geography, Climate, and Soils

4.1.1 Geography

MCLB Barstow is located on the western plain of the Mojave Desert adjacent to the Mojave River (Figure 1.1). The Mojave Desert is a large, wedge-shaped, alluvial-filled basin lying between the Garlock Fault on the north and the San Andreas Fault on the south. It is bounded by the Transverse Ranges to the southwest and by the Tehachapi Mountains and the southern Sierra Nevada to the northwest. To the east are the Colorado River, northwestern Arizona, and Las Vegas, Nevada (Schoenherr 1992). There are many types of landforms including broad alluvial fans, old desiccated terraces, playas, and isolated mountain ranges of diverse geologic nature (Tugel and Woodruff 1986). The western Mojave is

considered part of the high desert with elevations that range from 2,000 to 4,000 feet (610 to 1,219 meters).

4.1.2 Climate

The Mojave Desert is the northernmost "hot" desert in North America, occurring between the cold-steppe of the Great Basin and the subtropical Sonoran Desert. MCLB Barstow experiences an arid desert climate characterized by hot, dry summers, warm springs and autumns, and mild winters. The area has mean summer temperatures of 77 to 102°F, (25 to 39 [°C]). Temperatures fluctuate throughout a 24-hour period with high temperatures during the day and cool temperatures at night, and daytime and nighttime temperatures varying as much as 77°F (25°C) (Beck and Haase 1974). Precipitation occurs mostly in the winter, but there are occasional summer thunderstorms. Yearly rainfall is low, ranging from 3 to 7 inches (8 to 18 centimeters).

4.1.3 Geology and Soils

The Mojave is characterized by low, isolated hills and mountain ranges, separated by expanses of basins and valleys (MCLB Barstow 2005). The Calico Mountains, located north of MCLB Barstow, are composed primarily of late Cenozoic era rocks, overlain and underlain by multi-colored, extrusive igneous rocks, which range from yellow-white to red (Hart 1987). Middle Miocene calcareous clays of the Barstow Formation also exist in the area. The highly dissected alluvial fans of the immediate region of MCLB Barstow are late Pleistocene Epoch in origin and have the appearance of very low, undulating hills (Strudwick 1999).

The project footprint occurs just south of the Calico Mountains, and is located in the west-northwest portion of the Lake Manix Basin. Throughout the region cryptocrystalline, basalt, rhyolite, and felsite outcrops, as well as secondary cobble deposits, occur (Strudwick 1999). The present conditions of the region surrounding MCLB Barstow are characterized by geological layering of sediment and rocks. Exposed bedrock in the area is generally sedimentary and volcanic in origin. Dry washes are common features in the landscape.

Older soils derived from mixed sources occur on the majority of the Range Complex especially on the alluvial fans and hills. These soil types include Nebona-Cuddback and Typic Haplagrids-Yermo Complexes (MCLB Barstow 2005). They may support desert pavement of varnished gravel and cobbles on their surfaces. Soils at the Yermo Annex are typically immature, low in organic material, and of the Cajon sand soil type (MCLB Barstow 2005).

4.2 Hydrology and Aquatic Resources

The project footprint is located within the Mojave River watershed, which encompasses approximately 4,500 square miles (11,654 square kilometers) within San Bernardino County. The Mojave River originates in the San Bernardino Mountains; the Mojave River flows north past Victorville then east through Barstow and terminates at Soda Lake, a distance of about 120 miles (193 kilometers). The section of the Mojave River that runs through MCLB Barstow is typically dry except in extreme storm events (Lahontan Regional Water Quality Control Board 2002; MCLB Barstow 2005).

Jurisdictional determination surveys were conducted concurrently with the botanical and wildlife surveys. The results of these surveys are provided in a separate report (Leidos 2015b).

4.3 Vegetation

Vegetation in the Range East and KD Range Complex and Range West survey areas is dominated by creosote bush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*) with cheesebush (*Hymenoclea salsola*) scrub and developed area less common, whereas the Yermo Stables survey area has creosote and white bursage, allscale (*Atriplex polycarpa*), California joint fir scrub, Scale broom scrub, Desert willow woodland, and desert wash habitats. Details on the plant communities in the survey area are provided in Section 4.4. A total of 110 plant species were observed during the surveys, with 91 percent of the species native and 9 percent non-native. Surveys were conducted during very dry years and also outside of the blooming period for many spring and fall annual plant species. Only remnant vegetative material from many seasons, most of which could not be positively identified, was present during most of the surveys. A list of plant species found during the surveys is included in Appendix A. Plant species were identified using the Jepson Manual (Baldwin et al. 2012), although several resources were consulted for identification, including Baldwin et al. (2002), MacKay (2003), and Stewart (1998).

The terrain in Range West is undulating with a rocky substrate and desert pavement on the flat areas and ridges. The spatial distribution of shrubs varies depending on location in the survey area. Spatial distribution of shrubs can be attributed to a variety of factors, such as elevation, precipitation, temperature, slope aspect, topographic position, and substrate (Franklin 1998). In the flat areas of the Range West survey area, plants occur in clumps or are widely spaced (up to 15 feet [3 meters] apart). Creosote bush and white bursage shrubs are dominant throughout the survey area, and purple heather (*Krameria erecta*), Engelmann's hedgehog cacti (*Echinocereus engelmannii*), branched pencil cholla (*Cylindropuntia ramosissima*), and sweetbush (*Bebbia juncea*) are less common. Native spring and fall annual species common in the understory include sandmat spurge (*Chamaesyce micromera*), chinch weed (*Pectis papposa* var. *papposa*), pebble pincushion (*Chaenactis carphoclinia* var. *carphoclinia*), cryptantha (*Cryptantha* spp.), buckwheat (*Eriogonum* spp.), and snake's head (*Malacothrix coulteri*), and less common are fringed spurge (*C. setiloba*), fringed amaranth (*Amaranthus fimbriatus*), and six weeks grama (*Bouteloua* spp.). Non-native schismus (*Schismus* sp.) is common in many areas throughout the survey area. The western and eastern ends of Range West have steep slopes that terminate into a large basin with various desert washes. On the steeper slopes vegetation is widely distributed. In the basins of the desert washes, vegetation is sparse and shrubs become more densely distributed along the banks. Cheesebush, box thorn (*Lycium* spp.), spiny senna (*Senna armata*), Mojave indigo bush (*Psorothamnus arborescens*), catclaw (*Senegalia greggii*), and sandpaper bush (*Petalonyx thurberi* subsp. *thurberi*) are mainly restricted to the desert washes.

The Range East and KD Range Complex has a similar distribution and composition of plant species to Range West. The KD Range Complex also has developed areas (e.g., KD Rifle Range, KD Pistol Range, and 100-yard shotgun range) and cheesebush scrub is present in the previously disturbed areas adjacent to the KD Range Complex. The terrain is generally flat with exception to the man-made berms in the KD Rifle Range, KD Pistol Range, and 100-yard shotgun range. Throughout the survey area there are numerous shallow sandy, cobble desert washes that slope to the north.

The Range Main Supply Route is intermittently disturbed and vegetated with Creosote bush–white bursage scrub habitat. The two existing unimproved, utility ROW access routes within this survey area are sandy with vegetation concentrated along the border and occasionally growing in the roads. There are several buried gas pipelines on the edges of the existing access routes. In some areas, the buried pipelines have created berms that have changed the natural drainage patterns. The terrain is undulating and the substrate is sandy with rocks and cobbles throughout the survey area. Various areas have eroded after rain events and parts of the existing access routes have washed away exposing the buried pipelines. Shrubs are sparsely distributed with creosote bush and white bursage dominant.

The northern portion of Yermo Stables is flat and the southern portion of the survey area has numerous undulating sandy mounds and includes the floodplain of the Mojave River. Allscale (*Atriplex polycarpa*) and creosote are the dominant shrubs with desert willow (*Chilopsis linearis*), scale broom (*Lepidospartum squamatum*), and desert tea (*Ephedra californica*) dominant in areas. Sparsely disturbed shrubs include box thorn (*Lycium* spp.), cheesebush, sandpaper bush, and climbing milkweed (*Funastrum hirtellum*).

4.4 Plant Communities

Vegetation within the survey area directly relates to the terrain and landforms present, which fall into three basic categories: (1) rocky slopes and ridges; (2) large desert washes; and (3) alluvial terraces with small channels and minor desert washes. These landform categories differ in soil characteristics that are directly related to the amount of water available to plants and the degree of flash flooding, which together affect plant survival and the establishment of species. The survey area consists of three major cover types (i.e., communities): (1) shrublands, which include Creosote bush–white bursage scrub (low terrace, desert pavement, and rocky hillslopes), Allscale scrub, Desert wash, California joint fir scrub, Scale broom scrub, and disturbed vegetation; (2) woodlands, which include desert willow woodlands; and (3) developed communities (Table 4.1). In addition, disturbed forms of Creosote bush–white bursage scrub and Allscale scrub are present in the survey area. Ten different cover types occur in the survey area, as described below.

Table 4.1. Vegetation Communities within the Survey Area

Cover Type*	Total Acres	Total Hectares	Percent of Survey Area
Shrubland Communities			
Creosote bush–white bursage scrub			
Low terrace	296.7	120.1	22.7
Desert pavement	108.8	44.0	8.3
Rocky Hillslopes	297.6	120.4	22.8
Disturbed Creosote bush–white bursage	87.2	35.3	6.7
Creosote bush–allscale scrub	165.6	67.0	12.7
Allscale scrub	62.9	25.5	4.8
Desert wash	85.8	34.7	6.6
California joint fir scrub	28.9	11.7	2.2
Scale broom scrub	8.4	3.4	0.6
Disturbed vegetation	76.7	31.0	5.9
Woodland Communities			
Desert willow woodland	18.8	7.6	1.4
Developed Communities			
Developed	68.3	27.6	5.2
Total	1305.8	58.4	100
Notes: * = Sawyer et al. 2009.			

4.4.1 Shrubland Communities

Creosote bush–white bursage scrub. Creosote bush and white bursage are co-dominant with other shrubs not exceeding the cover of these two species. Other shrubs present include cheesebush, Mojave indigo bush, box thorn, ephedra (*Ephedra* spp.), purple heather, Mojave yucca (*Yucca schidigera*), and catclaw (*Senegalia greggii*). Creosote bush–white bursage scrub is the most dominant habitat type and is

present throughout the Range Complex (Range East and KD Range Complex and Range West). Due to the extensive area this community represents, it was further divided into sub classes based on topographic features, which include low terrace, desert pavement, and rocky hillslopes.

Creosote bush–white bursage low terrace occurs at the base of the slopes and is generally flat with shrubs dominant but sparsely distributed. Annuals are common in the understory.

Creosote bush– white bursage desert pavement is defined as the areas where desert pavement occurs and is typically on the upper terraces between small channels with vegetation cover that ranges from nearly absent to very sparse. Annuals are also sparsely distributed in these areas. Desert pavement within the survey area differs in the degree to which it has been subject to weathering, and some is very dark whereas other areas are lighter in color. On very weathered surfaces, typically isolated from overflow, well-varnished desert pavement consists of a covering of tightly packed stones and rocks. Other areas that have been exposed to overflow or disturbance are lighter in color and rocks are less compact.

Creosote bush–white bursage rocky hillslopes occur on rocky slopes (over 20 percent). These areas are rocky with sparsely distributed shrubs and few annuals in the rock crevices. Typically desert washes or small channels occur at the base of the hillslopes.

Disturbed Creosote bush–white bursage scrub. This alliance is not included as a classification in Sawyer et al. (2009) but was assigned to areas that are more disturbed than Creosote bush–white bursage scrub. Species composition is the same but forbs and bare ground are more abundant. Disturbed Creosote bush–white bursage scrub alliance is present within the Range Main Supply Route, which includes sandy dirt access routes with some vegetation growing through and Creosote bush–white bursage scrub along the borders.

Allscale scrub. Allscale is dominant in this community with creosote bush sparsely distributed. Other shrubs less common include white bursage, cheesebush, and rabbit thorn (*Lycium pallidum* var. *oligospermum*). Allscale scrub occurs in disturbed areas within Yermo Stables.

Disturbed Allscale scrub. This alliance is not included as a classification in Sawyer et al. (2009) but was assigned to areas that were more disturbed than Allscale scrub. Species composition was the same but forbs and bare ground were more abundant. Disturbed Allscale scrub alliance is present along the Yermo Dirt Road, which is a sandy dirt road with some vegetation growing through and Allscale scrub along the border.

Desert wash. Desert washes occur in Range East and KD Range Complex, Range West, and Yermo Stables. The desert washes on the Range Complex flow to the north and eventually to the Mojave River. The washes are narrow in the southern portion of the Range Complex and become wider and more braided toward the north. In general, vegetation within the active flow channels is sparse to absent and the areas along the banks that are less frequently flooded support a variety shrub species including cheesebush, spiny senna, Mojave indigo bush, catclaw, desert thorn, purple heather, and sandpaper bush. Dominant shrub species vary among the washes (based on width, slope, time between flooding events, and volume of flood waters). The transition from desert wash to Creosote bush–white bursage low terrace (described above) is fairly abrupt.

Desert wash in the Yermo Stables includes the Mojave River. At Barstow the Mojave River is ephemeral with flow only occurring during large storm events. There is no vegetation within the active flow channel. The low floodplain supports large shrubs, most of which are on sandy hummocks (i.e., low mounds or ridges) that form as a result of periodic high-velocity flows. The roots of the shrubs anchor the soils as flowing waters wash away the surrounding soils.

California joint fir scrub. California joint fir scrub is dominated by desert tea with allscale scrub less common. Associated species include alkali heliotrope (*Heliotropium curassavicum*), sandpaper bush, red-root cryptantha (*Cryptantha micrantha* var. *micrantha*), and schismus. Desert tea and other associated shrubs occur in clumps about 3 to 4 feet (0.9 to 1.2 meters) tall, and 2 to 3 feet (0.6 to 0.9 meters) wide. California joint fir scrub occurs in Yermo Stables in the low terrace of the Mojave River.

Scale broom scrub. Scale broom is dominant on hummocks. These areas are dominated by schismus, red-root cryptantha, golden sun cup (*Chylismia brevipes)*, and sand dropseed (*Sporobolus cryptandrus*) with non-native Russian thistle and foxtail brome (*Bromus madritensis* ssp. *rubens*) present. Scale broom scrub occurs in Yermo Stables adjacent to the Mojave River.

Disturbed vegetation. This community occurs in disturbed areas along the buried gas pipelines adjacent to the existing unimproved, utility ROW access routes within the Range Main Supply Route and in the KD Range Complex (e.g., KD Rifle Range, KD Pistol Range, and 100-yard shotgun range). Although the pipeline corridor was revegetated after disturbance, it remains clearly visible and distinguishable from the surrounding natural vegetation communities. The dominant vegetation type is annual herbaceous species with scattered shrubs. Schismus (a non-native annual grass) is common to dominant in many areas of the existing utility corridor. In many parts of the corridor, the common plant species are different than the adjacent communities, likely from seed planted as part of the revegetation, and include Acton encelia (*Encelia actonii*), desert marigold (*Baleya multiradiata*), fourwing salt bush (*Atriplex canescens*), and brittlebush (*Encelia farinosa*). During the 2015 surveys, numerous dead shrubs were observed within the disturbed vegetation along the pipeline corridor. In the KD Range Complex, disturbed vegetation occurs adjacent to developed areas the dominant shrub is cheesebush.

4.4.2 Woodland Communities

Desert willow woodland. Desert willow (*Chilopsis linearis*) and saltcedar (*Tamarix ramosissima*) are the two dominant plant species in this community. Both are very large shrubs or small, multi-branch trees and occur on hummocks as individuals or as groups with one or both species present. The size of the hummocks ranges from 10 to 50 feet (3 to 15 meters) wide. Desert willow woodland occurs in Yermo Stables within the low terrace of the Mojave River.

4.4.3 Developed Communities

Developed. There is no Sawyer et al. (2009) equivalent to “Developed” communities. This category was assigned to all areas that have been constructed or physically altered. This category includes urban structures or other developed land (e.g., semi-permanent structures and gravel roads). Developed habitat occurs in the Range East and KD Range Complex (i.e., KD Rifle Range, KD Pistol Range, 100-yard shotgun range, Rifle Range Road, and KD Range Complex administrative area) and in Yermo Stables (i.e., old gravel test track). Vegetation is generally sparse on the developed lands either as a result of repeated disturbance and/or maintenance activities.

4.4.4 Vegetation Structure within Different Geomorphic Settings

Shrub density within different geomorphic settings (rocky hillslope, low terrace, desert wash, and desert pavement) in Creosote bush–white bursage habitat is presented in Figure 4.1. The width and height of creosote bush shrubs within different geomorphic settings is provided in Figure 4.2 and the number of shrub species and annual species within different geomorphic settings is depicted in Figure 4.3.

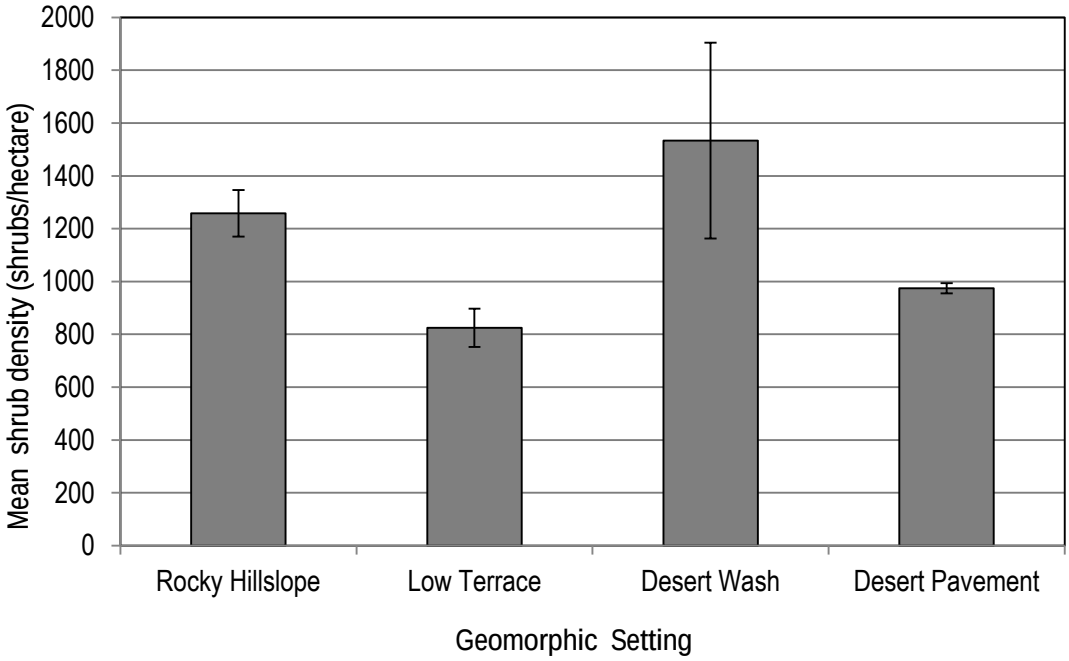


Figure 4.1. Mean Shrub Density (± SE) within Geomorphic Settings in Creosote bush–white bursage Habitat

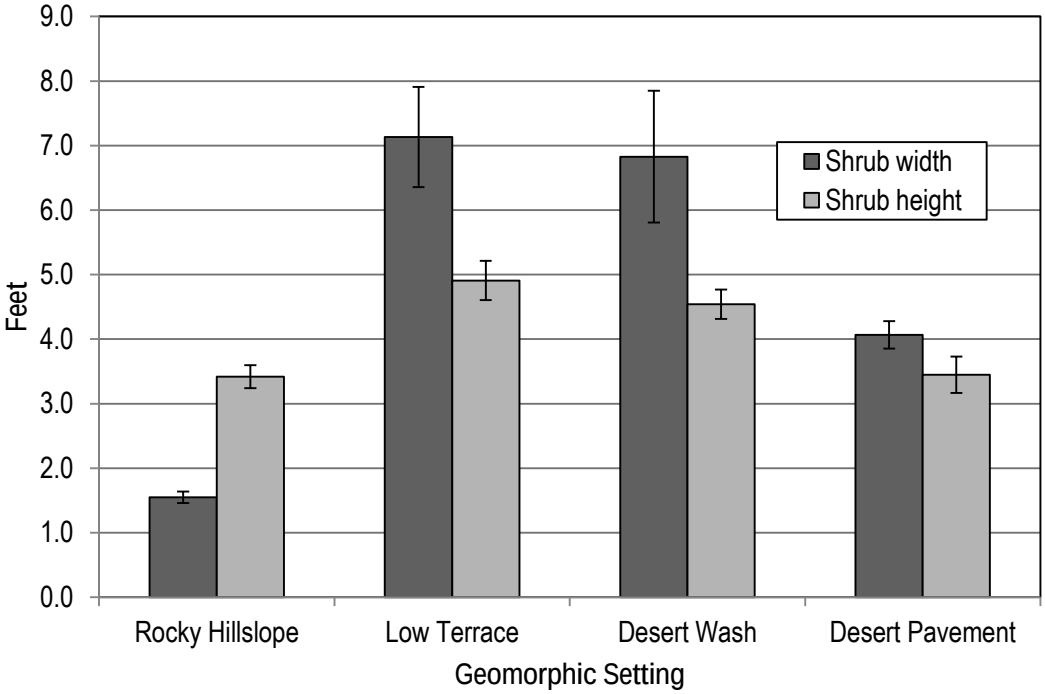


Figure 4.2. Mean Creosote Bush Shrub Width and Height (± SE) within Geomorphic Settings in Creosote bush–white bursage Habitat

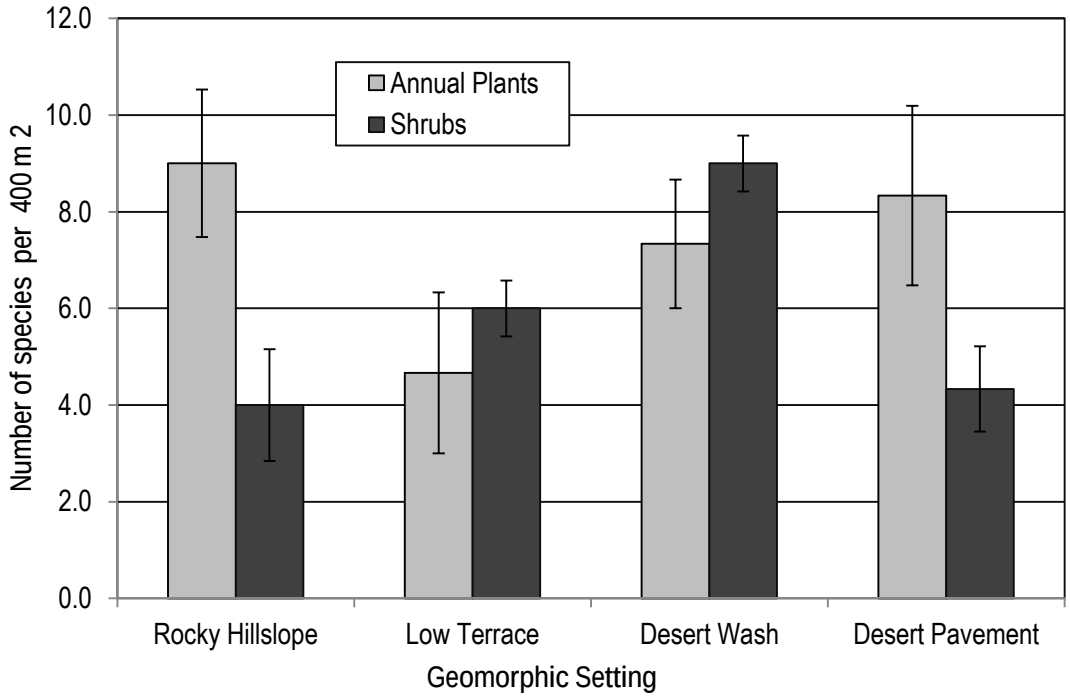


Figure 4.3. Mean Number of Species (± SE) for Annual Plants and Shrubs within Geomorphic Settings in Creosote bush–white bursage Habitat

4.4.5 Invasive Plant Species

Invasive plant species were observed within the survey area. Saltcedar and some annual plant species were identified including Sahara mustard (*Brassica tournefortii*), foxtail brome (*Bromus madritensis* ssp. *rubens*), London rocket (*Sisymbrium irio*), Russian thistle (also known as tumbleweed [*Salsola tragus*]), and schismus (*Schismus* sp.). Saltcedar, Sahara mustard, and foxtail brome are listed on the California Invasive Plant Council's (CalIPC) Invasive Plant Inventory with a "High" rating of invasiveness (i.e., species that have severe impacts on ecological processes, plant and animal communities, and vegetation structure). London rocket has a "Moderate" rating of invasiveness (i.e., these species have substantial and apparent—but generally not severe—ecological impacts on physical processes, plant and animal communities, and vegetation structure). Russian thistle and schismus are also on the CalIPC Invasive Plant Inventory with a "Limited" rating of invasiveness (i.e., ecological impacts are minor on a state-wide level, they have a low to moderate rate of invasiveness, and distribution is generally limited, although may be locally persistent or problematic) (CalIPC 2006). Overall, with the exception of schismus, invasive species were found in scattered, isolated occurrences within the natural communities and were more abundant in or near disturbed communities.

Saltcedar is generally a small tree or shrub that is often found where surface or subsurface water is available most of the year. Saltcedar can be prolific and when it occurs in dense numbers, it is known to cause dramatic changes in the geo-morphology, groundwater availability, soil chemistry, fire frequency, plant community composition, and native wildlife diversity (Bossard et al. 2000). Saltcedar is present at one location on the Range East and KD Range Complex in the KD Range Complex parking area. It is also common along the southeastern portion of Yermo Stables, adjacent to the Mojave River, where it occurs

Sahara mustard is an annual herb that is 4 to 40 inches (10 to 100 centimeters) tall and occurs in the Mohave and Sonoran deserts of California. This species is especially common in areas with wind-blown sediments and is becoming increasingly frequent in the Mojave and Sonoran deserts and south coastal California. During rains, a sticky coat forms over the seeds that enables them to attach to passing animals or vehicles, allowing the plant to spread over long distances. Where Sahara mustard is abundant, it can increase fuel loads and alter fire regimes, which in turn results in a change of plant community as the species can survive fires and re-establish in burn areas (Bossard et al. 2000). In the survey area, Sahara mustard was sparse, occurring as individual plants or small clumps with scatted plants. It was observed toward the eastern and western ends of the Range Main Supply Route, within a few desert washes in the Range Complex, and in Yermo Stables adjacent to the Yermo Dirt Road and berm on the southern boundary. Overall, there was less than 1 percent cover of Sahara mustard observed in the survey area.

Foxtail brome is a fairly widespread annual grass that invades disturbed areas, roadsides, and natural areas, where it can increase fire frequency and convert habitat to annual grassland (CalIPC 2006). Foxtail brome was present but sparse within the survey area, with less than 1 percent cover overall.

London rocket is a winter annual forb/herb, which can be found in abandoned fields, roadsides, and orchards. It matures earlier in the year than native species, allowing it to out-compete them. A few scattered plants were present along the Range Main Supply Route and one dense patch of London rocket occurs on the western portion of Yermo Stables adjacent to the berm. Overall, there was approximately 1 percent cover of London rocket observed in the survey area.

Russian thistle is a large, bushy summer annual found throughout California, which occurs in the desert, roadsides, and other disturbed areas. After they dry, the plants are easily transported by wind where they impede traffic or can collect along fences or other barriers and create fire hazards (CalIPC 2006). Within the survey area, this species was frequently observed within disturbed areas in Yermo Stables. Overall, there was about 1 percent cover of Russian thistle observed in Yermo Stables.

Schismus (*Schismus arabicus* or *S. barbatus*) is a non-native annual grass species observed throughout the survey area. Schismus has replaced native annual grasses in arid and semi-arid regions of California and also may compete with other annual species for limited nutrients in shrublands (Bossard et al. 2000). Schismus was sparse to common throughout the survey area, occurring in both open areas and under shrubs in the Range East and KD Range Complex, Range West, and Yermo Stables. Overall, there was about 15 to 20 percent cover of schismus observed in the survey area.

Cheat grass (*Bromus tectorum*) was observed in a few locations and has previously been reported in the Range Complex and Yermo Annex (MCLB Barstow 2005). Cheat grass is the most widely distributed invasive plant in the United States (U.S.) and invades interior scrub, woodlands, grasslands, and desert shrub communities. Cheat grass displaces native vegetation and dense stands can interfere with the establishment of native perennial species. In the survey area, cheat grass was observed in a few isolated locations that generally consisted of a few to several plants on the Range Main Supply Route and Range West. Overall, there was less than 1 percent cover of cheat grass observed in the survey area.

The survey area is within the Mojave Weed Management Area, which has a list of target weed species to focus control efforts. Of the species included on the Mojave Weed Management Area list, foxtail brome, Russian thistle, Sahara mustard, and saltcedar have been documented to occur on MCLB Barstow (MCLB Barstow 2005). None of the plants on the California Department of Food and Agriculture or the Federal Noxious Weed List (USDA 2012, see Appendix G) were found, or are expected to occur, in the survey area.

4.5 Wildlife

The plant communities described in Section 4.4 provide habitats for wildlife present in and around the survey area. A list of wildlife species observed during the field reconnaissance surveys is included as Appendix B.

Several wildlife species and/or their signs were observed during the surveys. Rodent and small mammal sign was frequently noted throughout the survey area and included the white-tailed antelope squirrel (*Ammospermophilus leucurus*), Merriam's kangaroo rat (*Dipodomys merriami*), desert woodrat (*Neotoma lepida*), black-tailed jack rabbit (*Lepus californicus*), and desert cottontail (*Sylvilagus audubonii*). Side-blotched lizards (*Uta stansburiana*), Great Basin whiptails (*Aspidoscelis tigris tigris*), zebra tail (*Callisaurus draconoides*), desert horned lizard (*Phrynosoma platyrhinos*), desert spiny lizard (*Sceloporus magister*), and Northern desert iguana (*Dipsosaurus dorsalis dorsalis*) were also documented. Rattlesnakes (*Crotalus* spp.), especially sidewinders (*C. cerastes*), Mojave rattlesnake (*C. scutulatus*), and Southwestern speckled rattlesnake (*C. mitchellii pyrrhus*), were observed in the survey area. Sign for coyotes (*Canis latrans*), bobcats (*Felis rufus*), and kit fox (*Vulpes macrotis*) was also noted in the survey area. Twenty-six bird species were observed during the surveys; common species included the common raven (*Corvus corax*), white crown sparrow (*Zonotrichia leucophrys*), sage sparrow (*Amphispiza belli*), verdin (*Auriparus flaviceps*), blue gray gnatcatcher (*Polioptila caerulea*), black Black-throated sparrow (*Amphispiza bilineata*), loggerhead shrike (*Lanius ludovicianus*), and horned lark (*Eremophila alpestris*). Active nests of various birds including loggerhead shrike, red-tailed hawk (*Buteo jamaicensis*), blue-gray gnatcatcher, cactus wren (*Campylorhynchus brunneicapillus*), Scott's oriole (*Icterus parisorum*), common raven, Ash-throated flycatcher (*Myiarchus cinerascens*), and mourning dove (*Zenaida macroura*) were observed in the Range Complex. Many native birds recorded on MCLB Barstow are neotropical migratory species, moving between California and countries to the south as part of their life cycle, and use habitats for stopover resting (MCLB Barstow 2005).

Temperatures during the October 2013 nighttime surveys ranged from to 71 °F (22 °C) to 76 °F (25 °C) and wind speed ranged from 5.2 miles per hour (8.4 kilometers per hour) to 11.2 miles per hour (18 kilometers per hour). Few wildlife species were observed during the nighttime surveys. Sage sparrows and a jack rabbit were observed near the gravel road (i.e., gravel test track) in Yermo Stables. No nighttime surveys were conducted in 2014 and 2015.

4.6 Special Status Species

4.6.1 Special Status Plant Species

Appendix C presents the results of the CNDDB search and includes a list of special status plant species that have the potential to occur in the survey area. Appendix C provides habitat types, blooming periods, and recorded observations (based on CNDDB data) for each species, as well as the potential for the species to occur in the survey area. The survey area supports Creosote bush–white bursage scrub, which is widespread throughout the Mojave Desert, as well as various other scrub and woodland communities that provide suitable habitat for several sensitive plant species (Appendix C). No federal or state-listed plant species were observed in the survey area; however, surveys conducted outside the survey area noted dentate blazing star (*Mentzelia tridentata*) (a CNPS and CDFW Inventory of California Rare Plant Rank [CRPR] listed species 1B.3 [rare and endangered in California and elsewhere]) west of the Range East and KD Range Complex (personal communication, Stephanie White 2015).

4.6.2 Special Status Wildlife Species

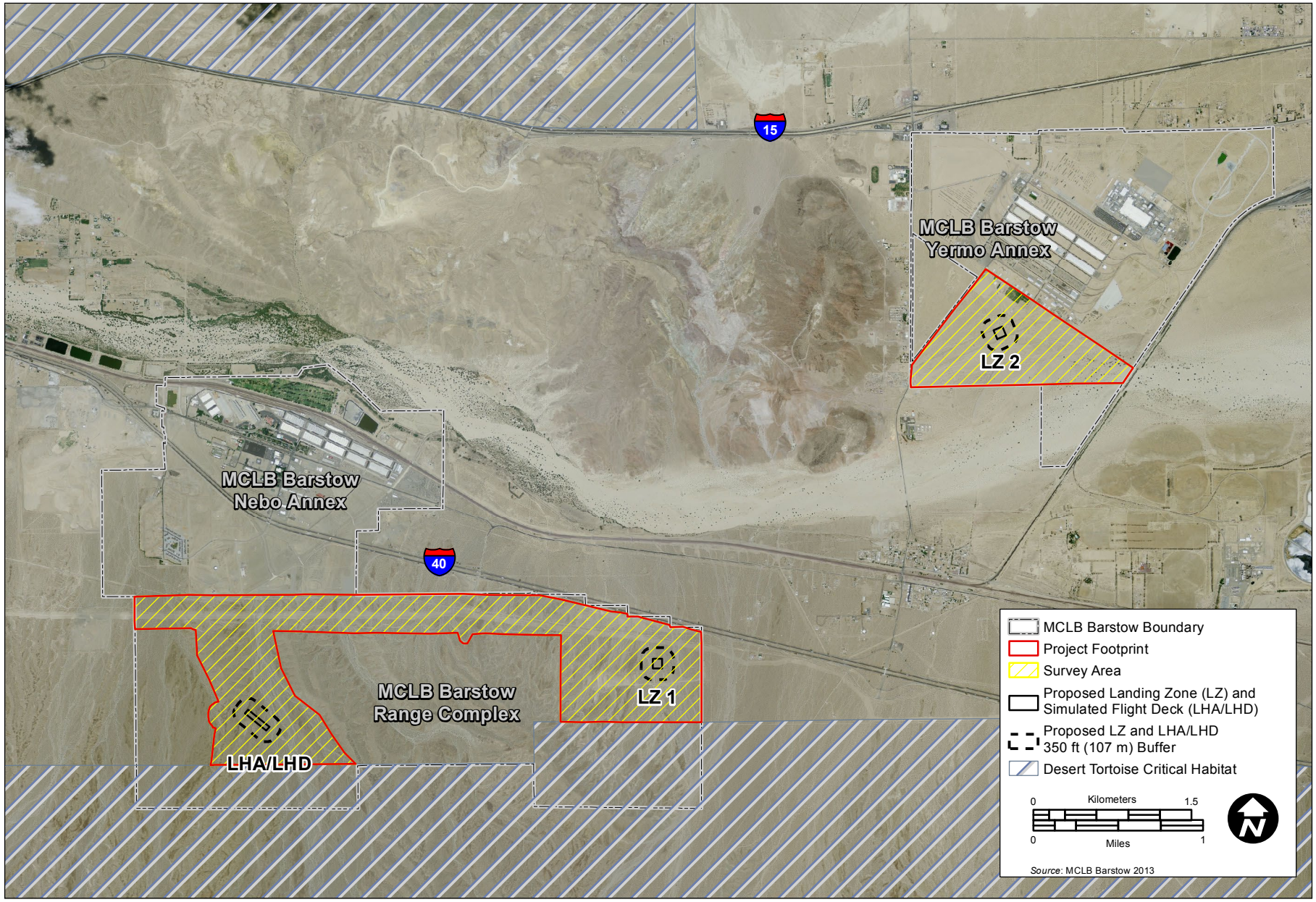
Surveys were completed throughout the survey area to determine presence and potential suitable habitat for special status or sensitive animals. A list of special status wildlife species with the potential to occur in the survey area is provided in Appendix D. The only federally listed wildlife species documented in the survey area is Agassiz's desert tortoise (USGS 2011; Gardner 2000; Walde 2007; Lovio 2006). MCLB Barstow is included in the Western Mojave Desert Recovery Unit and is part of the Ord- Rodman Desert Wildlife Management Area (USFWS 1994). There are approximately 541 acres (219 hectares) of desert tortoise critical habitat on MCLB Barstow, situated along the southern boundary of the Range Complex. However, the survey area does not overlap with desert tortoise critical habitat (Figure 4.4). For details on the desert tortoise listing and critical habitat, refer to the USFWS *Federal Register* 55(63):12178–12191 (USFWS 1990), *Determination of Critical Habitat for the Mojave Population of the Desert Tortoise* (USFWS 1994 [59 FR 5820]), and the *Final Revised Recovery Plan for the Mojave Population of the Desert Tortoise* (USFWS 2011).

Desert tortoises have been documented on MCLB Barstow since 1992. A variety of studies have been conducted on MCLB Barstow that focus on desert tortoise presence absence surveys (e.g., Walde 2007, 2012), habitat use and utilization of steep slopes (Gardner 2000), and seasonal comparisons of desert tortoise sign (burrows, carcasses and live tortoises) on permanent research plots (Walde 2012). These surveys have documented a continued decline of the desert tortoise population on MCLB Barstow and similar trends are being observed nearby in the Mojave Desert (e.g., Fort Irwin) (personal communication, Andrew Walde 2013).

The desert tortoise is a herbivorous reptile found throughout the Sonoran and Mojave Deserts. The species occupies a variety of habitats from flats to rocky slopes, and is associated with the creosote bush scrub plant community at lower elevations and juniper woodland ecotones at higher elevations (USFWS 2011). Unlike most areas that have critical habitat designation and are relatively flat or gently sloped, the area at MCLB Barstow that is designated as critical habitat has extreme topographic relief and contains areas that have very steep slopes.

Desert tortoise on MCLB Barstow is mainly associated with Creosote bush–white bursage scrub habitat but also occurs in Disturbed Creosote–white bursage as well as areas with disturbed vegetation. Burrows occur in friable (easily crumbled) and coarse substrates on flat or steep slopes that can be greater than 40 degrees (Leidos 2014, 2015a). For burrow construction, the soil is generally a fine gravel and/or sandy loam to enable digging but contains some clay for burrow stability. Tortoise burrows are primarily located under or adjacent to shrubs but are also found under rocks, in the banks of gullies and desert washes, and on rocky hillsides. The desert tortoise spends much of the year underground in burrows to avoid extreme temperatures during summer and winter. The tortoise is active above ground during the spring, summer, and autumn when daytime temperatures are below 90 °F (32 °C).

The emergence of tortoises generally coincides with healthy growth of annual plants. The Western Mojave Desert differs from the East Mojave and Colorado Deserts in that it primarily receives fall and winter precipitation that produces spring annuals, which are an important food source for tortoises. Tortoises primarily eat annual forbs but will also forage on perennials (grasses and cacti), and will eat non-native species such as red-stem filaree (*Erodium cicutarium*) and schismus. Tortoises in the region



Location of Desert Tortoise Critical Habitat in the Project Vicinity
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
4.4

are primarily active in spring (April to May) and fall (September to October). Desert tortoises derive much of their water requirements from the vegetation they eat and can go for extended periods without drinking. The size of desert tortoise home ranges varies with location, year, and resource availability (USFWS 2011). Female home ranges may be less than half that of the average male, which can be up to 200 acres (80 hectares) or more. This species may live for more than 50 years and does not reach reproductive maturity until 14 to 20 years of age.

No other federally or state-listed special status or sensitive species other than the desert tortoise was observed within the survey area. No preferred bat habitats such as large caves, deep rock crevices, mines, or abandoned buildings were observed during the surveys. Additionally, none of the surveyed sites contained perennial water necessary to support the special status fish Mohave Tui chub (*Siphateles bicolor mohavensis*) or riparian habitat required for the southwestern willow flycatcher. The Yermo Annex supports suitable habitat for the burrowing owl (*Athene cunicularia* [California species of special concern]), and burrowing owls have been reported in the Yermo Annex (Walde 2012).

5 Results: Survey Area Descriptions

5.1 Range East and KD Range Complex

Habitat Description: The Range East and KD Range Complex consists of 262.9 acres (106.4 hectares) of Creosote bush–white bursage scrub habitat, 25.9 acres (10.5 hectares) of Desert wash, 24.2 acres (9.8 hectares) of Disturbed vegetation, and 19.7 acres (8 hectares) of Developed habitat in the KD Rifle Range, KD Pistol Range, and 100-yard shotgun range (Figure 5.1, Photographs 1 through 4). In the northern portion of the site, the terrain is generally flat with exception to the man-made berms in the KD Rifle Range, KD Pistol Range, and 100-yard shotgun range and undulating habitat, which is a result of previous soil movement activities. Throughout the survey area there are numerous shallow sandy, cobble desert washes that slope to the north. Shrubs are sparsely distributed with Creosote bush–white bursage dominant and less common shrubs including the following: Mojave yucca; branched pencil cholla; and cottontop cactus (*Echinocactus polycephalus*). Spiny senna, box thorn, Mojave indigo bush, and cheesebush are mainly distributed along the desert washes. Sandmat spurge, chinch weed, and schismus are the dominant annual species and fringed amaranth, fringed spurge, and six weeks grama are less common. Disturbed vegetation occurs adjacent to the KD Pistol Range. Please refer to Appendix A for a list of plant species and Appendix B for a list of wildlife species.

Soil Notes: Soils at the Range East and KD Range Complex are gravelly sand. The surface is predominantly gravel and sand, with scattered cobble and small boulders throughout the survey area.

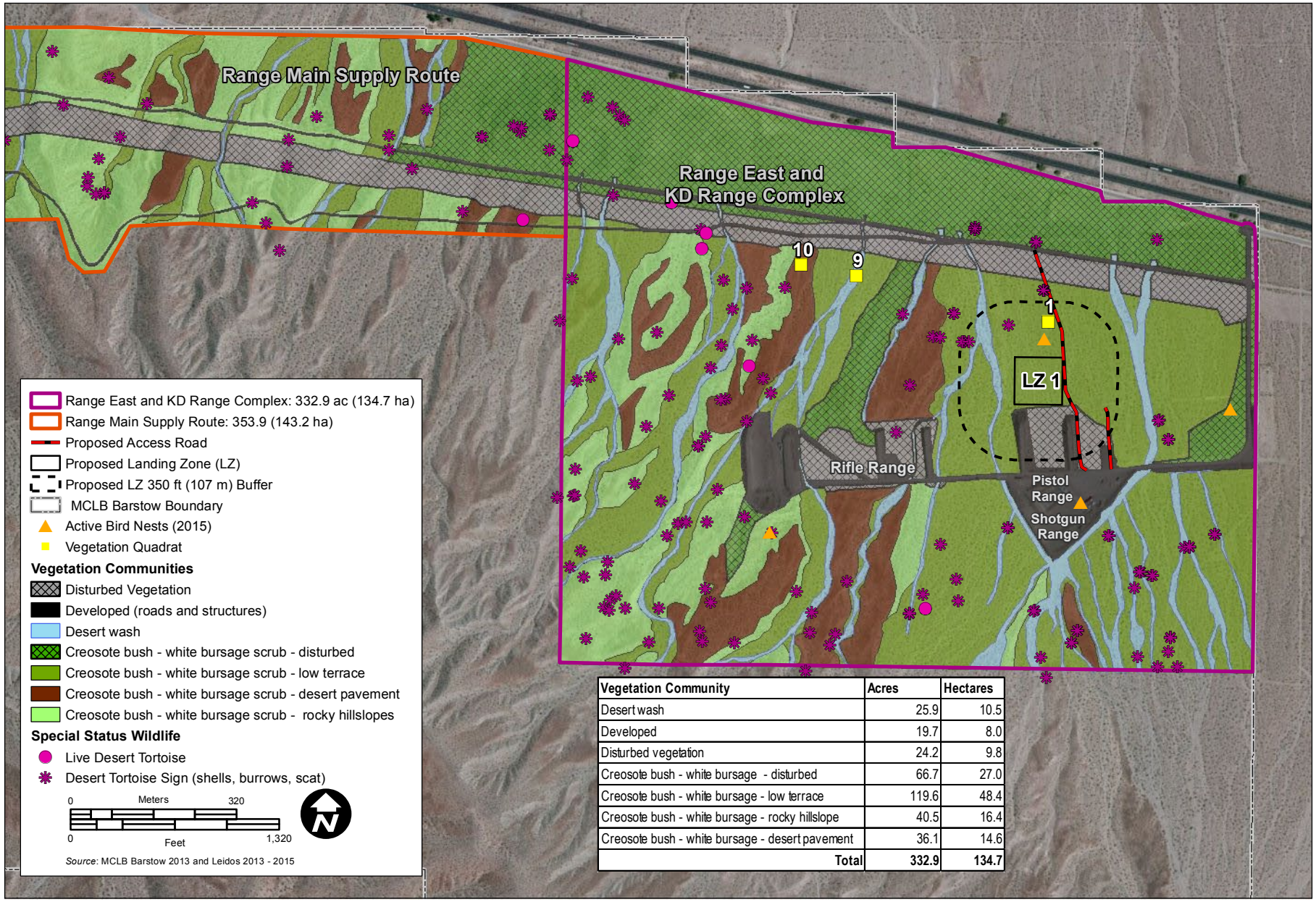
Invasive Plant Species: Saltcedar is present near the KD Range Complex parking area and schismus is common in the understory of Creosote bush–white bursage scrub and in disturbed areas. Sahara mustard occurs in patches near the desert washes, especially in the northern portion of the site, and foxtail brome is present, especially in disturbed areas.

Special Status Plant Species: No sensitive plant species were observed during the surveys. Suitable habitat is present for CNPS and CDFW Inventory of CRPR-listed species such as Mojave monkeyflower (CRPR 1B.2 [rare and endangered in California and elsewhere]) and dentate blazing star (*Mentzelia tridentata* [CRPR 1B.3]).

Special Status Wildlife Species: The desert tortoise was the only federally or state-listed wildlife species observed during the surveys. Six live tortoises (including 1 juvenile) were noted in 2015. In addition, a variety of types of desert tortoise sign (carcass, shell remains, scat, and burrows) has been documented throughout the survey area. Active bird nests including red-tailed hawk, cactus wren, black-throated sparrow, ash-throated fly catcher, mourning dove, and loggerhead shrike were observed during the 2015 surveys.

Other Noteworthy Observations: Temperature during the daytime surveys ranged from 72 °F (22 °C) to 100 °F (38 °C) and wind speeds reached 25 miles per hour (40 kilometers per hour). Woodrat middens/nests, white-tailed antelope squirrels, and black-tailed jackrabbit were observed in the survey area. Two Mojave rattlesnakes, a Mojave desert sidewinder, and various lizards including common side-blotched, great basin whiptail, long-nosed leopard lizard, northern desert iguana, and zebra-tailed lizards were observed. During the surveys, sleepy sulfur (*Eurema nicippe*) butterflies, harvester ants Formicidae (family), and grasshoppers Caelifer (suborder) were common. Dragonflies Anisoptera [suborder]) were also observed though less frequent.

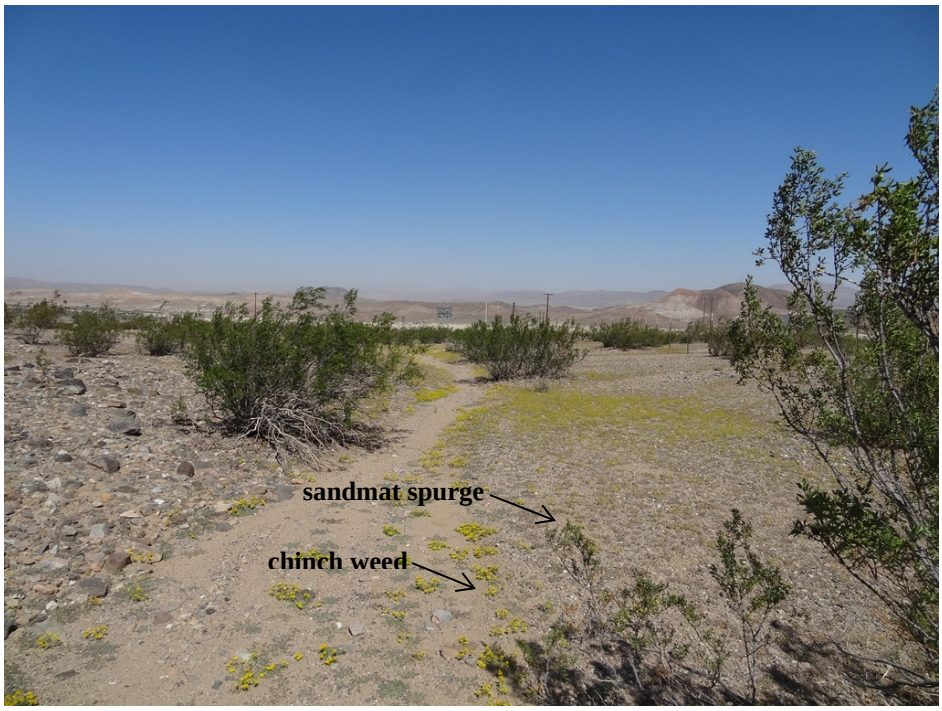
Date Surveyed: Surveys were conducted on 1 and 3 October 2013; 22 – 24 April 2014; 9 and 10 December 2014; and 20 – 24 and 27 – 30 April.



Vegetation Community	Acres	Hectares
Desert wash	25.9	10.5
Developed	19.7	8.0
Disturbed vegetation	24.2	9.8
Creosote bush - white bursage - disturbed	66.7	27.0
Creosote bush - white bursage - low terrace	119.6	48.4
Creosote bush - white bursage - rocky hillslope	40.5	16.4
Creosote bush - white bursage - desert pavement	36.1	14.6
Total	**332.9**	**134.7**

Biological Survey Results - Range East and KD Range Complex
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
5.1



Photograph 1. Range East and KD Range Complex. Creosote bush (*Larrea tridentata*) is the dominant shrub with summer annuals chinch weed (*Pectis papposa* var. *papposa*) and sandmat spurge (*Chamaesyce micromera*) common throughout the site.

Photograph 2. Overview of Range East and KD Range Complex looking toward the north. The soil is a rocky sandy substrate.

Photograph 3. An active loggerhead shrike (*Lanius ludovicianus*) nest observed during 2015 surveys on the Range East and KD Range Complex, at the northern end of the survey area.

Photograph 4. Mojave rattlesnake (*Crotalus scutulatus*) observed in the southern portion of the Range East and KD Range Complex during 2015 surveys.

5.2 Range West

Habitat Description: Range West consists of 252.1 acres (102 hectares) of Creosote bush–white bursage scrub, 38.7 acres (15.6 hectares) of Desert wash, and 0.1 acre (less than 1 hectare) of Developed habitat (Figure 5.2, Photographs 5 through 8). The survey area is rocky, with steeper slopes on the western and eastern ends that terminate into a large basin with various desert washes. During the October 2013 survey, there was evidence of recent heavy rains and many of the desert washes had evidence of sediment flow, debris piles, and clear bed and banks. The terrain is undulating with desert pavement on the flat areas and the ridges. Shrubs are sparsely distributed with creosote bush and white bursage dominant and purple heather, Engelmann's hedgehog cacti, branched pencil cholla, cottontop cactus, and sweetbush less common. Cheesebush, box thorn, spiny senna, Mojave indigo bush, and catclaw are mainly restricted to the desert washes. Chinch weed is a common summer annual. Schismus is a common groundcover, especially toward the north end of Range West. Please refer to Appendix A for a list of plant species and Appendix B for a list of wildlife species.

Soil Notes: Soils are loamy sand with gravel, cobble, and small boulders patchy throughout the site. The substrate is predominantly rocky with desert pavement in areas, and the desert washes are mostly sandy with scattered rocks.

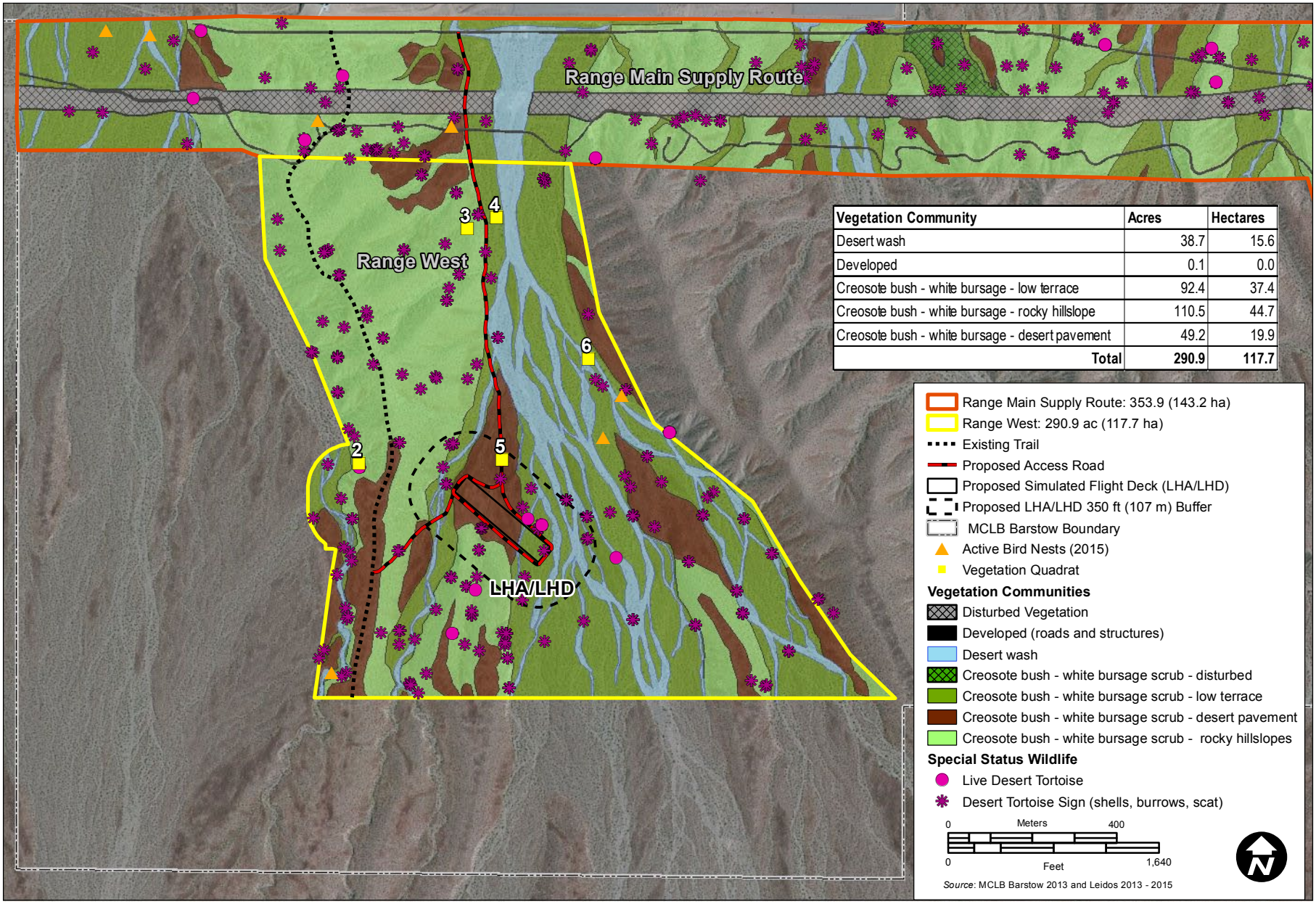
Invasive Plant Species: There were no invasive plant species observed during the October 2013 surveys; however, during the April and December 2014 and April and May 2015 surveys, schismus was common in the understory of Creosote bush–white bursage scrub (especially on the low terraces), and in disturbed areas. Sahara mustard, cheat grass, and foxtail brome were also observed in isolated patches, and were most common in or near the desert washes in the northern portion of the site.

Special Status Plant Species: No federal or state-listed plant species were observed. Suitable habitat is present for plant species such as Mojave monkeyflower (*Mimulus mohavensis* [CRPR 1B.2]), spinyhair blazingstar (*Mentzelia tricuspis* [CRPR 2.1]), and Barstow woolly sunflower (*Eriophyllum mohavense* [CRPR 1B.2]). Occupied Mojave monkeyflower habitat occurs south of the survey area.

Special Status Wildlife Species: The desert tortoise was the only federally or state-listed wildlife species observed during the surveys. Six live tortoises were observed during the surveys. Desert tortoise sign including carcass, shell remains, and burrows were observed on Range West. Active bird nests including red-tailed hawk, raven, black throated sparrow, blue-gray gnatcatcher, mourning dove, and Scott's oriole were observed during the surveys.

Other Noteworthy Observations: Temperature during the daytime surveys was approximately 70 °F (21 °C) to 100 °F (38 °C) and wind speeds averaged 7.2 miles per hour (12 kilometers per hour). Signs of use by burrowing rodents such as Merriam's kangaroo rat and numerous white-tailed antelope squirrels and black-tailed jackrabbit were observed throughout Range West. A short-eared owl (*Asio flammeus*) was documented at the northern portion of the site up a side channel, and a coyote was observed traversing the southwestern portion of the site. Numerous desert woodrat middens/nests were noted throughout Range West. Reptile species including common side-blotched lizard, Great Basin whiptail, zebra-tailed lizard, desert horned lizard, desert spiny lizard, Great basin gopher snake (*Pituophis catenifer deserticola*), and a red racer were observed during the surveys. Insects commonly observed included sleepy sulfur butterflies, harvester ants, and grasshoppers Caelifer (suborder).

Date Surveyed: Surveys were conducted on 1 and 2 October 2013; 22 – 24 April 2014; 9 and 10 December 2014; 20 – 24 April 2015; and 26 – 30 May 2015.



Vegetation Community	Acres	Hectares
Desert wash	38.7	15.6
Developed	0.1	0.0
Creosote bush - white bursage - low terrace	92.4	37.4
Creosote bush - white bursage - rocky hillslope	110.5	44.7
Creosote bush - white bursage - desert pavement	49.2	19.9
Total	**290.9**	**117.7**

Biological Survey Results - Range West
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE 5.2

Photograph 5. Overview of Range West looking toward the northeast; vegetation community is Creosote bush–white bursage scrub.

Photograph 6. Range West contains numerous ephemeral desert washes (pictured above). Photograph taken looking toward the north.

Photograph 7. A blue-gray gnatcatcher (*Polioptila caerulea*) nest was observed during 2015 surveys in a cheesebush (*Ambrosia salsola*) shrub that was located in a desert wash at the southern end of Range West.

Photograph 8. The substrate on Range West is predominantly rocky with desert pavement in areas, as shown in the photograph. Photograph taken looking toward the northwest.

5.3 Range Main Supply Route

Habitat Description: The Range Main Supply Route is 275.1 acres (81.4 hectares) Creosote bush–white bursage scrub, 18.6 acres (7.5 hectares) of Desert wash, 52.5 acres (21.2 hectares) of Disturbed vegetation and 7.6 acres (3.1 hectares) of Developed habitat (Figure 5.3, Photographs 9 through 12). The two existing unimproved, utility ROW access routes in the Range Main Supply Route are dirt with vegetation along the borders and sometimes growing in the roads. Various areas have eroded after rain events and parts of the utility access routes have washed away exposing the buried pipelines. There are berms on the edges of the utility access routes and previously disturbed areas that have provided suitable habitat for various mammals and desert tortoise. The terrain is undulating and the substrate is sandy with rocks and cobbles throughout the site. Please refer to Appendix A for a list of plant species and Appendix B for a list of wildlife species.

Soil Notes: Soils within the Range Main Supply Route are sandy with scattered rocks and cobble. There are many areas where the utility access routes have washed out and erosion is present.

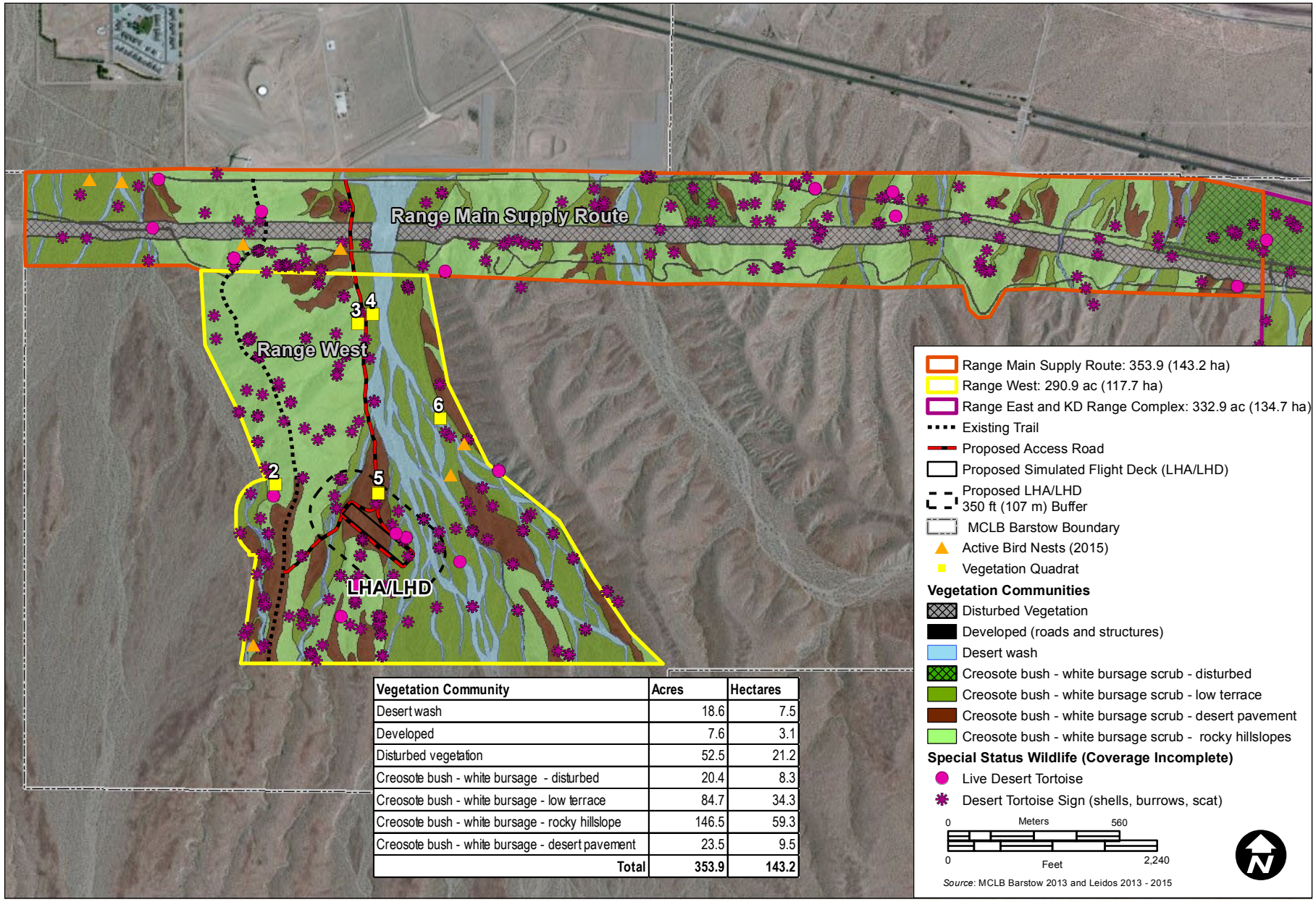
Invasive Plant Species: Sahara mustard was observed in numerous areas within the disturbed vegetation and desert washes. A large patch occurs on the western end of the northern utility access route, where the road crosses a large desert wash. Schismus was common as ground cover throughout the Range Main Supply Route and cheatgrass was observed as isolated individuals.

Special Status Plant Species: No sensitive plant species were observed during the surveys.

Special Status Wildlife Species: The desert tortoise was the only federally listed or state-listed, or other special status wildlife, species observed during the surveys. Eight live desert tortoises were observed in the survey area (one tortoise was observed on two occasions). Desert tortoise sign including carcass, shell remains, egg shell fragments, scat, and burrows was observed on the site. Numerous active tortoise burrows and live tortoises were observed alongside existing access routes and disturbed areas. Active red-tailed hawk and raven nests were observed during the 2015 surveys.

Other Noteworthy Observations: Signs of use by Merriam's kangaroo rat, white-tailed antelope squirrels, black-tailed jackrabbit, desert cottontail, and middens/nests for desert woodrats were observed during the surveys. In addition, non-active song bird nests were observed in the survey area. Reptile species including common side-blotched lizard, Great Basin whiptail, zebra-tailed lizard, desert horned lizard, Great basin gopher snake, and the Southwestern speckled rattlesnake were observed during the surveys.

Date Surveyed: Surveys were conducted on 1 – 3 October 2013; 22 – 24 April 2014; 9 and 10 December 2014; 21 – 23 and 27 – 30 April 2015; and 26 – 30 May 2015.



Vegetation Community	Acres	Hectares
Desert wash	18.6	7.5
Developed	7.6	3.1
Disturbed vegetation	52.5	21.2
Creosote bush - white bursage - disturbed	20.4	8.3
Creosote bush - white bursage - low terrace	84.7	34.3
Creosote bush - white bursage - rocky hillslope	146.5	59.3
Creosote bush - white bursage - desert pavement	23.5	9.5
Total	**353.9**	**143.2**

Biological Survey Results - Range Main Supply Route
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE 5.3

Photograph 9. Overview of the Range Main Supply Route looking toward the west. Disturbed Creosote bush–white bursage scrub habitat is present throughout.

Photograph 10. Disturbed vegetation occurs along the scar of the buried gas pipeline that runs east–west of the Range Main Supply Route. Photograph taken looking east.

Photograph 11. A live desert tortoise (*Gopherus agassizii*) was observed in 2015 adjacent to an access road on the northwestern side of site. The tortoise appeared healthy, indicated by good coloring and remnant vegetation around the mouth. Note the distorted carcass along the right rear scutes.

Photograph 12. Great basin gopher snake (*Pituophis catenifer deserticola*) observed in a wash on the west end of the existing utility access route.

5.4 Yermo Stables

Habitat Description: The survey area at Yermo Stables consists of 165 acres (67 hectares) of Creosote bush–allscale scrub, 62.0 acres (25.5 hectares) of Allscale scrub, 40.9 acres (16.5 hectares) of Developed habitat, 2.6 acres (1 hectare) of Desert wash, 28.9 acres (11.7 hectares) of California joint fir scrub, 19.3 acres (7.8 hectares) of Desert willow woodland, and 7.9 acres (3.2 hectares) of Scale broom scrub habitat (Figure 5.4, Photographs 13 through 16). There is a gravel road (i.e., old test track) that runs through Yermo Stables. The northern portion of the survey area is flat and encompasses a portion of the Mojave River; the southern portion of the site has numerous undulating sandy mounds that appear to be man-made. Allscale and creosote are the dominant shrubs throughout Yermo Stables. Box thorn, California ephedra, cheesebush, scale broom, sandpaper bush, and climbing milkweed are also present in Yermo Stables. Please refer to Appendix A for a list of plant species and Appendix B for a list of wildlife species.

Soil Notes: The substrate is fine to coarse, compacted sand with sparsely scattered gravel on the surface.

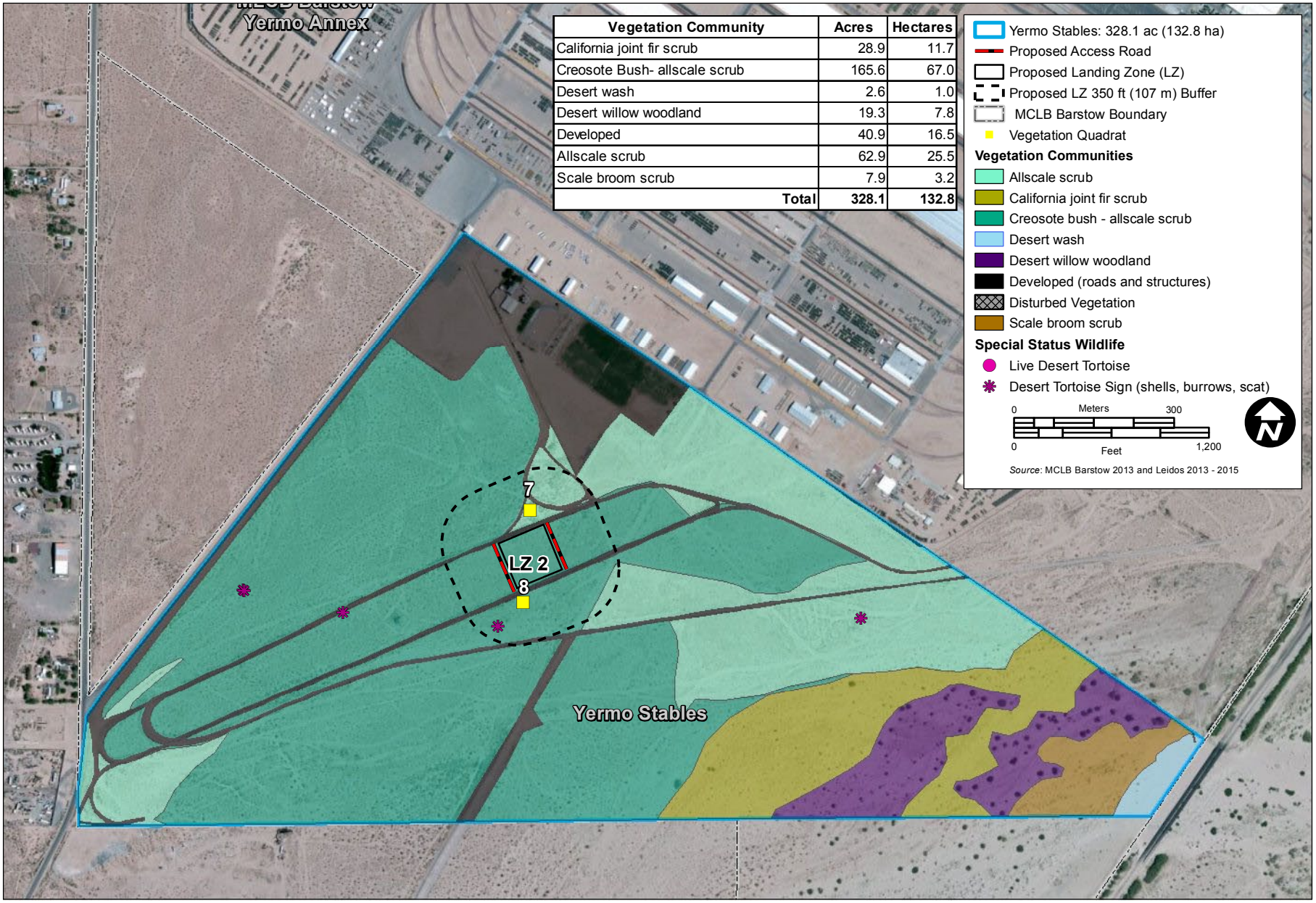
Invasive Plant Species: Numerous saltcedar shrubs occur in the survey area. One small saltcedar was observed within a small depression in the northern portion of the survey area and numerous large shrubs were observed in the desert willow woodland near the Mojave River. Russian thistle was observed in the ditch adjacent to the Yermo Dirt Road and scattered in areas adjacent to the Mojave River. Schismus is a common groundcover throughout the survey area and there is a dense patch of London rocket adjacent to the berm.

Special Status Plant Species: No sensitive plant species were observed during the survey. However, suitable habitat is present for CRPR-listed species such as chaparral sand verbena (*Abronia villosa* var. *aurita* [CRPR 1B.1]) and Parish's phacelia (*Phacelia parishii* [CRPR 1B.1]).

Special Status Wildlife Species: The desert tortoise was the only federally listed or state-listed, or other special status, wildlife species observed during the surveys. Desert tortoise sign (burrows and shell remains) was observed in Yermo Stables. Special status wildlife species sign (i.e., burrows suitable for burrowing owls) was also observed at the site.

Other Noteworthy Observations: Temperature during the daytime surveys was approximately 62 °F (17 °C) to 103 °F (39.4 °C) and wind speeds averaged 8 miles per hour (12 kilometers per hour). Black-tailed jackrabbit and desert cottontail sign (scat, browsed branches, and forms) was especially prevalent in the survey area. Reptiles including long-nosed leopard lizard, northern desert iguana, Great Basin whiptail, zebra-tailed lizard, and Mojave Desert sidewinder were observed during 2015 surveys. Yermo Stables contains a large amount of scat, particularly of rabbit species and carnivores. Many small burrows and even burrows suitable for burrowing owls were observed in the survey area. Sage sparrows, loggerhead shrikes, and a northern harrier (*Circus cyaneus*) were observed. Animal bones were present in several areas and sign of domestic horses (scat, tracks, and horseshoes) was evident. Dogs were observed wandering around the survey area. Trash is scattered throughout Yermo Stables. Shaggy mane (*Coprinus comatus*) fungus was sparsely scattered throughout the survey area.

Date Surveyed: Surveys were conducted on 4 October 2013; 25 April 2014; 11 December 2014; 21–23 and 27 – 30 April 2015; and 26 – 30 May 2015.



Vegetation Community	Acres	Hectares
California joint fir scrub	28.9	11.7
Creosote Bush- allscale scrub	165.6	67.0
Desert wash	2.6	1.0
Desert willow woodland	19.3	7.8
Developed	40.9	16.5
Allscale scrub	62.9	25.5
Scale broom scrub	7.9	3.2
Total	**328.1**	**132.8**

Biological Survey Results - Yermo Stables
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
5.4

Photograph 13. Overview of the Yermo Stables survey area looking southeast; vegetation in foreground consists primarily of allscale scrub (*Atriplex polycarpa*).

Photograph 14. Desert willow (*Chilopsis linearis*) is common in the low terrace of the Mojave River.

Photograph 15. Long-nosed leopard lizard (*Gambelia wislizenii*) was observed during 2015 surveys.

Photograph 16. Shaggy mane (*Coprinus comatus*) fungus was sparsely scattered throughout the Yermo Stables survey area.

6 Summary and Conclusions

Biological surveys were conducted to assess the current conditions and potential for sensitive resources to occur within the survey area. The Range East and KD Range Complex, Range West, Range Main Supply Route, and Yermo Stables are located within desert scrub habitats, predominantly Creosote bush–white bursage scrub and allscale scrub with lesser amounts of California joint fir scrub, Scale broom scrub, and Desert willow woodland. Disturbed and developed communities are also present throughout the survey area and support suitable habitat for sensitive resources. Desert washes that flow intermittently only after large storm events are important habitat for numerous plant and wildlife species. Sensitive species were observed or have the potential to occur on all the survey areas. Table 6.1 provides a summary of the results from the biological surveys.

Table 6.1. Summary of Results from the Biological Surveys on MCLB Barstow

Survey Area	Vegetation Community	Habitat may be Suitable for Sensitive Plants	Desert Tortoise Sign Observed
Range East and KD Range Complex	Creosote bush–white bursage scrub (low terrace, rocky hillslopes and desert pavement) Desert wash Disturbed vegetation Developed	yes	yes
Range West	Creosote bush–white bursage scrub (low terrace, rocky hillslopes and desert pavement) Desert wash Developed	yes	yes
Range Main Supply Route	Disturbed creosote bush–white bursage scrub (low terrace, rocky hillslopes and desert pavement) Desert wash Disturbed vegetation Developed	yes	yes
Yermo Stables	Creosote bush–allscale scrub Allscale scrub Desert willow woodland Desert wash California joint fir scrub Scale broom scrub Disturbed vegetation	yes	yes

Vegetation data collected within the different geomorphic settings suggest rocky slopes, low terraces, and desert washes; desert pavement shows trends in shrub density, shrub stature (height and width), and the number of species (= species richness) present. Shrub density is somewhat similar across the different geomorphic settings. The low terraces had the lowest density (825 shrubs/ hectare) and the desert washes were most dense (1,533 shrubs /hectare). Creosote shrub stature showed similar patterns across the different geomorphic settings, although shrub widths tend to vary more than height across the different geomorphic settings. The annual plants and shrub species richness varied across the landscape: the most shrub species occurred in the desert washes and annual plant species richness was greatest on rocky hillslopes. To better understand desert tortoise habitat, these results could be used with desert tortoise occurrence data (e.g., occupied habitat type [historic and current], burrow location, and orientation of

burrow opening), to provide more detailed information on desert tortoise patterns of occurrence on MCLB Barstow.

No federally and/or state-listed or sensitive plant species were observed within the survey area. However, surveys were not always conducted during the optimal time of year to identify sensitive plant species and ongoing drought conditions could also affect species composition. Several sensitive plant species have the potential to occur within the Creosote bush–white bursage scrub and Allscale scrub habitat, including Mojave monkeyflower (CRPR 1B.2), Barstow woolly sunflower (CRPR 1B.2), dentate blazing star (CRPR 1B.3), and spiny hairy blazing star (*Mentzelia tricuspis*).

The only sensitive wildlife species observed during 2013 – 2015 surveys was desert tortoise. Desert tortoise protocol surveys were conducted in October 2013 and April – May 2015 and the results are provided in separate reports (Leidos 2014, 2015a). In summary, live desert tortoises were observed on the Range East and KD Range Complex, Range West, and Range Main Supply Route. Desert tortoise sign including shell remains (carcass and bone fragment), egg shell fragments, scat, and burrows was also present throughout the survey area, and especially prevalent on the Range East and KD Range Complex, Range West, and Range Main Supply Route. One juvenile tortoise was observed just west of the KD Rifle Range. A few burrows were observed on Yermo Stables.

Many active bird nests were observed on the Range Complex including red-tailed hawk, cactus wren, black-throated sparrow, ash-throated fly catcher, verdin, mourning dove, blue-gray gnatcatcher, Scott's oriole, common raven, and loggerhead shrike.

Numerous invasive plant species were observed throughout the survey area including saltcedar, Sahara mustard, Russian thistle, London rocket, cheat grass, foxtail brome, and schismus. These species are listed on CalIPC and many are included on the Mojave Weed Management Area list and should be monitored. None of the plants on the Federal Noxious Weed List (USDA 2012) were found, or are expected to occur, in the survey area.

7 Recommendations

Due to the documented presence of the desert tortoise in the survey area, MCLB Barstow should consult with the USFWS prior to any project initiation and incorporate the recommendations into the project. For example, a desert tortoise monitor may need to be present for construction activities to ensure no tortoises are harmed. Additionally, compliance with the Migratory Bird Treaty Act may require that if any activities occur during the nesting season (i.e., after March 15), a biologist should be present to ensure no birds are nesting in construction area.

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Appendix A

List of Plant Species Observed during 2013 – 2015 Surveys

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Appendix A. List of Plant Species Observed During 2013 – 2015 Surveys

Scientific Name	Common Name	Family	Plant Type	Range Complex			Yermo Stables
				Range East and KD Range Complex (including LZ 1)	Range West (including LHA/LHD)	Range Main Supply Route	LZ 2 and proposed access roads
Acamptopappus sphaerocephalus	Goldenhead	Asteraceae	P	X		X	
Adenophyllum cooperi	Cooper's dyssodia	Asteraceae	P		X		
Allionia incarnata var. *incarnata*	trailing windmills	Nyctaginaceae	A	X	X		
Amaranthus fimbriatus	fringed amaranth	Amaranthaceae	A	X	X		
Ambrosia dumosa	white bursage	Asteraceae	P	X	X	X	X
Ambrosia salsola (= Hymenoclea salsola)	cheesebush	Asteraceae	P	X	X	X	X
Amsinckia tessellata	checker fiddleneck	Boraginaceae	A	X	X	X	
Anisocoma acaulis	scalebud	Astraceae	A		X		
Asclepias sp.	milkweed	Apocynaceae	P			X	
Atriplex canescens	fourwing saltbush	Chenopodiaceae	P			X	
Atriplex hymenelytra	desert holly	Chenopodiaceae	P			X	
Atriplex polycarpa	allscale saltbush	Chenopodiaceae	P				X
Baileya multiradiata var. *multiradiata*	desert marigold	Asteraceae	P	X	X	X	
Baccharis sarothroides	desertbroom	Asteraceae	P		X		
Bebbia juncea	sweetbush	Asteraceae	P	X	X	X	
Bouteloua aristidoides	needle grama	Poaceae	A	X			
Bouteloua barbata	six weeks grama	Poaceae	A	X			
*Brassica tournefortii**	Sahara mustard	Brassicaceae	A		X	X	X
Brickellia incana	woolly brickellia	Asteraceae	P	X			
*Bromus diandrus **	ripgut brome	Poaceae	A				X
Bromus madritensis ssp. *rubens**	foxtail brome	Poaceae	A	X	X		X
*Bromus tectorum**	cheatgrass	Poaceae	A		X	X	
Camissonia sp.	suncup	Onagraceae	A				
Camissonia claviformis var. *claviformis*	browneyes	Onagraceae	A,P	X	X		X
Chamaesyce micromera	sandmat spurge	Euphorbiaceae	A	X	X	X	X
Chamaesyce setiloba	fringed spurge	Euphorbiaceae	A	X	X		X
Chaenactis carphoclinia var. *carphoclinia*	pebble pincushion	Asteraceae	A		X		
Chilopsis linearis	desert willow	Bignoniaceae	P				X
Chorizanthe brevicornu	brittle spineflower	Polygonaceae	A		X	X	
Chorizanthe rigida	devil's spineflower	Polygonaceae	A	X	X	X	X
Chylismia brevipes (= Camissonia brevipes)	golden suncup	Onograceae	A	X	X	X	

Appendix A. List of Plant Species Observed During 2013 – 2015 Surveys

Scientific Name	Common Name	Family	Plant Type	Range Complex			Yermo Stables
				Range East and KD Range Complex (including LZ 1)	Range West (including LHA/LHD)	Range Main Supply Route	LZ 2 and proposed access roads
Cryptantha circumscissa var. circumscissa	Cushion cryptantha	Boraginaceae	A		X		
Cryptantha micrantha var. micrantha	Red-root cryptantha	Boraginaceae	A				X
Cryptantha nevadensis var. *nevadensis*	Nevada cryptantha	Boraginaceae	A	X	X	X	
Cryptantha pterocarya var. *cyloptera*	wignut cryptantha	Boraginaceae	A	X	X	X	
Cucurbita palmata	coyote gourd	Cucurbitaceae	P	X	X		X
Cylindropuntia echinocarpa	slender or golden cholla	Cactaceae	P	X	X		
Cylindropuntia ramosissima (= *Opuntia ramosissima*)	branched pencil cholla	Cactaceae	P	X	X		
Curcurbita digitata	finger leaved gourd	Cucurbitaceae	P				X
Dalea mollissima	downy dalea	Fabaceae	P	X	X	X	
Datura wrightii	jimsonweed	Solanaceae	P				X
Echinocactus polycephalus var. *polycephalus*	cottontop cactus	Cactaceae	P	X	X		
Echinocereus engelmannii	Engelmann's hedgehog cactus	Cactaceae	P	X	X		
Encelia actoni	Acton encelia	Asteraceae	P	X	X		
Encelia farinosa	Brittlebush	Asteraceae	P			X	
Ephedra californica	desert tea	Ephedraceae	P	X	X		X
Ephedra nevadensis	Nevada ephedra	Euphedraceae	P	X	X		
Eremalche rotundifolia	desert five spot	Malvaceae	A	X	X		
Eremothera boothii ssp. *condensata (= Camissonia boothii)*	Booth's sun cup	Onograceae	A	X	X		
Eremothera refracta (=Camissonia refracta)	narrowleaved primrose	Onograceae	A		X		
Eriastrum eremicum ssp. *eremicum*	desert wooly star	Polemoniaceae	A	X	X		
Ericameria sp.	goldenbush	Asteraceae	P		X		
Eriogonum angulosum	angled stem buckwheat	Polygonaceae	A			X	
Eriogonum deflexum var. *deflexum*	flat topped buckwheat	Polygonaceae	A	X	X	X	X
Eriogonum fasciculatum var. *polifolium*	California buckwheat	Polygonaceae	A	X	X		
Eriogonum inflatum	desert trumpet	Polygonaceae	P	X	X		
Eriogonum nudularium	birdnest buckwheat	Polygonaceae	A	X	X	X	
Eriogonum reniforme	kidneyleaf buckwheat	Polygonaceae	A	X	X	X	
Eriogonum thomasii	Thomas' buckwheat	Polygonaceae	A	X	X	X	

Appendix A. List of Plant Species Observed During 2013 – 2015 Surveys

Scientific Name	Common Name	Family	Plant Type	Range Complex			Yermo Stables
				Range East and KD Range Complex (including LZ 1)	Range West (including LHA/LHD)	Range Main Supply Route	LZ 2 and proposed access roads
*Erodium cicutarium**	red stemmed filaree	Geranaceae	A	X		X	X
Eschscholzia minutiflora	pygmy poppy	Papaveraceae	A		X		
Funastrum hirtellum	climbing milkweed	Apocynaceae	P	X			
Geraea canescens	desert sunflower	Asteraceae	A	X	X	X	
Heliotropium curassavicum	alkali heliotrope	Boraginaceae	P				X
Hordeum sp.*	barley	Poaceae	A				
Krameria erecta	purple heather	Krameriaceae	P	X	X	X	
Langloisia setosissima ssp. puctata	Great Basin langloisia	Polemoniaceae	A	X	X		
Larrea tridentata	creosote bush	Zygophyllaceae	P	X	X	X	X
Lepidium dictyotum	Alkali pepperweed	Brassicaceae	A		X		
Lepidospartum squamatum	scale broom	Asteraceae	P	X			X
Leptosyne bigelovii	coreopsis	Asteraceae	A		X		
Lupinus sp.	small annual lupine	Fabaceae	A		X		
Lycium andersonii	Anderson's desert thorn	Solanaceae	P	X	X		
Lycium pallidum var. *oligospermum*	rabbit-thorn	Solanaceae	P	X	X		X
Malacothrix coulteri	snake's head	Asteraceae	A		X	X	
Mammillaria sp.	fish-hook cactus	Cactaceae	P		X		
Mentzelia sp.	yellow blazing star	Losaceae	A				
Monoptilon bellioides	Mojave desertstar	Asteraceae	A	X			X
Mirabilis laevis	wishbone bush	Nyctaginaceae	P	X	X		
Oenothera californica ssp. avita	California evening primrose	Onograceae	P		X	X	X
Opuntia basilaris	beavertail cactus	Cactaceae	P	X	X		
Oxytheca perfoliata	roundleaf oxytheca	Polygonaceae	A		X	X	
Palafoxia arida var. *arida*	desert needle	Asteraceae	A				X
Pectis papposa var. *papposa*	chinch weed	Asteraceae	A	X	X	X	X
Pectocarya recurvata	Arch nutted comb bur	Boraginaceae	A		X		
Petalonyx thurberi subsp. *thurberi*	sandpaper bush	Loasaceae	P	X	X		X
Phacelia crenulata	heliotrope phacelia	Boraginaceae	A	X	X		
Pholisma arenarium (parasitic)	Dune food	Boraginaceae	P	X			

Appendix A. List of Plant Species Observed During 2013 – 2015 Surveys

Scientific Name	Common Name	Family	Plant Type	Range Complex			Yermo Stables
				Range East and KD Range Complex (including LZ 1)	Range West (including LHA/LHD)	Range Main Supply Route	LZ 2 and proposed access roads
Plantago ovata	Desert plantain	Plantaginaceae	A				
Portulaca oleraceae	purslane	Portulacaceae	A				X
Psorothamnus arborescens	Mojave indigo bush	Fabaceae	P	X	X		X
*Salsola tragus**	Russian thistle	Chenopodiaceae	A				X
Salvia carduacea	thistle sage	Lamiaceae	A		X		
Salvia columbariae	chia	Lamiaceae	A		X	X	
Schismus sp.*	Mediterranean grass	Poaceae	A	X	X	X	X
Scutellaria mexicana (=*Salazaria mexicana)*	Mexican bladdersage	Lamiaceae	P	X	X		
Senegalia greggii (= *Acacia greggii*)	catclaw	Fabaceae	P	X	X		
Senna armata	spiny senna	Fabaceae	P	X	X		
Sisymbrium irio *	London rocket	Brassicaceae	A				X
Sphaeralcea ambigua var. *rugosa*	globe-mallow	Malvaceae	P		X		
Sporobolus cryptandrus	sand dropseed	Poaceae	P				X
Stephanomeria pauciflora	wire lettuce	Asteraceae	P	X	X	X	X
Stylocline intertexta	tangled nest straw	Asteraceae	A	X	X		X
*Tamarix ramosissima**	saltcedar	Tamaricaceae	P	X			X
Tidestromia oblongifolia	white leaved amaranth	Amaranthaceae	A	X			
Tiquilia plicata	fanleaf crinklemat	Boraginaceae	P	X			
Xylorhiza tortifolia	Mohave woodaster	Asteraceae	P		X		
Yucca schidigera	Mojave yucca	Agavaceae	P	X	X		

Notes: Plant type A= annual, P= Perennial, "X" denotes species present on the site. Nomenclature follows Baldwin et. al. 2012. Old Latin name according to Hickman 1993 is indicated in this manner: (= old name), * = indicates non-native species.

Appendix B

List of Wildlife Species and Sign Observed During 2013 – 2015 Surveys

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Appendix B. List of Wildlife Species and Sign Observed During 2013 – 2015 Surveys

Species	Common Name	Range Complex			Yermo Stables
		Range East and KD Range Complex (including LZ 1)	Range West (including LHA/LHD)	Range Main Supply Route	LZ 2 and proposed access roads
Reptiles					
Gambelia wislizenii	Long-nosed leopard lizard	X			X
Callisaurus draconoides	Zebra-tailed Lizard	X	X	X	X
Dipsosaurus dorsalis dorsalis	Northern desert iguana	X	X	X	X
Phrynosoma (= Doliosaurus) platyrhinos	Desert Horned Lizard		X		
Aspidoscelis (= Cnemidophorus) tigris tigris	Great Basin Whiptail	X	X	X	X
Sceloporus magister	Desert Spiny lizard		X		
Uta stansburiana	Common side-blotched lizard	X	X	X	X
Coluber flagellum piceus	Red racer		X		
Crotalus cerastes cerastes	Mojave desert sidewinder	X			X
Crotalus mitchellii pyrrhus	Southwestern speckled rattlesnake			X	
Crotalus scutulatus	Mojave rattlesnake	X			
Pituophis catenifer deserticola	Great Basin gopher snake		X	X	
Salvadora hexalepis	Western patch-nosed snake		X		
Gopherus agassizi+	Desert tortoise	X	X	X	
Insects					
Eurema nicippe	Sleepy sulfur	X			
Anisoptera (suborder)	Dragonfly	X	X		
Formicidae (family)	Harvester ant	X	X	X	
Pepsis sp.	Tarantula wasp		X		
Birds					
Amphispiza belli	Sage sparrow	X			X
Amphispiza bilineata	Black-throated sparrow [1]	X	X		
Asio flammeus	Short-eared owl		X		
Auriparus flaviceps	Verdin [1]	X	X	X	
Buteo jamaicensis	Red-tailed hawk [1]	X		X	
Campylorhynchus brunneicapillus	Cactus Wren [1]	X			
Circus cyaneus	Northern harrier				X
Chordeiles minor	Common nighthawk		X		
Columba livia	Rock Pigeon				X
Corvus corax	Common raven [1]	X	X	X	X

Appendix B. List of Wildlife Species and Sign Observed During 2013 – 2015 Surveys

Species	Common Name	Range Complex			Yermo Stables
		Range East and KD Range Complex (including LZ 1)	Range West (including LHA/LHD)	Range Main Supply Route	LZ 2 and proposed access roads
Birds					
Eremophila alpestris	Horned lark	X			
Falco sparverius	American kestrel			X	
Geothlypis tolmiei	MacGillivray's warbler	X			
Haemorhous mexicanus	House finch			X	
Hirundo rustica	Barn swallow				X
Icterus parisorum	Scott's oriole [1]	X	X		
Lanius ludovicianus	Loggerhead shrike [1]	X		X	X
Myiarchus cinerascens	Ash-throated flycatcher [1]	X	X		
Piranga ludoviciana	Western tanager	X	X		
Polioptila caerulea	Blue- gray gnatcatcher [1]	X	X		
Polioptila melanura	Black-tailed gnatcatcher	X	X		
Salpinctes obsoletus	Rock wren[1]	X			
Sayornis saya	Say's phoebe				X
Setophaga coronata	Yellow rumped warbler	X	X	X	
Tyrannus verticalis	Western kingbird		X		
Zenaida macroura	Mourning dove [1]	X	X		
Zonotrichia leucophrys	White crown sparrow			X	
Mammals					
Lepus californicus	Black-tailed jackrabbit	X	X		X
Sylvilagus audubonii	Desert cottontail	X	X		X
Neotoma lepida	Desert woodrat	X	X		
Dipodomys merriami	Merriam's kangaroo rat	X	X		X
Ammospermophilus leucurus	White-tailed antelope squirrel	X		X	
Spermophilius beecheyi	California ground squirrel	X			X
Canis latrans	Coyote	X	X	X	X
Felis rufus	Bobcat	X	X		X
Vulpes macrotis	Kit fox	X	X		X
Canis lupus familiaris	Domestic dog	X			X
Equus caballus	Domestic horse				X
Notes: + = special status species, "X" denotes species present on the site, 1= active bird nests observed during 2015 surveys					

Appendix C

List of Special Status Plant Species that have the Potential to Occur in the Survey Area

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Appendix C. List of Special Status Plant Species that have the Potential to Occur in the Survey Area

Species	Status Fed/State/ CRPR	Habitat	Blooming period	Notes	Potential for Occurrence in Survey Area
Abronia villosa var. *aurita* Chaparral sand verbena	--/--/1B.1	Annual herb that occurs in chaparral, coastal scrub, desert dunes; on sandy soils; 246 – 5,249 feet (75 – 1,600 meters).	January - September	Record of occurrence northwest of Barstow in 1976 in chaparral coastal sage scrub community. Suitable sandy soils present in Yermo Stables, but species not found during 2013 – 2015 surveys and is unlikely to occur in the survey area.	Low to medium
Astragalus jaegerianus *Lane mountain milkvetch*	FE/--/1B.1	Perennial herb that occurs in creosote bush scrub, Joshua tree woodlands, washes and roadcuts, in sand or gravel; 2,953 – 3,937 feet (900 – 1,200 meters).	April - June	Known from a small population adjacent to Fort Irwin. Survey areas are above elevational range for this species. Species not observed during 2013 – 2015 surveys and is unlikely to occur in the survey area.	Low
Castela emoryi *Crucifixion thorn*	--/--/2.3	Deciduous shrub that occurs on playa, creosote bush scrub, Mojavean desert scrub, Sonoran desert scrub; 295 – 2,198 feet (90 – 670 meters).	June - July	Known to occur within 5 miles (8 kilometers) of the survey area. Suitable habitat is present in the Range Complex and Yermo Stables but species was not found during 2013 – 2015 surveys.	Medium
Chorizanthe spinosa *Mojave spineflower*	--/--/4.2	Annual herb that occurs in creosote bush scrub and shadscale scrub in sand or gravel; 1,960 – 4,265 feet (600 – 1,300 meters).	March - July	Suitable habitat is present in the survey area but species not found during 2015 surveys.	Medium
Cryptantha clokeyi *Prickly cryptantha*	--/--/1B.2	Annual herb that occurs in creosote bush scrub on rocky to gravelly slopes, ridge crests and desert woodlands; 2,789 – 5,413 feet (850 – 1,650 meters).	April	Suitable habitat is present in the Range Complex and Yermo Stables, species not observed during 2013 – 2015 surveys.	Medium
Cymopterus deserticola Desert spring parsley	--/--/1B.2	Perennial herb that occurs in creosote bush scrub and Joshua tree woodlands on sand soils; 2,297 – 4,921 feet (700 – 1,500 meters).	March – May	Suitable habitat is present in the Range Complex and Yermo Stables, species not observed during 2013 – 2015 surveys.	Medium
Eriophyllum mohavense Barstow woolly sunflower	--/--/1B.2	Annual herb that occurs in desert chenopod scrub, Mojavean desert scrub and desert playas; on open silty or sandy areas; 1,640 – 2,953 feet (500 – 900 meters).	April - May	Known to occur within 5 miles (8 kilometers) of the survey area. Suitable habitat is present in the Range Complex and Yermo Stables, species not observed during 2013 – 2015 surveys.	High
Menodora spinescens var. *mohavensis* Mojave menodora	--/--/1B.2	Deciduous shrub that occurs in Mojavean desert scrub, Andesite gravel, rocky hillsides and canyons; 2,264 – 6,562 feet (690 – 2,000 meters).	April - May	Known to occur within 5 miles (8 kilometers) of the survey area. Suitable habitat is present in the Range Complex but species not found during 2013 – 2015 surveys.	Medium

Appendix C. List of Special Status Plant Species that have the Potential to Occur in the Survey Area

Species	Status Fed/State/ CRPR	Habitat	Blooming period	Notes	Potential for Occurrence in Survey Area
Mentzelia tricuspis Spinyhair blazingstar	--/--/2.1	Annual herb that occurs in in Mojavean desert scrub, creosote bush scrub, Andesite gravel, rocky hillsides and canyons; 492 – 4,200 feet (150 – 1,280 meters).	March - May	Known to occur within 5 miles (8 kilometers) of the survey area and found west of Range East. Suitable habitat is present in the Range Complex but species not observed during 2013 – 2015 surveys.	Medium to high
Mentzelia tridentata Dentate (creamy) blazing star	--/--/1B.3	Annual herb that occurs in in Mojavean desert scrub, gravelly, rocky and sandy soil; 2,297 – 3,806 feet (700 – 1,160 meters).	March - June	Known to occur within 5 miles (8 kilometers) of the survey area. Suitable habitat is present in the Range Complex, species not observed during 2013 – 2015 surveys.	Medium to high
Mimulus mohavensis Mojave monkeyflower	--/--/1B.2	Annual herb that occurs in Mojavean desert scrub, creosote bush scrub and Joshua tree woodlands, sandy or gravelly often in washes; 1,969 – 3,937 feet (600 – 1,200 meters).	April - June	Known to occur within 5 miles (8 kilometers) of the survey area. Suitable habitat is present in the Range Complex, species not observed during 2013 – 2015 surveys.	High
Pediomelum castoreum Beaver dam breadroot	--/--/1B.2	Perennial herb that occurs in creosote bush scrub, Joshua tree woodlands, sandy, washes and roadcuts; 0 – 5,003 feet (0 – 1,525 meters).	April - May	Known to occur within 5 miles (8 kilometers) of the survey area. Suitable habitat is present in the Range Complex but species not observed during 2013 – 2015 surveys.	Medium
Phacelia parishii Parish's phacelia	--/--/1B.1	Annual herb that occurs on playas in creosote bush scrub, alkali sink; 1,772 – 3,937 feet (540 – 1,200 meters).	April - May	Known to occur within 5 miles (8 kilometers) of the survey area. Suitable habitat (playas) not present in the survey area.	Low

Status:

Federal Status (determined by U. S. Fish and Wildlife Service):

FE Federally Listed Endangered
FT Federally Listed Threatened
FP Federally Proposed for Listing
FC Federal Candidate for listing as threatened or endangered

California State Status (determined by California Department of Fish and Wildlife):

SE California State Listed Endangered
ST California State Listed Threatened
SR California State Listed Rare

Sources:

Baldwin et al. 2012; CalFlora 2015; CDFW 2015a, 2015b; CNPS 2015; MCLB Barstow 2005

California Rare Plant Rank (CNPS/CDFW):

List 1B: Plants rare, threatened or endangered in California and elsewhere.
List 2: Plants rare, threatened or endangered in California but more common elsewhere.
List 3: Plant about which we need more information- (A review list).
List 4: Plants of limited distribution (A watch list).

Threat Ranks:

0.1-Seriously threatened in California
0.2-Fairly threatened in California
0.3-Not very threatened in California

Appendix D

List of Animal Species with the Potential to Occur in the Survey Area

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Appendix D. List of Animal Species with the Potential to Occur in the Survey Area

Sensitive Species	Status Federal/State	Habitat and Distribution	Breeding period	Notes	Potential for Occurrence in Survey Area
Mammals					
Antrozous pallidus Pallid bat	--/CSSC	Low elevation <6,000 feet (1,829 meters) rocky arid deserts, grasslands and canyon lands, higher elevation >7,000 feet (2,133 meters) coniferous forests. Roosts in rock crevices and basal tree hollows as well as in man-made structures.	Mating: October – February, Parturition: April – July, Weaning: August	May occasionally forage; roost sites not known and unlikely to occur in the survey area.	Low
Corynorhinus townsendii Townsend's big-eared bat	--/CSSC	Found throughout California from sea level to 10,827 feet (3,300 meters). Occurs in a wide variety of habitats. Associated habitats include coniferous forest, mixed mesophytic forests, deserts, native prairies, riparian communities, active agricultural areas, and coastal habitats. Requires caves, mines, tunnels, buildings, or other human-made structures for roosting.	Most mating occurs from November – February, births occur in May and June. Maternity roosts are warm areas found in caves, mines, tunnels, and buildings. Small clusters or groups (<100 individuals) of females and young form the maternity colony.	Move to hibernacula sites and stay from October to April. Known to occur north of the Yermo Annex about 3.5 miles (5.6 kilometers) in the Calico Mountains. May occasionally forage; roost sites not known and unlikely to occur in the survey area.	Low
Eumops perotis Western mastiff bat	--/CSSC	Uncommon resident in coastal ranges from Monterey County southward through southern California. Occurs in many open, semi-arid to arid habitats, including conifer and deciduous woodlands, coastal scrub, annual and perennial grasslands, palm oases, chaparral, desert scrub, and urban.	In California, parturition may occur from early April through August or September but dates vary more for this species than for any other bat in the U.S. Nursery roosts described as tight rock or building crevices at least 35 inches (90 centimeters) deep and 2 inches (5 centimeters) wide.	May occasionally forage; roost sites not known and unlikely to occur in survey area.	Low
Xerospermophilus mohavensis Mohave ground squirrel	--/ST	Occupies all desert scrub habitats in the western Mojave Desert including Joshua tree woodlands, creosote scrub, saltbush scrub, and Mojave mixed woody scrub. Generally inhabits flat to moderate terrain. Primarily feeds on leaves and seed of forbs and shrubs from February to July and then begins period of estivation.	Breeding occurs after hibernation around February.	The Mohave ground squirrel was mapped about 3 miles (4.8 kilometers) southwest of the Range Complex and 3 miles (4.8 kilometers) southeast of the Yermo Annex.	Medium to high

Appendix D. List of Animal Species with the Potential to Occur in the Survey Area

Sensitive Species	Status Federal/State	Habitat and Distribution	Breeding period	Notes	Potential for Occurrence in Survey Area
Birds					
Athene cunicularia Burrowing owl	--/CSSC	Distributed throughout most of California in grasslands, shrub-steppes grasslands, savannas and open areas such as agricultural lands or vacant lots near human habitation. Burrows are usually in areas with a low, open cover that can provide good horizontal visibility. Nests are in abandoned burrows, such as those dug by prairie dogs, ground squirrels, foxes and woodchucks.	Nesting begins in spring, burrows are used for breeding nesting and brooding.	Previously documented on MCLB Barstow. Suitable habitat is present in the Yermo Annex and Range Complex. Several burrowing owl sightings were also recorded south of Barstow and approximately 2 miles (3.2 kilometers) from the Nebo Annex.	High
Empidonax traillii extimus Southwestern willow flycatcher	FE-CH/SE	Nests only in dense riparian vegetation associated with streams, rivers, lakes, springs, and other watercourses and wetlands. In California, this bird breeds from near sea level on the Santa Margarita River to 2,640 feet (805 meters) at the South Fork Kern River and 3,000 feet (914 meters) at upper San Luis Rey River.	Arrives on the breeding grounds between early May and early June. Successful breeders depart from breeding territories as early as mid-August, and fledglings probably leave the breeding area a week or two after adults, but few details are known.	Suitable habitat is not present thus unlikely to occur in the survey area.	Low
Falco mexicanus Prairie falcon	--/CSSC	Occupy a variety of habitats mainly treeless terrain that includes prairies, deserts, riverine escarpments, canyons, foothills, and mountains in relatively arid and semiarid shrublands and grassland habitats. Generally forage in open areas with low vegetation.	Breeding begins about 2 years old and occurs from mid-February to mid-September with peak activity from early May to early August. Most nests in California have northern exposures.	Prairie falcons have been noted in the area and may visit MCLB Barstow to hunt for prey.	Medium to high
Icteria verens Yellow breasted chat	--/CSSC	A migrant and summer resident primarily from late March to September. Occurs in riparian habitats with a well-developed shrub layer and an open canopy. Nests along the borders of streams, creeks, sloughs and rivers.	Breeds from late April through early August	Suitable habitat is not present within the survey area.	Low

Appendix D. List of Animal Species with the Potential to Occur in the Survey Area

Sensitive Species	Status Federal/State	Habitat and Distribution	Breeding period	Notes	Potential for Occurrence in Survey Area
Toxostoma lecontei Le Conte's thrasher	--/CSSC	Occurs primarily in sparsely vegetated desert flats, dunes, alluvial fans or gentle rolling hills with desert scrub, alkali desert scrub, and desert succulent shrub habitats. Often occurs in habitats with a high proportion of saltbush or shadscale species (*Atriplex* spp.) and /or cholla cactus (*Opuntia* spp.); also occurs in Joshua tree habitat with scattered shrubs.	Territory defended most actively from early December – early February, with breeding occurring from February – June and peaks from mid-March – mid-April.	Le Conte's thrasher has been recorded in Barstow within 4 miles (6.4 kilometers) of the Nebo Annex and just east of the Yermo Annex along the Mojave River.	Medium
Vireo bellii pusillus Least Bell's vireo	FE/CE	Occurs in dense willow-dominated riparian habitats with lush understory vegetation, nesting in the understory and using taller trees for foraging and singing perches.	First eggs are laid in April.	Suitable habitat is not present and species is unlikely to occur in the survey area.	Low
Amphibians					
Anaxyrus californicus Arroyo toad	FE-CH/CSSC	Ranges west of the desert in coastal area washes, arroyos, sandy riverbanks, riparian areas with willows, sycamores, oaks, cottonwoods. Extremely specialized habitat needs, including exposed sandy streamsides with stable terraces for overwinter and forage sites. Streams not necessarily perennial but occur from sea level to 4,400 feet (1,341 meters).	Mating and egg-laying takes place from March to July at the quiet margins of shallow streams or pools free of predatory fishes with sandy or gravel bottoms without silt.	Arroyo toad uses low gradient riverine and adjacent floodplain habitats primarily. Suitable habitat is not present in survey area.	Low
Reptiles					
Gopherus agassizii Desert tortoise	FT-CH/ST	Rocky slopes in desert scrub to semi-desert grassland, as well as along washes, and extending into creosote bush flats. Generally occurs in areas where soil is friable (brittle) to dig burrows. Has been documented on rocky slopes of up to 40%.	March – May.	Known to occur on the Nebo Annex, Range Complex, and Yermo Annex. Desert tortoise sign documented in the Range Complex and on the Utility ROW Access Routes in the Range Main Supply Route during surveys.	High

Appendix D. List of Animal Species with the Potential to Occur in the Survey Area

Sensitive Species	Status Federal/State	Habitat and Distribution	Breeding period	Notes	Potential for Occurrence in Survey Area
Fish					
Siphateles bicolor mohavensis Mohave Tui chub	FE/SE	Mohave Tui chub is lacustrine and is mainly associated with deep pools and slough-like areas of the Mojave River.	Spawning takes place when water warms in March or April. Fish spawn in mass over vegetation.	Suitable habitat is not present and unlikely to occur within the survey area.	Low

Notes:

Federal
FE = Listed under ESA as endangered
FT = Listed under ESA as threatened
FC = Candidate for federal listing
PFT = Proposed for ESA listing as threatened
CH = USFWS-designated critical habitat occurs in the county
PCH = proposed critical habitat occurs in the county
SOC = USFWS species of special concern
BCC = USFWS bird of conservation concern

State
ST = listed as threatened in California
CE = Candidate for endangered status in California
FP = California fully protected
CSSC = California species of special concern
WL = California Watch List
SE = listed as endangered in California

Sources: CalHerps 2015; CDFW 2015a,2015b; NatureServe 2015.

Appendix E

List of Reptiles and Amphibians for MCLB Barstow

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INSTALLATION NAME	INSTALLATION DETACHMENT	DOD SERVICE	STATE NAME	COUNTY NAME	SPECIES TYPE	SCIENTIFIC NAME	COMMON NAME	PRESENCE	CITATIONS PRESENCE	FEDERAL STATUS	NATURESERVE STATUS	STATE ENDANGERED	STATE THREATENED	STATE PROTECTED	SGCN	NATIVE YES	NATIVE NO
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Frog or Toad	*Anaxyrus boreas halophilus*	California Toad	Confirmed	INRMP 2012	Species of Concern	G4 - Apparently Secure	CO, NM	UT	CO, MT, OR, UT, WA	CO, MT, NM, UT, WY, WA	AK, CA, CO, ID, MT, NV, NM, OR, UT, WY, WA	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Frog or Toad	*Anaxyrus punctatus*	Red-spotted Toad	Potential		none	G5 - Secure			CO, KS	KS	AZ, CA, CO, KS, NV, NM, OK, TX, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Frog or Toad	*Lithobates catesbeianus*	American Bullfrog	Confirmed	INRMP 2012	none	G5 - Secure			CO, DC, MN, MS, NE, TN	DC, MO, WY	AL, AR, CT, DC, FL, GA, IN, IA, KS, KY, LA, ME, MD, MA, MN, MS, MO, NE, NH, NJ, NM, NY, NC, OH, OK, PA, RI, SC, SD, TN, TX, VT, VA, WV, WI, WY	AZ, CA, CO, ID, MT, NV, OR, UT, WA
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Frog or Toad	*Pseudacris sierra*	Sierra Treefrog	Historic Record		none	G5 - Secure					CA, ID, NV, OR, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Lizard	*Anniella pulchra*	California Legless Lizard	Confirmed	Personal Observation NRM Tom Campbell	Species of Concern (Anniella p. pulchra)	G3G4			Species of Special Concern	CA	CA	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Lizard	*Callisaurus draconoides*	Zebra-tailed Lizard	Confirmed	INRMP 2012	none	G5 - Secure		UT	UT	UT	AZ, CA, NV, NM, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Lizard	*Cnemidophorus (Aspidoscelis) tigris tigris*	Great Basin Whiptail	Confirmed	Voucher -SDSNF Number forthcoming	none	G5 - Secure			CO		AZ, CA, CO, ID, NV, NM, OR, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Lizard	*Coleonyx variegatus variegatus*	Desert Banded Gecko	Confirmed	INRMP 2012	none	G5 - Secure		UT	UT	AZ, NV, UT	AZ, CA, NV, NM, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Lizard	*Crotaphytus bicinctores*	Great Basin Collared Lizard	Confirmed	INRMP 2012	none	G5 - Secure			OR	ID	AZ, CA, ID, NV, OR, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Lizard	*Dipsosaurus dorsalis*	Desert Iguana	Confirmed	INRMP 2012	Species of Concern	G5 - Secure		UT	UT	NV, UT	AZ, CA, NV, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Lizard	*Doliosaurus (Phrynosoma) platyrhinos*	Desert Horned Lizard	Confirmed	INRMP 2012	none	G5 - Secure			OR	NV	AZ, CA, ID, NV, OR, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Lizard	*Elgaria panamintina*	Panamint Alligator Lizard	Confirmed	Personal Observation D. Silverman and B. Garlinger	Species of Concern	G2G3			CA Species of Special Concern	CA, NV	CA, NV	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Lizard	*Eumeces (Plestiodon) gilberti*	Gilbert's Skink	Confirmed	Personal Observation John Richmond	Species of Concern (Eumeces g. arizonensis and E. g. rubricaudatus)	G5 - Secure				AZ‡, NV	AZ, CA, NV	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Lizard	*Gambelia wislizenii*	Long-nosed Leopard Lizard	Confirmed	INRMP 2012	Species of Concern, including (Gambelia w. wislizenii)	G5 - Secure		UT	CO, OR, TX, UT	CO, NV, TX, UT	AZ, CA, CO, ID, NV, NM, OR, TX, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	*Lizard*	Sauromalus obesus (ater)	Common Chuckwalla	Confirmed	INRMP 2012	none	G5 - Secure		UT	UT	NV, UT	AZ, CA, NV, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	*Lizard*	Sceloporus graciosus graciosus	Common Sagebrush Lizard	Potential		none	G5 - Secure			CO, MT, NE, WA	ND, WA, WY	AZ, CA, CO, ID, MT, NE, NV, NM, ND, OR, SD, TX, UT, WA, WY	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	*Lizard*	Sceloporus occidentalis	Western Fence Lizard	Confirmed	HerpNet Record	none	G5 - Secure					CA, ID, NV, OR, UT, WA	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Lizard	*Sceloporus uniformis*	Yellow-backed Spiny Lizard	Confirmed	Personal Observation Rob Lovich	none	G5TNR					NV	

INSTALLATION NAME	INSTALLATION DETACHMENT	DOD SERVICE	STATE NAME	COUNTY NAME	SPECIES TYPE	SCIENTIFIC NAME	COMMON NAME	PRESENCE	CITATIONS PRESENCE	FEDERAL STATUS	NATURESERVE STATUS	STATE ENDANGERED	STATE THREATENED	STATE PROTECTED	SGCN	NATIVE YES	NATIVE NO
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Lizard	*Uma scoparia*	Mohave Fringe-toed Lizard	Potential		none	G3G4			CA	AZ, CA	AZ, CA	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Lizard	*Urosaurus graciosus*	Long-tailed Brush Lizard	Potential		none	G5 - Secure				NV	AZ, CA, NV	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Lizard	*Uta stansburiana*	Common Side-blotched Lizard	Confirmed	Voucher -SDSNF Number forthcoming	none	G5 - Secure			CO, OK	OK	AZ, CA, CO, ID NV, NM, OK, OR, TX, UT, WA	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Lizard	*Xantusia vigilis*	Desert Night Lizard	Confirmed	INRMP 2012	Species of Concern (Xantusia v. sierrae)	G5 - Secure		UT	UT	AZ, NV, UT	AZ, CA, NV, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Salamander	*Batrachoseps robustus*	Kern Plateau Slender Salamander	Potential		none	G2 - Imperiled					CA	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Arizona elegans candida*	Mohave Glossy Snake	Confirmed	INRMP 2012	Species of Concern	G5 - Secure		UT	CO, KS, NE, UT	KS, UT	AZ, CA, CO, KS, NE, NV, NM, OK, TX, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Charina bottae*	Northern Rubber Boa	Confirmed	Personal Observation NRM Tom Campbell, needs confirmation	none	G5 - Secure						
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Chionactis occipitalis*	Western Shovel-nosed Snake	Confirmed	INRMP 2012	Candidate (Chionactis o. klauberi)	G5 - Secure				AZ‡	AZ, CA, NV	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Crotalus cerastes*	Sidewinder	Confirmed	INRMP 2012	none	G5 - Secure		UT	UT	UT	AZ, CA, NV, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Crotalus scutulatus*	Mohave Rattlesnake	Confirmed	INRMP 2012	Species of Concern (Crotalus scutulatus scutulatus)	G5 - Secure		UT	UT	UT	AZ, CA, NV, NM, TX, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Crotalus stephensi*	Panamint Rattlesnake	Confirmed	INRMP 2012		G5 - Secure		UT	UT	UT	CA, NV	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Diadophis punctatus pulchellus*	Coral-bellied Ring-necked Snake	Confirmed	INRMP 2012	none	T4 - Apparently Secure						
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Hypsiglena chlorophaea*	Desert Nightsnake	Potential		none	G5 - Secure						
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Lampropeltis getula*	Common Kingsnake	Confirmed	INRMP 2012	none	G5 - Secure		IA, UT	AL, CO, MS, NE, NJ, NC‡, OH, OR, UT	AL, AZ‡, DE, CO, FL, IA, MO, NJ, NC, VA‡	AL, AZ, AR, CA, CO, DE, DC, FL, GA, IN, IA, KS, KY, LA, MD, MS, MO, NE, NV, NJ, NM, NC, OH, OK, OR, SC, TN, TX, UT, VA, WV	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Leptotyphlops humilis*	Western Threadsnake	Potential		none	G5 - Secure		UT	TX, UT	AZ‡, UT	AZ, CA, NV, NM, TX, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Lichanura orcutti*	Northern Three-Lined Boa	Confirmed	INRMP 2012	none	G4 - Apparently Secure						
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Masticophis (Coluber) flagellum piceus*	Red Coachwhip	Confirmed	Voucher -SDSNF Number forthcoming	none	G5 - Secure	IL	UT	AL, CO, MS, NE, UT	AZ, KY, MO, NC, TN, UT	AL, AZ, AR, CA, CO, FL, GA, IL, KS, LA, MS, MO, NE, NV, NM, NC, OK, SC, TN, TX, UT	KY
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Masticophis (Coluber) taeniatus*	Striped Whipsnake	Confirmed	HerpNet Record	none	G5 - Secure			CO, WA	WA	AZ, CA, CO, ID, NV, NM, OR, TX, UT, WA	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Phyllorhynchus decurtatus*	Spotted Leaf-nosed Snake	Potential		none	G5 - Secure		UT	UT	UT	AZ, CA, NV, UT	

INSTALLATION NAME	INSTALLATION DETACHMENT	DOD SERVICE	STATE NAME	COUNTY NAME	SPECIES TYPE	SCIENTIFIC NAME	COMMON NAME	PRESENCE	CITATIONS PRESENCE	FEDERAL STATUS	NATURESERVE STATUS	STATE ENDANGERED	STATE THREATENED	STATE PROTECTED	SGCN	NATIVE YES	NATIVE NO
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Pituophis catenifer*	Gophersnake	Confirmed	INRMP 2012	none	G5 - Secure			CO, IA, MN, NE, WI	IA, MN, MO, WA, WI, WY	AZ, CA, CO, ID, IN, IA, KS, MN, MO, NE, NV, NM, ND, OK, OR, SD, TX, UT, WA, WI, WY	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Rhinocheilus lecontei*	Long-nosed Snake	Potential		Species of Concern (R. l. lecontei)	G5 - Secure		KS, UT	CO, OK, UT	CO, ID, KS, OK, UT	AZ, CA, CO, ID, KS, NV, NM, OK, TX, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Salvadora hexalepis*	Western Patch-nosed Snake	Confirmed	HerpNet Record	none	G5 - Secure		UT	UT	UT	AZ, CA, NV, NM, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Tantilla hobartsmithi*	Smith's Black-headed Snake	Potential		none	G5 - Secure		UT	CO, UT	AZ, CO, UT	AZ, CA, CO, NV, NM, TX, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Snake	*Trimorphodon lyrophanes*	California Lyresnake	Potential		Species of Concern	GNR - Not Yet Ranked		UT	UT	NV, UT	AZ, CA, NV, NM, UT	
NAWS China Lake	Main Base	Navy	California	Inyo/Kern/San Bernardino	Turtle	*Gopherus agassizii*	Desert Tortoise	Confirmed	INRMP 2012	Threatened, Similarity of Appearance (Threatened), Candidate (Sonoran population)	G4 - Apparently Secure		CA, NV, UT	AZ, NV, UT	AZ, CA, NV	AZ, CA, NV, UT	

NOTE: At the time of the surveys there was no list available for Barstow. Per NAVFAC SW (Rob Lovich), the list for China Lake was used because the species expected to occur in the project region are similar.

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Appendix F

United States Fish and Wildlife Service Letter, Species List for MCLB Barstow

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

IN REPLY REFER TO:
08EVEN00-2013-SL-0419

September 9, 2013

Vicki Davis
Director, Environmental Division
U.S. Marine Corps, MCL Base, Barstow
P.O. Box 110570
Barstow, California 92311-5050

Subject: Species List Request for Threatened or Endangered Species that Occur Within the Boundaries of the U.S. Marine Corps Logistics Base, Barstow, San Bernardino County, California.

Dear Ms. Davis:

This letter is in response to your request of August 28, and received in our office on September 3, for information on threatened, endangered, proposed, and candidate species, and critical habitat that may occur in the vicinity of the United States Marine Corps Logistics Base, Barstow California. You are proposing to use this list as a guide for site-specific analysis of the project described in your request. You have identified the United States Marine Corps (USMC) as the lead Federal agency for the projects, and that it would assume responsibility under section 7 of the Endangered Species Act of 1973, as amended (Act).

The enclosed list of species fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act of 1973, as amended (Act). The United States Marine Corps (USMC), as the lead Federal agency for the project, has the responsibility to review its proposed activities and determine whether any listed species may be affected. If the project is a construction project, which may require an environmental impact statement[1], the USMC has the responsibility to prepare a biological assessment to make a determination of the effects of the action on the listed species or critical habitat. If the USMC determines that a listed species or critical habitat is likely to be adversely affected, it should request, in writing, through our office, formal consultation pursuant to section 7 of the Act. Informal consultation may be used to exchange information and resolve conflicts with respect to threatened or endangered species or their critical habitat prior to a written request for formal consultation. During this review process, the USMC may engage in planning efforts but may not make any irreversible commitment of resources. Such a commitment could constitute a violation of section 7(d) of the Act.

Federal agencies are required to confer with the Service, pursuant to section 7(a)(4) of the Act, when an agency action is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat (50 CFR 402.10(a)). A request

[1] "Construction project" means any major Federal action which significantly affects the quality of the human environment designed primarily to result in the building of structures such as dams, buildings, roads, pipelines, and channels. This includes Federal actions such as permits, grants, licenses, or other forms of Federal authorizations or approval which may result in construction.

for formal conference must be in writing and should include the same information that would be provided for a request for formal consultation. Conferences can also include discussions between the Service and the Federal agency to identify and resolve potential conflicts between an action and proposed species or proposed critical habitat early in the decision-making process. The Service may also recommend ways to minimize or avoid adverse effects of the action. These recommendations are advisory because the jeopardy prohibition of section 7(a)(2) of the Act does not apply until the species is listed or the proposed critical habitat is designated. The conference process fulfills the need to inform Federal agencies of possible steps that an agency might take at an early stage to adjust its actions to avoid jeopardizing a proposed species.

The information provided in this letter is based on the best available information, scientific and technical literature, and information in our files. Newer information based on updated surveys, changes in the abundance and distribution of listed species, changed habitat conditions, or other factors could change this information. Please feel free to contact us if you need more current information or assistance regarding the potential presence of federally proposed, listed, or candidate species, and critical habitat. Please note that pursuant to Federal regulation (50 CFR 402.12(e)) a species list is valid for 90 days.

Only federally listed species receive protection under the Act; however, species listed by the State of California or otherwise considered to be sensitive should be considered in the planning process in the event that they become listed or proposed for listing prior to project completion. We recommend that you also review information in the California Department of Fish and Wildlife's Natural Diversity Database. You can contact the California Department of Fish and Wildlife at (916) 324-3812 for information on other sensitive species that may occur in this area.

The Migratory Bird Treaty Act (16 U.S.C. 703-712) (MBTA) prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. The Service's Division of Law Enforcement carries out its mission to protect migratory birds not only through investigations and enforcement, but also through fostering relationships with individuals and industries that proactively seek to eliminate their impacts on migratory birds. While it is not possible to absolve individuals or companies from MBTA liability, the Division of Law Enforcement focuses its resources on investigating and prosecuting those who take migratory birds without identifying and implementing reasonable and effective measures to avoid the take.

If you have any questions regarding this letter, please contact Ray Vizgirdas of my staff at (208) 373-4020 or (909) 382-2959. He may also be contacted at Raymond_Vizgirdas@fws.gov.

Sincerely,

Carl T. Benz
Assistant Field Supervisor

Enclosure

LISTED, PROPOSED, AND CANDIDATE SPECIES THAT MAY OCCUR IN THE VICINITY OF U.S. MARINE CORPS LOGISTICS BASE, BARSTOW, SAN BERNARDINO COUNTY, CALIFORNIA

Birds

Least Bell's vireo	*Vireo bellii pusillus*	E
Southwestern willow flycatcher	*Empidonax traillii extimus*	E
Yellow-billed cuckoo	*Coccyzus americanus*	C

Reptiles

Mojave desert tortoise	*Gopherus agassizii*	T, CH

LEGEND

C - Candidate
CH - Critical Habitat
E - Endangered
T - Threatened

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Appendix G

Federal Noxious Weed List

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United States Department of Agriculture
Natural Resources Conservation Service

NRCS | PLANTS Database

Introduced, Invasive, and Noxious Plants

Federal Noxious Weeds

112 records returned

Noxious weeds that are synonyms retain their noxious status, and are indented beneath the current PLANTS accepted name.

USDA, Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ). *State Plant Regulatory Officials letters* (http://nationalplantboard.org/laws/spro.html). National Plant Board.

USDA, Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ). 2012. *Federal noxious weed list* (http://www.aphis.usda.gov/plant_health/plant_pest_info/weeds/downloads/weedlist.pdf, 1 February 2012). USDA, APHIS, PPQ.

Symbol	Scientific Name	Noxious Common Name	Federal Noxious Status†	Native Status*
AEGIN	*Aeginetia* L.		NW	
AGAD2	*Ageratina adenophora* (Spreng.) King & H. Rob.	crofton weed	NW	L48 (I), HI (I)
ALECT2	*Alectra* Thunb.		NW	
ALSE4	*Alternanthera sessilis* (L.) R. Br. ex DC.	sessile joyweed	NW	L48 (I), HI (I), PR (N), VI (N)
ASFI2	*Asphodelus fistulosus* L.	onionweed	NW	L48 (I)
AVST	*Avena sterilis* L.	animated oat	NW	L48 (I), CAN (W)
AZPI	*Azolla pinnata* R. Br.	mosquito fern	NW	L48 (I)
CAOX6	*Carthamus oxyacanthus* M. Bieb.			L48 (I)
CAOX2	*Carthamus oxyacantha* M. Bieb., orth. var.	wild safflower	NW	
CATA5	*Caulerpa taxifolia* (Vahl) C. Agardh[1]		NW	
CHAC	*Chrysopogon aciculatus* (Retz.) Trin.	pilipiliula	NW	HI (I)
COBE2	*Commelina benghalensis* L.	Benghal dayflower	NW	L48 (I), HI (I), PR (I)
CRVU2	*Crupina vulgaris* Cass.	common crupina	NW	L48 (I)
CUSCU	*Cuscuta* L.[2]	dodder	NW	
DIAB	*Digitaria abyssinica* (Hochst. ex A. Rich.) Stapf			HI (I)
DISC5	*Digitaria scalarum* (Schweinf.) Chiov.	African couch grass	NW	
DIVE2	*Digitaria velutina* (Forssk.) P. Beauv.	velvet fingergrass	NW	L48 (I)
DRAR7	*Drymaria arenarioides* Humb. & Bonpl. ex Schult. [excluded]	alfombrilla	NW	
EIAZ2	*Eichhornia azurea* (Sw.) Kunth	anchored waterhyacinth	NW	L48 (I), PR (I)
EMAU	*Emex australis* Steinh.	three-cornered jack	NW	L48 (I)
EMSP	*Emex spinosa* (L.) Campd.	devil's thorn	NW	L48 (I), HI (I)
GAOF	*Galega officinalis* L.	goatsrue	NW	L48 (I), CAN (I)
HEMA17	*Heracleum mantegazzianum* Sommier & Levier	giant hogweed	NW	L48 (I), CAN (I)
HYVE3	*Hydrilla verticillata* (L. f.) Royle	hydrilla	NW	L48 (I)
HYPO3	*Hygrophila polysperma* (Roxb.) T. Anderson	Miramar weed	NW	L48 (I)

IMBR	*Imperata brasiliensis* Trin.	Brazilian satintail	NW	L48 (I), PR (I)
IMCY	*Imperata cylindrica* (L.) P. Beauv.	cogongrass	NW	L48 (I)
IPAQ	*Ipomoea aquatica* Forssk.	Chinese waterspinach	NW	L48 (I), HI (I), PR (I)
ISRU	*Ischaemum rugosum* Salisb.	murain-grass	NW	L48 (I)
LAMA15	*Lagarosiphon major* (Ridley) Moss	oxygen weed	NW	
LECH2	*Leptochloa chinensis* (L.) Nees [excluded]	Asian sprangletop	NW	
LISE3	*Limnophila sessiliflora* (Vahl) Blume	ambulia	NW	L48 (I)
LYFE4	*Lycium ferocissimum* Miers			L48 (I)
LYFE3	*Lycium ferrocissimum* Miers, orth. var.	African boxthorn	NW	
LYFL7	*Lygodium flexuosum* (L.) Sw.	maidenhair creeper	NW	
MEQU	*Melaleuca quinquenervia* (Cav.) S.F. Blake	melaleuca	NW	L48 (I), HI (I), PR (I)
MEMA	*Melastoma malabathricum* L.		NW	HI (I)
MICO16	*Mikania cordata* (Burm. f.) B.L. Rob. [excluded]	mile-a-minute	NW	
MIMI5	*Mikania micrantha* Kunth	mile-a-minute	NW	L48 (I), PR (N)
MIDI8	*Mimosa diplotricha* C. Wright			HI (I), PR (I)
MIIN80	*Mimosa invisa* Mart., non Mart. ex Colla	giant sensitive plant	NW	
MIPE2	*Mimosa pellita* Kunth ex Willd.			L48 (N), PR (N)
MIPI	*Mimosa pigra* auct. non L.	catclaw mimosa	NW	
MOHA2	*Monochoria hastata* (L.) Solms [excluded]	monochoria	NW	
MOVA	*Monochoria vaginalis* (Burm. f.) C. Presl ex Kunth	pickerel weed	NW	L48 (I), HI (I)
MOCO8	*Moraea collina* Thunb.	Cape tulip	NW	L48 (I)
MOFL2	*Moraea flaccida* (Sweet) Steud.	Cape tulip	NW	
MOMI4	*Moraea miniata* Andrews		NW	
MOOC2	*Moraea ochroleuca* (Salisb.) Drapiez		NW	
MOPA8	*Moraea pallida* (Baker) Goldblatt		NW	
NATR3	*Nassella trichotoma* (Nees) Hack.	serrated tussock	NW	L48 (I)
ONAC2	*Onopordum acaulon* L.		NW	
ONIL	*Onopordum illyricum* L.		NW	L48 (I)
OPAU10	*Opuntia aurantiaca* Lindl.	jointed prickly pear	NW	
OROBA	*Orobanche* L.[2]	broomrape	NW	
ORLO3	*Oryza longistaminata* A. Chev. & Roehr.	red rice	NW	
ORPU13	*Oryza punctata* Kotzchy ex Steud.	red rice	NW	
ORRU	*Oryza rufipogon* Griffiths	red rice	NW	L48 (I)
OTAL	*Ottelia alismoides* (L.) Pers.	duck-lettuce	NW	L48 (I)
PASC6	*Paspalum scrobiculatum* L.	Kodo-millet	NW	L48 (I), HI (I)
PECL2	*Pennisetum clandestinum* Hochst. ex Chiov.	kikuyugrass	NW	L48 (I), HI (I), PR (I), VI (I)
PEMA80	*Pennisetum macrourum* Trin.	African feathergrass	NW	L48 (I), HI (I)
PEPE24	*Pennisetum pedicellatum* Trin.	kyasuma-grass	NW	L48 (I)
PEPO14	*Pennisetum polystachion* (L.) Schult.			L48 (I), HI (I), PR (I)
PEPO4	*Pennisetum polystachyon* (L.) Schult., orth. var.	missiongrass	NW	

PRAL11	*Prosopis alpataco* Phil.	mesquite	NW	
PRAR6	*Prosopis argentina* Burkart	mesquite	NW	
PRBU2	*Prosopis burkartii* Muñoz	mesquite	NW	
PRCA9	*Prosopis caldenia* Burkart	mesquite	NW	
PRCA10	*Prosopis calingastana* Burkart	mesquite	NW	
PRCA11	*Prosopis campestris* Griseb.	mesquite	NW	
PRCA12	*Prosopis castellanosii* Burkart	mesquite	NW	
PRDE4	*Prosopis denudans* Benth.	mesquite	NW	
PREL5	*Prosopis elata* (Burkart) Burkart	mesquite	NW	
PRFA2	*Prosopis farcta* (Banks & Sol.) J.F. Macbr.	Syrian mesquite	NW	L48 (I)
PRFE2	*Prosopis ferox* Griseb.	mesquite	NW	
PRFI4	*Prosopis fiebrigii* Harms	mesquite	NW	
PRHA4	*Prosopis hassleri* Harms ex Hassler	mesquite	NW	
PRHU3	*Prosopis humilis* Gillies ex Hook. & Arn.	mesquite	NW	
PRKU2	*Prosopis kuntzei* Harms ex Hassler	mesquite	NW	
PRPA4	*Prosopis pallida* (Humb. & Bonpl. ex Willd.) Kunth	kiawe	NW	HI (I), PR (I), VI (I)
PRPA10	*Prosopis palmeri* S. Watson	mesquite	NW	
PRRE2	*Prosopis reptans* Benth.	tornillo	NW	L48 (N)
PRRO4	*Prosopis rojasiana* Burkart	mesquite	NW	
PRRU4	*Prosopis ruizlealii* Burkart	mesquite	NW	
PRRU5	*Prosopis ruscifolia* Griseb.	mesquite	NW	
PRSE5	*Prosopis sericantha* Gillies ex Hook. & Arn.	mesquite	NW	
PRST3	*Prosopis strombulifera* (Lam.) Benth.	Argentine screwbean	NW	L48 (I)
PRTO3	*Prosopis torquata* DC.	mesquite	NW	
PRVE	*Prosopis velutina* Woot.			L48 (N), HI (I)
PRAR4	*Prosopis articulata* S. Watson	velvet mesquite	NW	
ROCO6	*Rottboellia cochinchinensis* (Lour.) W.D. Clayton	itchgrass	NW	L48 (I), PR (I)
RUFR80	*Rubus fruticosus* L. [excluded]	wild blackberry complex	NW	
RUMO4	*Rubus moluccanus* L. [excluded]	wild blackberry	NW	
SASP	*Saccharum spontaneum* L.	wild sugarcane	NW	HI (I), PR (I)
SASA7	*Sagittaria sagittifolia* L. [excluded]	arrowhead	NW	
SAVE6	*Salsola vermiculata* L.	wormleaf salsola	NW	L48 (I)
SAAU	*Salvinia auriculata* Aubl.	giant salvinia	NW	PR (I)
SABI9	*Salvinia biloba* Raddi	giant salvinia	NW	
SAHE7	*Salvinia herzogii* de la Sota	giant salvinia	NW	
SAMO5	*Salvinia molesta* Mitchell	giant salvinia	NW	L48 (I), HI (I)
SEIN10	*Senecio inaequidens* DC.	South African ragwort	NW	
SEPUP3	*Setaria pumila* (Poir.) Roem. & Schult. ssp. *pallidefusca* (Schumach.) B.K. Simon			L48 (I)
SEPA82	*Setaria pallidifusca* (Schumach.) Stapf & C.E. Hubbard, orth. var.	cattail grass	NW	
SOTA3	*Solanum tampicense* Dunal	wetland nightshade	NW	L48 (I)
SOTO4	*Solanum torvum* Sw.	turkeyberry	NW	L48 (I), HI (I), PR (I), VI (I)

SOVI2	*Solanum viarum* Dunal	tropical soda apple	NW	L48 (I)
SPER	*Sparganium erectum* L.	exotic bur-reed	NW	L48 (N)
SPAL3	*Spermacoce alata* Aubl. [excluded]	borreria	NW	
STRIG	*Striga* Lour.	witchweed	NW, Q	
TRPR5	*Tridax procumbens* L.	coat buttons	NW	L48 (I), HI (I), PR (I), VI (I)
URPA	*Urochloa panicoides* P. Beauv.	liverseed grass	NW	L48 (I)

†Code	Noxious Status
NW	Noxious weed
Q	Quarantine

*Code	Native Status
I	Introduced
N	Native
W	Waif

*Code	Native Status Jurisdiction
L48	Lower 48 States
HI	Hawaii
PR	Puerto Rico
VI	Virgin Islands
CAN	Canada

[1] Mediterranean clone
[2] other than native or widely distributed species

Additional Federal government efforts to understand and control noxious plants can be found at:

- APHIS Federal Noxious Weed List
- APHIS Web: Noxious Weeds Factsheets and Publications
- APHIS-NAPIS Pest Tracker
- Aquatic Nuisance Species Task Force
- Army Corps Noxious & Nuisance Plant Management Information System
- ARS: Exotic & Invasive Weed Research
- BLM: The Weed Hall of Shame
- Defense Environmental Network and Information Exchange (DENIX)
- Executive Order: Federal Effort to Combat Invasive Species (1999)
- Federal Highway Administration
- FHWA Guidance on Invasive Species
- FHWA-The Nature of Roadsides and the Tools to Work With It
- Great Lakes Indian Fish and Wildlife Commission-Exotic Plants
- Invasive Plants Fact Book (FICMNEW)
- InvasiveSpeciesInfo.Gov
- MT-USDA NRCS Management and Ecology of Invasive Plant Species
- NAPPO Phytosanitary Alert System
- National Agricultural Pest Information System (NAPIS)
- Nonnative Invasive Plants of Southern Forests: Identification Guide
- NPCI Alien Plant Working Group
- NPS Invasive Species Management and Control
- Plant Conservation Alliance Alien Plants
- PLANTS Database Home Page
- U.S. National Plant Board
- USDA APHIS Federal Noxious Weed Disseminules of the U.S.
- USDA ARS Invasive Plant Research Laboratory-Florida
- USDA FS Invasive Plants-Northeastern Area
- USDA FS Invasive Plants-Northeastern Area Weeds of the Week
- USDI GS-Southwest Exotic Plant Information Clearinghouse
- USDI NPS Plant Invaders of Mid-Atlantic Natural Areas

- USDI NPS-Priority Weed Species
- USFS Weed Wanted Posters
- USFWS Invasive Species Program
- Western Rangeland Weeds

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Appendix D-2

Results of Focused Desert Tortoise Surveys

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Final
Results of Focused Desert Tortoise Surveys for Barstow Training and Range Environmental Assessment Marine Corps Logistics Base Barstow, San Bernardino County, California

Prepared for:

Marine Corps Logistics Base
Barstow, CA

Under Contract to:
U.S. Department of the Navy
Naval Facilities Engineering Command Southwest
1220 Pacific Highway, Building 1 CIPT
San Diego, CA 92132-5190
Phone; (619) 532-3844
Point of Contact: Jesse Martinez

Prepared by:

leidos
5464 Carpinteria Avenue, Suite K
Carpinteria, CA 93013

October 2015

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Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
AMSL	above mean sea level
EES	Endemic Environmental Services
KD	Known Distance
LHA	Landing Helicopter Assault
LHA/LHD	Simulated Flight Deck
LHD	Landing Helicopter Dock
LZ	Landing Zone
MCLB	Marine Corps Logistics Base
U.S.	United States
USFWS	United States Fish and Wildlife Service
USMC	United States Marine Corps

1 Introduction

Focused United States Fish and Wildlife Service (USFWS) protocol-level Agassiz's desert tortoise (*Gopherus agassizii*) surveys were conducted in support of the National Environmental Policy Act and Endangered Species Act compliance for the Barstow Training and Range Environmental Assessment, Marine Corps Logistics Base (MCLB) Barstow, California (hereinafter "proposed action"). The project footprint is located on MCLB Barstow, which is in western San Bernardino County, California, approximately 3.5 miles (6 kilometers) east of the City of Barstow (Figure 1). The United States Marine Corps (USMC) is proposing to enhance and update operational capabilities of existing training ranges and areas at MCLB Barstow. This would include establishing general aviation maneuver areas and designating rotary wing/tilt-rotor Landing Zones (LZs) and a Simulated Flight Deck (Landing Helicopter Assault [LHA] or Landing Helicopter Dock [LHD]) site to accommodate components of regional Marine Air-Ground Task Force training activities. The project footprint is located in the western plain of the Mojave Desert, and has elevations ranging from 1,970 to 2,464 feet (601 to 751 meters) above mean sea level (AMSL). The total survey area is approximately 1,306 acres (528 hectares).

Agassiz's desert tortoise is federally and state-listed as threatened. Projects proposed within the geographic range of desert tortoise require an assessment of the site's habitat suitability. Focused surveys are required within suitable habitat to determine if tortoises are present and whether the proposed actions would potentially impact the species. Impacts to desert tortoise require both federal and state permitting as well as incorporation of impact avoidance (where possible), minimization, and mitigation measures into the project design. The objective of the surveys was to determine the presence or absence of the desert tortoise within the survey area. The following report presents the methodologies, data, and results of the surveys.

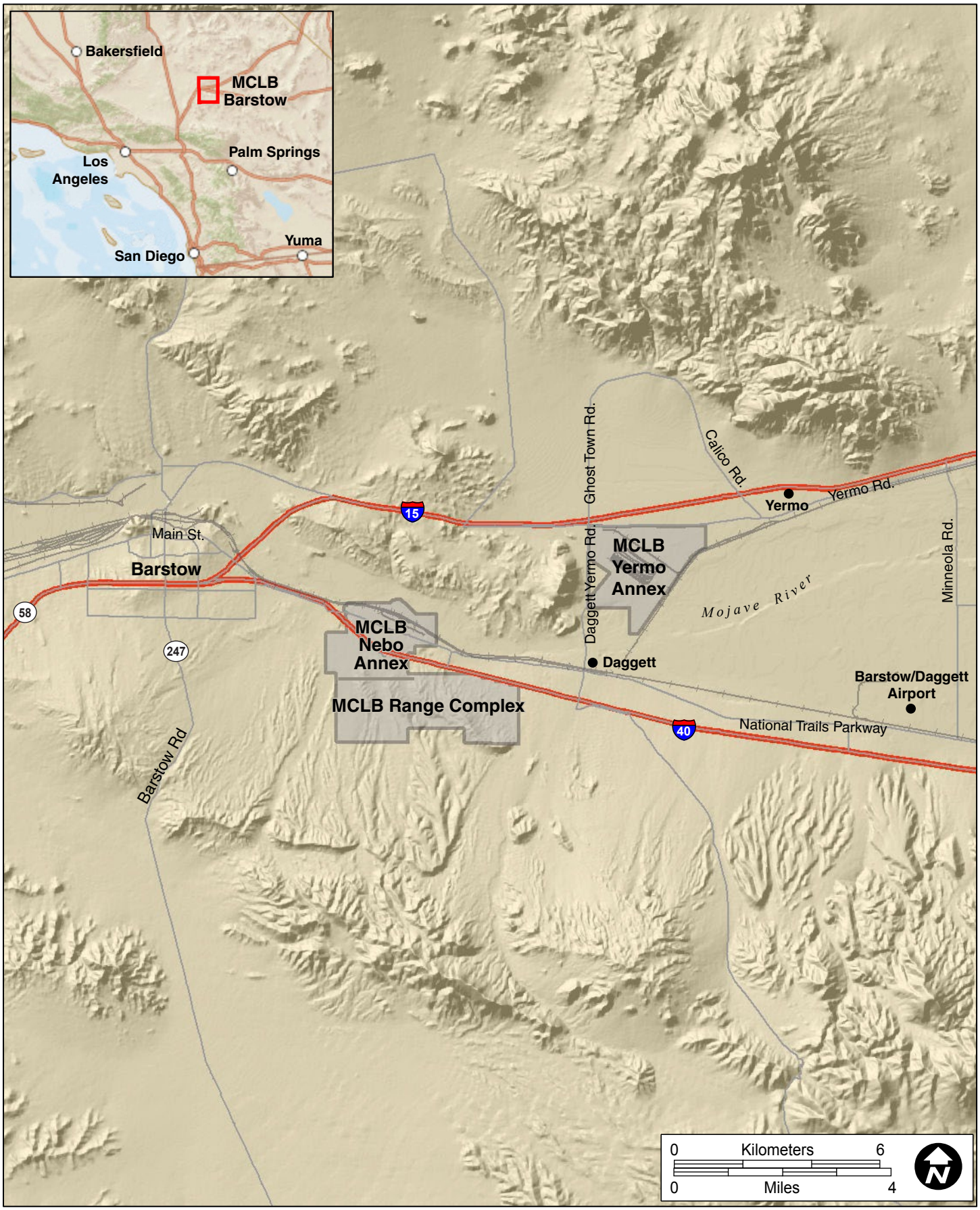
2 Survey Area

For the purpose of this report, the project footprint is separated into four survey areas: (1) Range West; (2) Range East and Known Distance (KD) Range Complex; (3) Range Main Supply Route; and (4) Yermo Stables (Table 1 and Figure 2).

Table 1. Elevation and Size of Survey Area on Marine Corps Logistics Base, Barstow

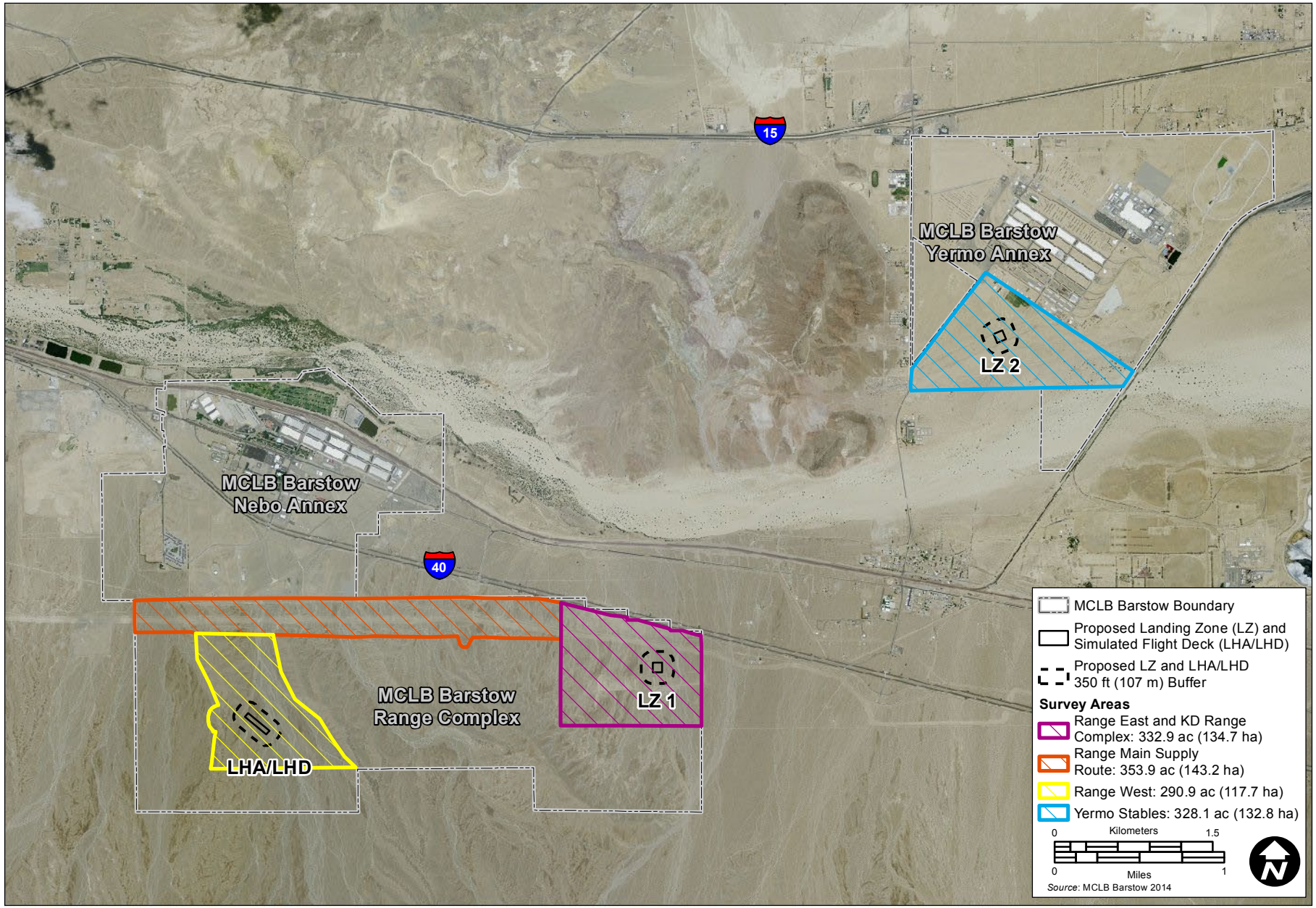
Survey Area	Elevation minimum (feet [meters])*	Elevation maximum (feet [meters])*	Size (acres [hectares])
Range East and KD Range Complex	2,118 (646)	2,262 (689)	333 (135).
Range West	2,236 (682)	2,464 (751)	291 (118)
Range Main Supply Route	2,102 (640)	2,358 (719)	354 (143)
Yermo Stables	1,970 (721)	1,984 (605)	328 (133).
Notes: * Elevation AMSL.			

The total area surveyed for Agassiz's desert tortoises was 1,306 acres (529 hectares). The survey areas ranged in elevation from 1,970 feet (601 meters) AMSL at Yermo Stables to 2,464 feet (751 meters) at Range West. Temperatures during the surveys ranged from 62 to 102 degrees Fahrenheit (°F) [17 to 39 degrees Celsius (°C)]. Creosote bush-white bursage scrub was the dominant habitat on the Range East and KD Range Complex, Range West, and Range Main Supply Route survey areas, whereas the Yermo Stables site was dominated by Creosote bush-allscale scrub habitat.



Location of Marine Corps Logistics Base Barstow
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
1



Desert Tortoise Survey Area
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
2

3 Methodology

USFWS pre-project desert tortoise protocol field surveys were performed from 27 April to 1 May and 26 to 31 May 2015. Surveys were performed during the season (April to May) and appropriate environmental conditions in accordance with the *2010 Field Season Pre-project Field Survey Protocol for Potential Desert Tortoise Habitats (Protocol)* (USFWS 2010).

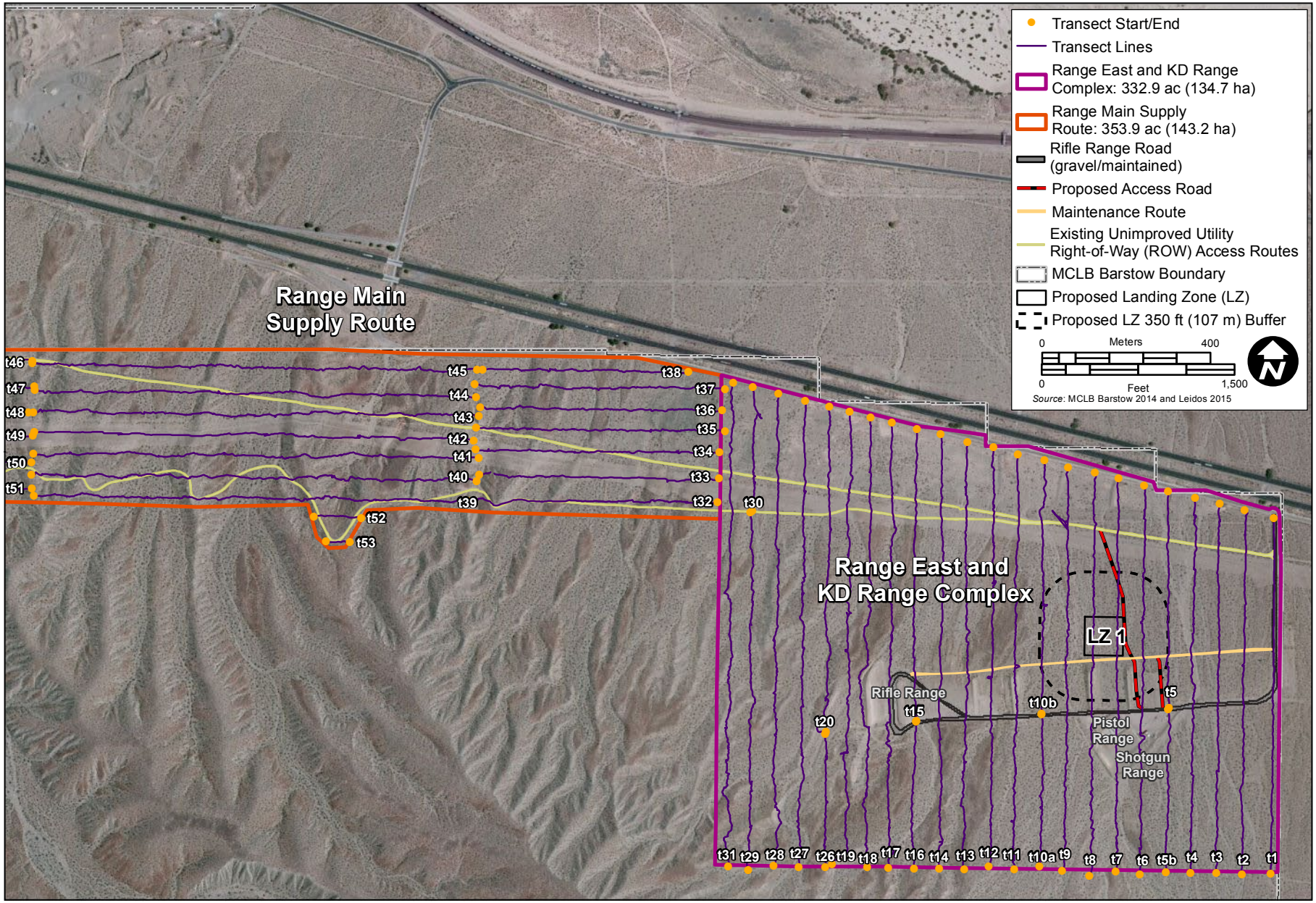
The presence/absence surveys were led by USFWS-authorized tortoise biologist, Barry Nerhus, and supported by Dr. Tara Schoenwetter, Joel Degner, Chris Woods, and Stephen Bryne of Leidos, and Dr. Eric Dugan, Diana Dellechiaie, and Dean Nerhus of Endemic Environmental Services (EES). Each area was surveyed using pedestrian belt transects spaced 33 feet (10 meters) apart to achieve 100 percent visual coverage, as per the Protocol (Figures 3, 4, and 5). Air temperatures at the start and end of each transect were taken with a Kestrel weather station. Results for each transect were recorded on data sheets, which are provided in Appendix A.

Visual-encounter searches were used to detect and identify desert tortoise sign classified according to Protocol (Table 2). All potential tortoise sign including burrows, scat, tracks, shell fragments, carcasses, or live tortoise were examined and recorded according to the Protocol. Only definitive tortoise sign was reported. Scat, shell remains, and carcasses were classed according to established classification. Each transect and tortoise sign was marked and recorded using the hand-held Trimble GeoXT 2005 Global Positioning System with sub-meter accuracy. A digital camera was used to record all observed sign.

Table 2. Desert Tortoise Sign Key

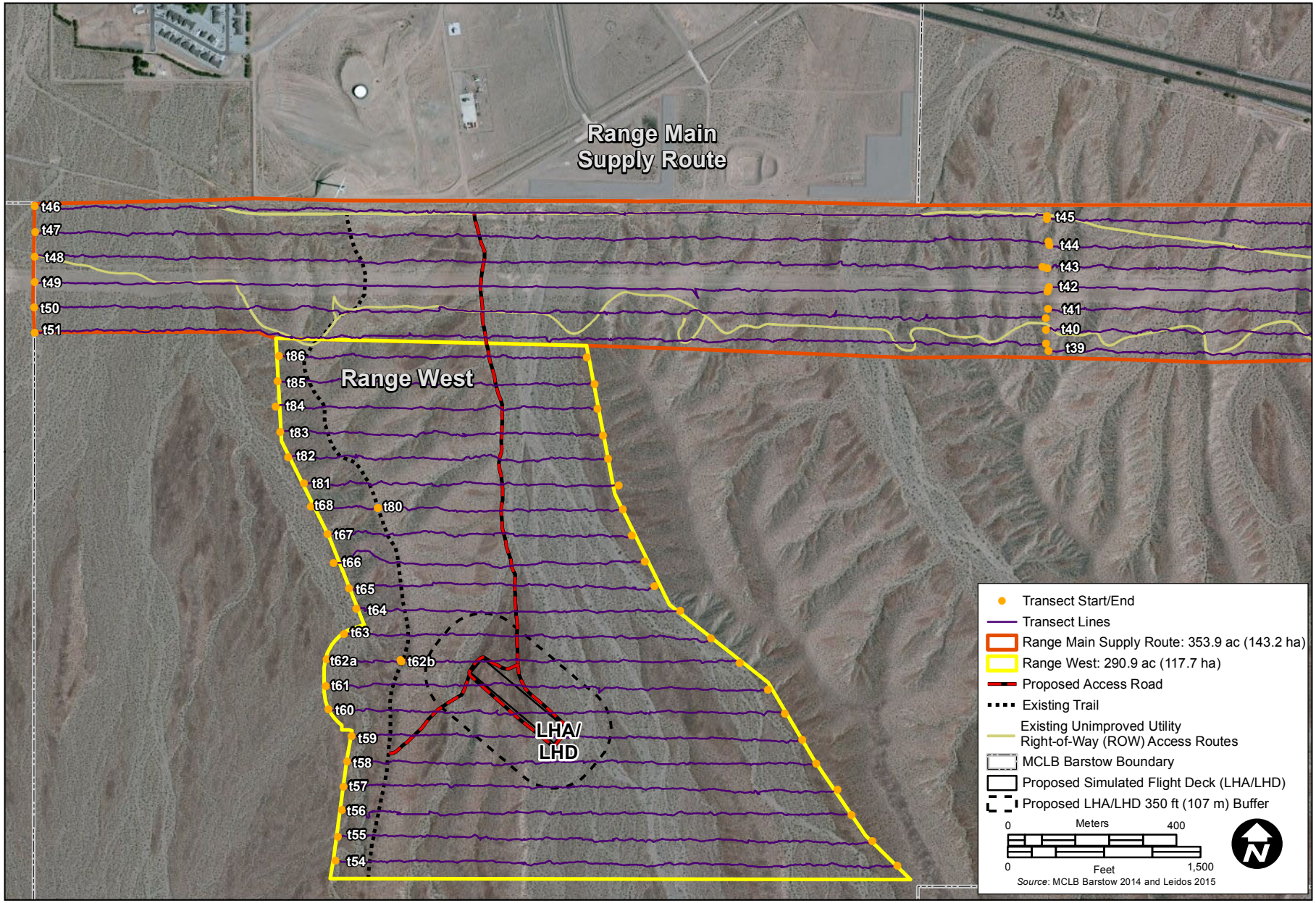
Sign Type	Class 1	Class 2	Class 3	Class 4	Class 5
Burrow and Den	Currently active with tortoise or recent tortoise sign	Good condition, definitely tortoise but no evidence of recent use	Deteriorated condition but is definitely tortoise	Deteriorated condition, possibly tortoise (no other corroborating sign)	Good condition, possibly tortoise (no other corroborating sign)
Scat	Wet or moist but not from rain or dew, or dried but with obvious odor	Dry, dark brown, has a glaze, and some odor	Dry, has no glaze or odor, is slightly bleached, is light brown, and plant fibers are tightly packed	Dry, has no glaze or odor, is somewhat bleached, is light brown to pale yellow, plant fibers are not tightly packed, and has a scaly appearance	Dry, has no glaze or odor, is bleached, is white, and consists only of plant fibers
Carcasses, Shell Remains and Bone Fragments	Fresh or putrid	Fresh or putrid, is of normal color, and the scutes adhere to the bone	Scutes are peeling from the bone	Shell bone is falling apart and the growth rings on the scutes are peeling	Disarticulated and scattered

All live tortoises observed were visually inspected for signs of injury, illness, abnormalities, and overall health. Additionally, each tortoise was sexed when possible and had its mid-line carapace measurement recorded. To determine the presence of tortoises in encountered burrows, a mirror was used to direct light into the openings. All other sensitive plant and wildlife species encountered during the survey were identified and documented. USFWS protocol calculations were used to estimate the number of tortoises within the survey area (USFWS 2010).



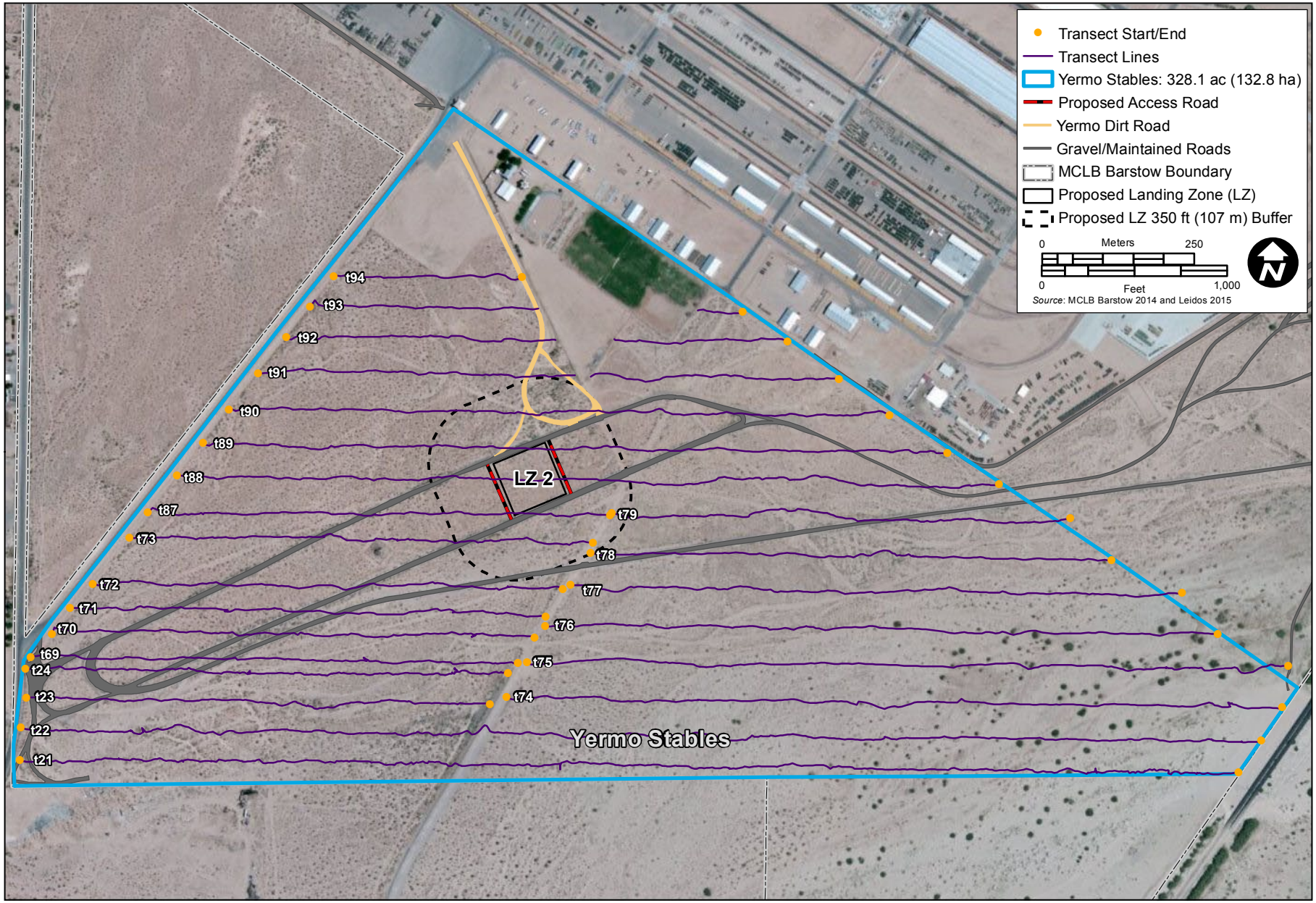
Desert Tortoise Survey Transects - Range East and KD Range Complex and Range Main Supply Route
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE 3



Desert Tortoise Survey Transects - Range West and Range Main Supply Route
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
4



Desert Tortoise Survey Transects - Yermo Stables
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
5

4 Results

A total of 13 live desert tortoises, including one (1) juvenile, 112 carcasses, 27 scat, one (1) set of eggshell fragments, and 227 burrows were observed during the 2015 surveys. Appendix A includes a copy of the field survey data sheets and Appendix B provides representative photographs.

4.1 Range East and KD Range Complex

Twenty-six transects provided 100 percent coverage and resulted in 117 signs of desert tortoise within the Range East and KD Range Complex survey area (Table 3, Figure 6). Specifically, 65 burrows, three (3) scat, 18 shell remains (11 were carcass), and five (5) live tortoises were recorded.

Of the shell remains, six (6) were entire carcasses that consisted of two (2) adult males, two (2) adult females, and two (2) single adults of undetermined sex. One male carcass was tagged (03-II) on the right scute. Five (5) live tortoises were observed; most were in burrows and one (1) juvenile was observed in a desert wash adjacent to the KD Range Complex. There was no sign of reproduction within the Range East and KD Range Complex survey area.

Table 3. Desert Tortoise Sign and Locations in the Range East and KD Range Complex Survey Area

Field Code	Type	Class	Date	Range East and KD Range Complex Desert Tortoise Sign Notes	Latitude	Longitude
s1	Shell	5	4/27/2015	Previously noted, under creosote, numerous fragments present	-116.91	34.8532
b1	Burrow	2	4/27/2015	On side of desert wash, rocky sandy soils	-116.911	34.85832
s2	Shell	3	4/27/2015	Previously marked female	-116.911	34.85518
s3	Shell	3	4/27/2015	Shell cracked, previously noted male	-116.911	34.85485
b2	Burrow	5	4/27/2015	Previously marked burrow, partially filled, no recent use	-116.911	34.85298
b3	Burrow	3	4/27/2015	Collapsed	-116.911	34.85297
s4	Shell	5	4/27/2015	In desert wash, previously marked 2013	-116.911	34.85141
s5	Shell	5	4/27/2015	Scattered in desert wash, 4 pieces	-116.911	34.85116
b4	Burrow	4	4/27/2015	Eroded by desert wash, on side of desert wash under cheesebush, looks like it has been washed away	-116.911	34.8509
s6	Shell	5	4/27/2015	s6 scattered, some in burrow and some next to creosote shrub nearby	-116.911	34.8509
b5	Burrow	2	4/27/2015	Near desert wash, desert wash is braided, rocky substrate	-116.912	34.85107
b6	Burrow	2	4/27/2015	Bank under creosote	-116.912	34.85227
s7	Shell	5	4/27/2015	1 piece previously mapped, under creosote	-116.911	34.85247
b7	Burrow	1	4/27/2015	Scat found in entrance, burrow is under creosote on edge of bush	-116.912	34.85255
scat 1	Scat	3	4/27/2015	Scat on outside of burrow 7, outside dry	-116.912	34.85255
s8	Shell	4	4/28/2015	Previously found	-116.912	34.85317
s9	Shell	5	4/28/2015	Previously noted, 3 pieces	-116.913	34.85132
s10	Shell	5	4/28/2015	Previously noted s10	-116.913	34.85153
s11	Shell	3	4/28/2015	Previously noted s11, scutes peeling off bone	-116.914	34.85745
s12	Shell	5	4/28/2015	Several pieces	-116.914	34.85107
s13	Shell	3	4/28/2015	Carcass on desert pavement, female 19L × 17W centimeters	-116.914	34.85071
s14	Carcass	3	4/28/2015	s14 previously recorded, male scutes peeling off bone,19L x 18W centimeters	-116.914	34.85187
b8	Burrow	3	4/28/2015	Side of desert wash, previously noted	-116.914	34.85332
b9	Burrow	5	4/28/2015	Previously recorded as class 4 now a class 5	-116.914	34.85828

Table 3. Desert Tortoise Sign and Locations in the Range East and KD Range Complex Survey Area

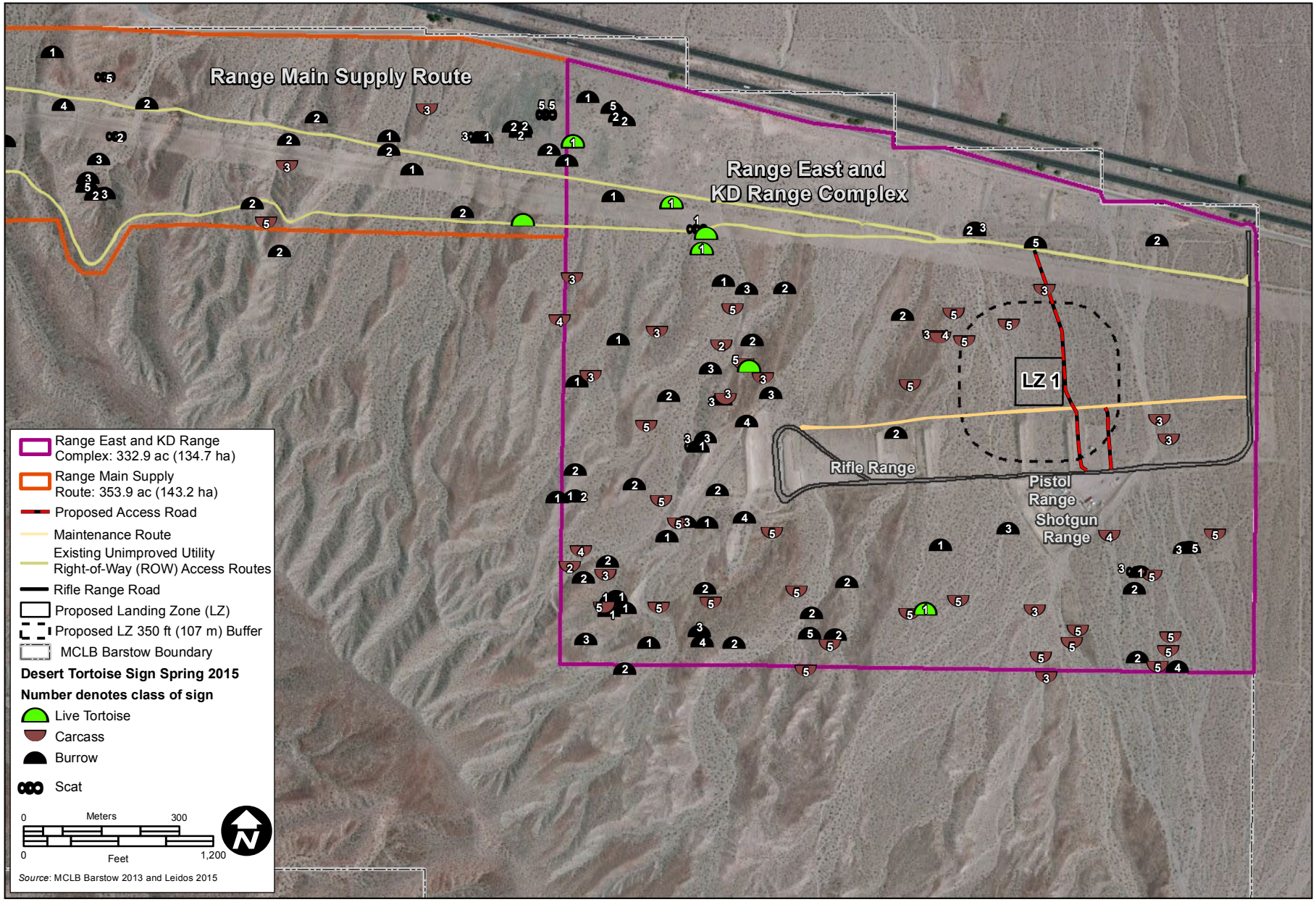
Field Code	Type	Class	Date	Range East and KD Range Complex Desert Tortoise Sign Notes	Latitude	Longitude
b11	Burrow	3	4/28/2015	Slightly collapsed, burrow adjacent to b10, class 3 definitely tortoise but deteriorating	-116.915	34.85849
b10	Burrow	2	4/28/2015	Burrow northeast facing, class 2	-116.915	34.85853
s15	Shell	5	4/28/2015	In old wood rat midden under creosote	-116.914	34.85685
s16	Shell	5	4/28/2015	3 fragments adjacent to old *Neotoma* midden	-116.915	34.85204
s17	Shell	5	4/28/2015	On desert pavement in *Neotoma* midden in yucca	-116.915	34.85656
s18	Shell	5	4/28/2015	Previously noted, on rocky area adjacent to desert wash, around 20+ fragments	-116.916	34.85704
s19	Shell	3	42122	Carcass male 25L × 21W centimeters, near desert pavement under creosote, still has bones inside	-116.916	34.85665
s20	Shell	4	42122	Broken bottom, large carcass flopped over under bursage	-116.916	34.85662
s21	Shell	5	42122	Shell fragments	-116.916	34.85579
b12	Burrow	1	4/28/2015	b12 freshly dug but shallow, appears to be recently used under creosote	-116.916	34.85303
b13	Burrow	1	4/28/2015	b13, desert tortoise in burrow	-116.916	34.85191
Live 1	Live Tortoise	NA	4/28/2015	Live tortoise in burrow 13, under creosote	-116.916	34.85191
s22	Shell	5	4/28/2015	By yucca, 3 pieces	-116.916	34.85182
b14	Burrow	2	4/28/2015	b14 at edge of channel, in small desert wash, no sign of recent use	-116.917	34.85498
b15	Burrow	2	4/28/2015	Under creosote north, on side of larger desert wash between rocky slopes, under creosote	-116.917	34.85702
s23	Shell	5	4/28/2015	Looks like it has been smashed/crushed in desert wash	-116.918	34.85127
b16	Burrow	2	4/28/2015	On side of hill southeast, steep rocky slope around 22.5 degrees	-116.918	34.85147
b17	Burrow	2	4/28/2015	On slope facing east, rocky slope, 30 degrees	-116.918	34.85239
s24	Shell	5	4/29/2015	Under Senna, shell fragments, some in *Neotoma* midden nearby	-116.919	34.85221
b18	Burrow	2	4/29/2015	Burrow on bottom of rocky slope	-116.919	34.85185
s25	Shell	5	4/29/2015	Shell fragments in side of desert wash, older at 10 pieces larger tortoise	-116.919	34.85083
b19	Burrow	5	4/29/2015	Older, on rocky slope in chelate	-116.919	34.85149
s26	Shell	5	4/29/2015	Shell, bones, and scutes in *Neotoma* midden under creosote	-116.919	34.85323
s27	Carcass	3	4/29/2015	Still flesh on carcass on desert pavement, large male, scutes peeling off bone, 27.5L × 21W centimeters, flesh tail still in carcass	-116.92	34.85592
b20	Burrow	3	4/29/2015	b20 on side of channel under ephedra californica on sides of desert wash, not recently used	-116.919	34.85566
b21	Burrow	2	4/29/2015	On rocky slope 30 degrees, caliche, mustard nearby	-116.919	34.8575
b22	Burrow	3	4/29/2015	Burrow on side of steep rocky slope, some caliche	-116.92	34.85749
b23	Burrow	2	4/29/2015	Burrow on side of rocky slope 25 degrees, really nice top, burrow goes deep, side of desert wash, below caliche	-116.92	34.85658
Live 2	Live Tortoise		4/29/2015	Live, 2 tortoise juveniles 3 years, in small desert wash, temp is 85, 9:50 a.m. Nearby vegetation is Ambrosia dumosa, Senna armata, and Psorothamnus, on slopes 15 to 20 degrees on rock, close to KD Rifle Range		-116.92
s29	Carcass	3	4/29/2015	Parts of shell broken, carcass in between class 3 and 4, scutes peeling off bone. Female on desert pavement.	-116.92	34.85556
b24	Burrow	4	4/29/2015	b24 on bank, burrow on man-made bank. Probably from when KD Rifle Range was built. Just behind KD Rifle Range.	-116.92	34.85517
b25	Burrow	4	4/29/2015	Under Lycium pallidum, close to KD Rifle Range	-116.92	34.85351

Table 3. Desert Tortoise Sign and Locations in the Range East and KD Range Complex Survey Area

Field Code	Type	Class	Date	Range East and KD Range Complex Desert Tortoise Sign Notes	Latitude	Longitude
b26	Burrow	2	4/29/2015	Small at edge of bluff, on rocky slope under caliche, slope is about 45 degrees	-116.92	34.85132
s30	Shell	5	4/29/2015	s30 shell fragments in *Neotoma* midden under creosote	-116.921	34.85202
b27	Burrow	1	4/29/2015	Under caliche, on top of slope, fairly shallow	-116.921	34.85342
b28	Burrow	3	4/29/2015	Under creosote near carcass, rocky area	-116.92	34.85555
b29	Burrow	3	4/29/2015	Under Lycium, in desert wash	-116.921	34.8561
s31	Carcass	2	4/29/2015	Under creosote, large male on back, 28L × 20W centimeters, still has good color. In desert wash, no sign of death, scutes worn in front and flesh in back.	-116.92	34.85649
s32	Shell	5	4/29/2015	Shell fragments in same desert wash as carcass, at least 30 fragments under Lycium pallidum and Senna	-116.92	34.85712
b30	Burrow	1	4/29/2015	Ground scraped, vegetation cleared, and tracks. On terrace of upper desert wash, near Lycium pallidum.	-116.92	34.85762
b31	Burrow	1	4/29/2015	Live, 3 desert tortoises inside burrow, on bottom of slope under creosote	-116.921	34.85818
Live 3	Live Tortoise	NA	4/29/2015	Live tortoise in burrow, close to utility access road on west side of desert wash, observed next morning at 8:24 a.m., female 19.5L × 16W centimeters. Sixth left marginal scute on the left damaged, cracked, or may be hypoxy. Along back right damaged too, back outer scute on left not symmetric to right.	-116.921	34.85817
b32	Burrow	3	4/29/2015	On rocky disturbed area	-116.921	34.8549
b33	Burrow	1	4/29/2015	Scat outside burrow. Burrow on hillside under creosote, on constructed berm.	-116.921	34.85474
scat 2	Scat	3	4/29/2015	Outside burrow	-116.921	34.85474
b34	Burrow	2	4/29/2015	b34 under Ephedra californica on bank of side desert wash	-116.921	34.85399
s5	Shell	5	4/29/2015	Shell fragments in desert wash under Senna, 2 fragments	-116.92	34.85474
b35	Burrow	3	4/30/2015	On desert wash bank, west facing	-116.921	34.85343
s33	Shell	5	4/30/2015	Only ¾ of the shell was present	-116.921	34.8534
b36	Burrow	2	4/30/2015	On side slope facing west, slope 25 degrees	-116.921	34.85227
b37	Burrow	3	4/30/2015	Under creosote, deteriorating on sides, on rocky hillside not too steep	-116.921	34.85152
b38	Burrow	4	4/30/2015	Under creosote, rocky hillside, on top of slope, gravelly	-116.921	34.85135
b39	Burrow	1	4/30/2015	On side slope at bottom of rocky slope, active, track present and trail to burrow	-116.922	34.85133
s34	Shell	5	4/30/2015	Disarticulated and scattered on side of desert wash, near Lycium pallidum, *Ambrosia dumosa*, around 29 pieces of scute still attached, some pieces buried	-116.922	34.85193
b40	Burrow	1	4/30/2015	Appears to be active tortoise burrow, fresh tracks inside, burrow on side of desert wash in open area	-116.922	34.85318
s35	Shell	5	4/30/2015	Shell in *Neotoma* midden on side of desert wash, upper terrace	-116.922	34.85378
b41	Burrow	2	4/30/2015	Under creosote on side of desert wash	-116.922	34.85562
s36	Carcass	3	4/30/2015	On side slope, scutes peeling off bone. Male 23L × 17.5W centimeters on side of hill adjacent to small desert wash	-116.922	34.85672
b42	Burrow	1	4/30/2015	Live, 4 desert tortoises in burrow under creosote, burrow just adjacent to disturbed area	-116.921	34.85897
live 4	Live Tortoise	NA	4/30/2015	Live tortoise	-116.921	34.85897
scat 3	Scat	1	4/30/2015	In road, squished by tire	-116.921	34.85851
b43	Burrow	5	4/30/2015	On side of desert wash, appears to be older burrow	-116.923	34.86063

Table 3. Desert Tortoise Sign and Locations in the Range East and KD Range Complex Survey Area

Field Code	Type	Class	Date	Range East and KD Range Complex Desert Tortoise Sign Notes	Latitude	Longitude
b44	Burrow	2	4/30/2015	Facing south, definitely tortoise on small raised area	-116.923	34.86049
b45	Burrow	2	4/30/2015	On north side of road	-116.922	34.86041
s37	Shell	5	4/30/2015	Disarticulated and scattered on low terrace near creosote, 2 spots, many fragments	-116.922	34.85508
b46	Burrow	2	4/30/2015	2 burrows adjacent to each other, on slope 20 degrees, on side slope	-116.922	34.85409
b47	Burrow	1	4/30/2015	b47 side slope, steep slopes, rocky hillsides, 36-degree slope, nice roof, class 1 tracks	-116.922	34.85193
b48	Burrow	2	4/30/2015	Under creosote, burrow on side of desert wash, under creosote	-116.922	34.85088
b49	Burrow	3	4/30/2015	Burrow at bottom of slope, rocky, lichens	-116.923	34.8514
b50	Burrow	1	4/30/2015	b50 near top of ridge, slope 40 degrees, rocky friable soils	-116.923	34.85188
s38	Shell	5	4/30/2015	Shell, bottom of rocky slopes, 50+ pieces	-116.923	34.85194
b51	Burrow	1	4/30/2015	b51 deep, on rocky slopes, fresh dirt movement	-116.923	34.85207
b52	Burrow	1	4/30/2015	Deep, near 50 active tracks with tail drag and soil on bottom of burrow. On rocky slopes.	-116.923	34.85214
s39	Carcass	3	4/30/2015	s39 most scutes intact, female, on side of desert wash has hole and looks like something ate rear scute, 23L × 10W centimeters, between class 2 and 3	-116.923	34.8525
b53	Burrow	2	4/30/2015	Near ridge top	-116.923	34.85246
b54	Burrow	2	4/30/2015	Near desert wash	-116.923	34.85274
b55	Burrow	1	4/30/2015	Rocky hillslope appears to be recent, schismus in burrow	-116.924	34.85388
s40	Carcass	3	4/30/2015	Tagged 03-II, 20L × 26.5W centimeters, male	-116.923	34.85595
b56	Burrow	1	4/30/2015	Under creosote, appears to be recent	-116.923	34.85661
b57	Burrow	1	4/30/2015	In utility corridor, edge of disturbed area, can see patterns of plastron	-116.923	34.8591
b58	Burrow	1	4/30/2015	Tracks plastron marks, in open area	-116.923	34.86082
live 5	Live Tortoise	NA	4/30/2015	Live tortoise in burrow 59, underneath large creosote, can only see front leg	-116.924	34.86004
b59	Burrow	1	4/30/2015	Large tortoise in burrow could only see arm, observed trail going toward burrow	-116.924	34.86003
s41	Carcass	4	4/30/2015	Large tortoise has scutes, shell bone apart under creosote side of desert wash	-116.924	34.85692
b60	Burrow	1	4/30/2015	Tracks worked up dirt, burrow on side of desert wash under Lycium pallidum	-116.923	34.85588
b61	Burrow	2	4/30/2015	Shallow on hillside, under shrub, rocky slope	-116.924	34.85434
b62	Burrow	1	4/30/2015	Tracks visible and appears that tortoise is close by, on top of rocky slope adjacent to each other	-116.924	34.85385
b63	Burrow	2	4/30/2015	Side of hill	-116.924	34.85389
s42	Carcass	4	4/30/2015	Shell bones somewhat falling apart	-116.923	34.85291
s43	Carcass	2	4/30/2015	s43 on back, appears to be predated, coyote scat next to it, female, beautiful color still original, 20L × 15W centimeters, found on its back on side of desert wash, freshest carcass seen	-116.924	34.85264
s44	Carcass	3	4/30/2015	s44 juvenile, on side of desert wash, scutes still on bone 12L × 10.5W centimeters	-116.924	34.85766
Notes: Refer to Table 2 for definition of classes.						



Desert Tortoise Survey Results - Range East and KD Range Complex
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
6

4.2 Range West

Twenty transects provided 100 percent coverage and resulted in 135 unique signs of desert tortoise within the Range West survey area (Table 4, Figure 7). Specifically, 78 burrows, 11 scat, 23 shell remains, 20 carcasses, and two (2) live tortoises were documented. No eggshell fragments or live juveniles were observed.

Two (2) live tortoises were observed in burrows under creosote bushes. Carcasses were comprised of 11 adult males, one (1) adult female, one (1) juvenile, two (2) sub-adults, and five (5) of undetermined sex. One of the male carcasses was still fresh or putrid with connective tissue still present. He was observed upside down on upper terrace with chew marks on back of rear scutes. This male appears to have died either early this year or late last year. The female carcass observed appeared to have been predated and had a small hole in the carapace. There was no sign of reproduction within the Range West survey area.

Table 4. Desert Tortoise Sign and Locations in the Range West Survey Area

Field Code	Type	Class	Date	Range West Desert Tortoise Sign Notes	Latitude	Longitude
b149	Burrow	1	5/28/2015	On rocky slope, clear tracks	-116.958	34.84792
b150	Burrow	1	5/28/2015	On same slope as 148	-116.958	34.8479
b151	Burrow	2	5/28/2015	Definitely tortoise	-116.958	34.84787
b152	Burrow	1	5/28/2015	On caliche slope, woodrat nest nearby	-116.957	34.84769
b153	Burrow	1	5/28/2015	On steep slope 20 to 45 degrees, scat outside burrow, large tortoise	-116.955	34.84782
scat 16	Scat	2	5/28/2015	scat 15	-116.955	34.84782
s69	Shell	5	5/28/2015	Scattered	-116.949	34.84796
b154	Burrow	1	5/28/2015	Facing east on stop of rocky slope, desert pavement	-116.948	34.84784
b155	Burrow	2	5/28/2015	Facing east near 155, no evidence of recent use	-116.948	34.84786
b156	Burrow	3	5/28/2015	Underneath creosote facing east on terrace of desert wash	-116.948	34.84858
b157	Burrow	2	5/28/2015	On rocky slope, cave like	-116.955	34.84845
b158	Burrow	1	5/28/2015	On desert pavement under creosote, tracks present facing northeast	-116.956	34.8486
b159	Burrow	1	5/28/2015	Facing west on rocky hillside, burrow near top of slope	-116.957	34.84813
b160	Burrow	1	5/28/2015	On rocky slope 20 to 25 degrees, burrow goes back to right	-116.959	34.84813
b161	Burrow	5	5/28/2015	Large, cave like, probably used by tortoise through very large northwest-facing, caliche slope	-116.959	34.84806
s70	Carcass	3	5/28/2015	Juvenile Carcass, 15L × 12W centimeters, on rocky hilltop	-116.96	34.84844
s71	Shell	5	5/28/2015	On bottom of desert wash, some scute on shell, fragmented	-116.96	34.84861
b162	Burrow	2	5/28/2015	Rocky slope facing southeast	-116.958	34.84899
b163	Burrow	2	5/28/2015	Under creosote, upper terrace	-116.958	34.84874
s72	Shell	5	5/28/2015	Scattered	-116.958	34.84903
b164	Burrow	1	5/28/2015	On rocky slope fresh, tracks to burrow from desert wash	-116.958	34.84885
b165	Burrow	1	5/28/2015	Live tortoise inside burrow, under creosote on top of slope around 15 degrees. There are two other burrows on same slope that do not appear to be used.	-116.957	34.84897
live 12	Live Tortoise	--	5/28/2015	Live tortoise inside burrow 165, under creosote	-116.957	34.84897
scat 16	Scat	3	5/28/2015	scat 16 on desert pavement	-116.956	34.84874
b166	Burrow	2	5/28/2015	No recent use, facing north rock in front of burrow looks to have recently fallen	-116.955	34.84899
b167	Burrow	1	5/28/2015	Rocky slope, 40 degrees, facing northeast	-116.955	34.84873
b168	Burrow	1	5/28/2015	Tracks into burrow larger, looks like it has tracks between the burrows across the slopes, steep slope 40 degrees	-116.955	34.84877
b169	Burrow	1	5/28/2015	Burrow facing east, steep slope, scat in front of burrow, 45 degrees	-116.955	34.84898
scat 17	Scat	3	5/28/2015	3 pieces brown	-116.955	34.84897

Table 4. Desert Tortoise Sign and Locations in the Range West Survey Area

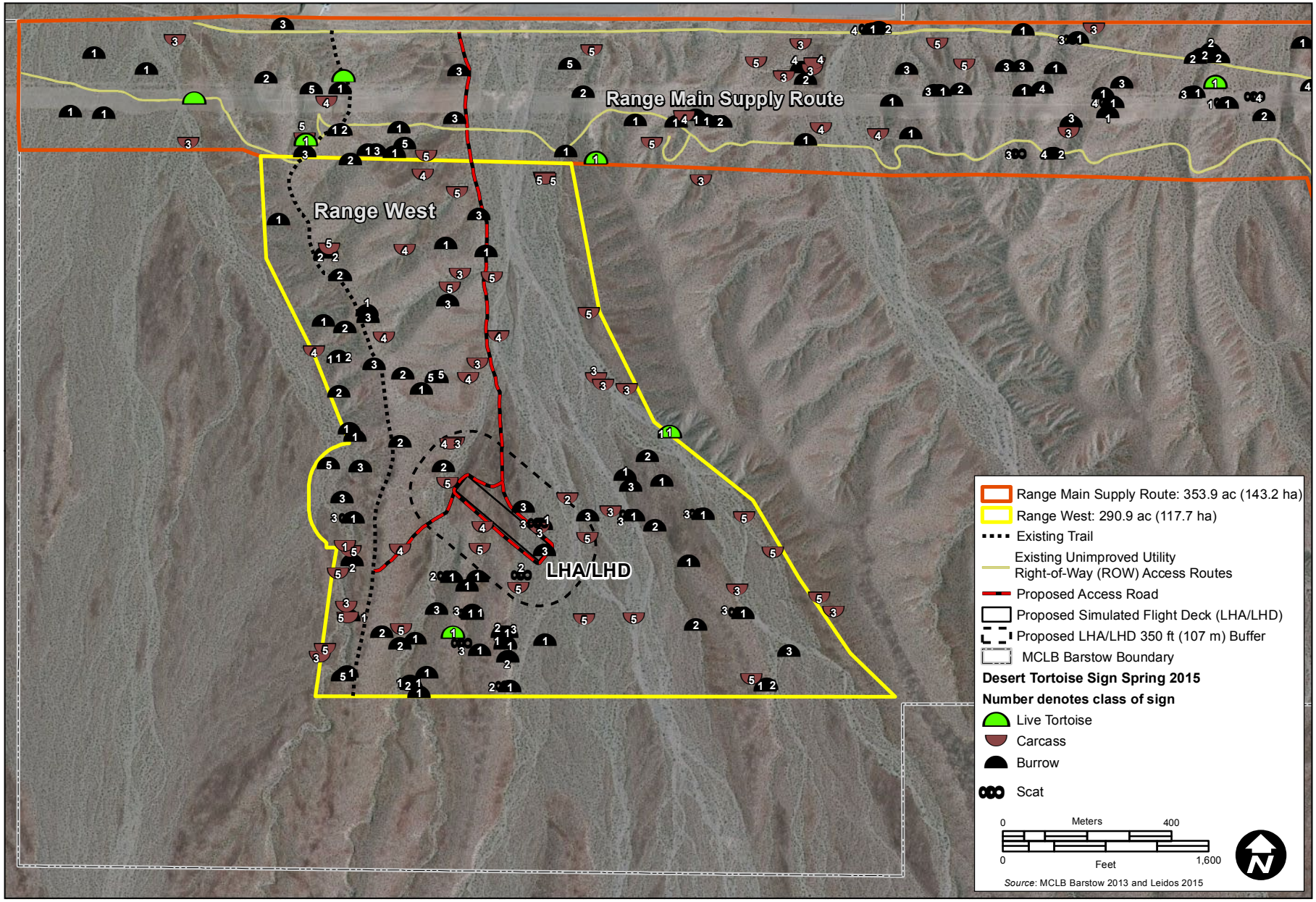
Field Code	Type	Class	Date	Range West Desert Tortoise Sign Notes	Latitude	Longitude
b170	Burrow	1	5/28/2015	Facing northwest on terrace, flat area creosote bush, track on bottom of burrow cobble on rocky inside burrow	-116.954	34.84881
b171	Burrow	2	5/28/2015	West side of desert wash	-116.95	34.84915
s73	Carcass	3	5/28/2015	Most scutes on but some peeling off bone, male on rocky area 20L × 17W centimeters	-116.947	34.8494
s74	Shell	5	5/28/2015	Scattered	-116.947	34.84971
b172	Burrow	1	5/28/2015	Scat on outside of burrow, burrow on side of wash facing east at bottom of slope	-116.949	34.84939
scat 18	Scat	3	5/28/2015	scat 18	-116.949	34.84941
s75	Shell	5	5/28/2015	Scattered on side desert wash	-116.952	34.84927
s76	Shell	5	5/28/2015	Scattered in wood on side desert wash	-116.953	34.84925
b173	Burrow	1	5/28/2015	Old scat	-116.956	34.84937
scat 19	Scat	3	5/28/2015	scat 19	-116.956	34.84937
b174	Burrow	1	5/28/2015	On same area as 172 facing west	-116.956	34.84945
b175	Burrow	3	5/28/2015	Facing northwest, rock inside, no recent use, filled with rocks	-116.957	34.84948
s77	Carcass	3	5/28/2015	Carcass in wash scutes peeling off bone, 21L × 16W centimeters male	-116.959	34.84951
s78	Shell	5	5/28/2015	Shell remains	-116.959	34.84929
b176	Burrow	1	5/28/2015	Facing west, track on side of desert wash looks like it has been recently used, behind acacia other burrows along the bank	-116.959	34.84934
s79	Shell	5	5/28/2015	Scattered	-116.96	34.85023
b177	Burrow	1	5/28/2015	East-facing slope with scat	-116.957	34.85017
scat 20	Scat	2	5/28/2015	scat 20	-116.957	34.85018
b178	Burrow	1	5/28/2015	West-facing slope	-116.956	34.84999
b179	Burrow	1	5/28/2015	Facing northeast	-116.956	34.85018
s80	Shell	5	5/28/2015	In woodrat midden	-116.955	34.84992
scat 21	Scat	2	5/28/2015	scat 21	-116.955	34.85018
s81	Carcass	3	5/28/2015	Entire carcass 18L x 14W centimeters, no sign of death, sex unknown	-116.949	34.84988
s82	Shell	5	5/28/2015	Scattered	-116.948	34.85067
b180	Burrow	1	5/28/2015	Facing northeast, tracks, under creosote 20-degree slope	-116.95	34.8505
b181	Burrow	3	5/28/2015	Southwest in desert wash	-116.954	34.85074
s83	Shell	5	5/28/2015	Scattered	-116.956	34.85075
s84	Shell	4	5/28/2015	Facing west on steep slope	-116.958	34.85074
s85	Shell	5	5/28/2015	In desert wash	-116.959	34.85071
b182	Burrow	2	5/28/2015	On side of wash at base of caliche	-116.959	34.85053
s86	Carcass	1	5/28/2015	Still is fresh or putrid male 10L × 17W centimeters, upside down on upper terrace, connective tissue still present, appears to have died either early this year or late last, chewed on back of both scutes	-116.959	34.85082
b183	Burrow	1	5/28/2015	On northwest slope with scat	-116.959	34.85143
scat 22	Scat	3	5/28/2015	scat 22	-116.959	34.85143
s87	Carcass	4	5/28/2015	In desert wash	-116.956	34.85123
s88	Carcass	3	5/28/2015	Predated, female 21L × 18W centimeters, has a hole	-116.954	34.8512
b184	Burrow	1	5/28/2015	East, scat present	-116.954	34.8513
scat 23	Scat	3	5/28/2015	scat 23	-116.954	34.8513
s89	Shell	5	5/28/2015	Shell remains in woodrat midden	-116.953	34.85099
s90	Carcass	3	5/28/2015	Juvenile male, in desert wash, 16L × 18W centimeters	-116.953	34.85156
b185	Burrow	2	5/28/2015	Facing north, desert pavement present	-116.951	34.85125
s91	Shell	5	5/28/2015	In woodrat midden in acacia	-116.949	34.85142
b186	Burrow	1	5/28/2015	Facing southeast, on side of desert wash	-116.95	34.85151
scat 24	Scat	3	5/28/2015	Brown, two pieces tightly packed	-116.95	34.85151

Table 4. Desert Tortoise Sign and Locations in the Range West Survey Area

Field Code	Type	Class	Date	Range West Desert Tortoise Sign Notes	Latitude	Longitude
b187	Burrow	1	5/28/2015	Side of desert wash previously noted	-116.952	34.85148
scat 25	Scat	3	5/28/2015	3 pieces, nice and large, good size	-116.952	34.8515
b188	Burrow	3	5/28/2015	Facing northwest under creosote, partially filled	-116.953	34.85147
s93	Carcass	2	5/28/2015	Normal color	-116.954	34.85183
b189	Burrow	3	5/28/2015	On terrace	-116.955	34.85167
b190	Burrow	3	5/28/2015	Base of slope, facing south	-116.959	34.85187
b191	Burrow	3	5/28/2015	Facing north, filling in	-116.959	34.85253
b192	Burrow	4	5/28/2015	Possible tortoise, burrow on side of desert wash, facing north	-116.959	34.85254
s94	Shell	5	5/29/2015	5 fragments	-116.957	34.85217
b193	Burrow	2	5/29/2015	Facing east on western bank	-116.957	34.85253
b194	Burrow	1	5/29/2015	On east bank of wash facing southwest	-116.952	34.85234
b195	Burrow	3	5/29/2015	Facing southeast under creosote on desert pavement, partially filled in with soil	-116.952	34.85211
b196	Burrow	1	5/29/2015	Facing east on side of bank, slope 15 degrees under creosote, clear fresh tracks, clean top	-116.951	34.85223
b197	Burrow	2	5/29/2015	b196	-116.952	34.85276
s95	Carcass	3	5/29/2015	Male, base of west slope	-116.957	34.85303
s96	Carcass	4	5/29/2015	Male, shell bone apart	-116.957	34.85301
b198	Burrow	2	5/29/2015	b197	-116.958	34.85305
b199	Burrow	5	5/29/2015	Possible tortoise on terrace of desert wash, facing south	-116.96	34.85259
b200	Burrow	1	5/29/2015	On rock slope, 45 degrees facing west, freshly dug	-116.959	34.85335
b201	Burrow	1	5/29/2015	Facing west on steep, rocky slope, 40 degrees near 199	-116.959	34.85318
b202	Burrow	1	5/29/2015	Live tortoise inside burrow, facing west on bottom of slope side of desert wash	-116.951	34.85326
live 13	Live tortoise	---	5/29/2015	Tortoise in burrow 201	-116.951	34.85326
b203	Burrow	1	5/29/2015	Adjacent to 201 about facing west, top of slope	-116.951	34.85328
b204	Burrow	1	5/29/2015	b203	-116.957	34.85419
b205	Burrow	2	5/29/2015	Rocky slope facing northwest 30 degrees, two-thirds up slope	-116.96	34.85414
b206	Burrow	2	5/29/2015	North	-116.958	34.85451
b207	Burrow	5	5/29/2015	Northeast	-116.957	34.85446
b208	Burrow	5	5/29/2015	Facing west under creosote, partially filled, near top of slope adjacent to access trail	-116.957	34.85444
s97	Carcass	4	5/29/2015	Shell bone apart	-116.956	34.85441
s98	Carcass	3	5/29/2015	Male 3. Scutes peeling off, terrace of wash 25L × 21W centimeters	-116.953	34.8544
s99	Carcass	3	5/29/2015	Male 3. Scutes peeling off, 26L × 21W centimeters large male near 98 scutes peeling off bone	-116.953	34.85427
s100	Carcass	3	5/29/2015	Male, larger, on side of desert wash 22L × 17W centimeters	-116.952	34.85418
s101	Carcass	3	5/29/2015	Large male on desert pavement, scutes starting to peel off in center 26L × 22W centimeters	-116.956	34.85473
b209	Burrow	3	5/29/2015	--	-116.959	34.85473
b210	Burrow	2	5/29/2015	--	-116.96	34.8549
b211	Burrow	1	5/29/2015	--	-116.96	34.85488
b212	Burrow	1	5/29/2015	--	-116.96	34.85487
s102	Carcass	4	5/29/2015	Younger tortoise, scutes peeling off bone approximately 17L x 13W centimeters	-116.96	34.85499
b213	Burrow	1	5/29/2015	No recent sign, definitely tortoise	-116.96	34.85565
b216	Burrow	3	5/30/2015	Facing southeast partially filled in with soil, behind creosote on rocky slope 25 degrees	-116.959	34.85574
s103	Shell	4	5/30/2015	Shell bone apart	-116.958	34.8553
s104	Carcass	4	5/30/2015	Shell bone apart, male in desert wash	-116.955	34.85531

Table 4. Desert Tortoise Sign and Locations in the Range West Survey Area

Field Code	Type	Class	Date	Range West Desert Tortoise Sign Notes	Latitude	Longitude
s105	Shell	5	5/30/2015	Scattered, small pieces	-116.953	34.8558
b217	Burrow	3	5/30/2015	In creosote bush facing east	-116.957	34.8561
s106	Shell	5	5/30/2015	15 pieces on slope	-116.957	34.85635
b218	Burrow	1	5/30/2015	b217	-116.959	34.85587
b219	Burrow	2	5/30/2015	b218	-116.96	34.85664
b220	Burrow	2	5/30/2015	b219	-116.96	34.85663
s107	Carcass	3	5/30/2015	Scutes peeling off	-116.956	34.85665
s108	Shell	5	5/30/2015	Scattered	-116.956	34.85657
b221	Burrow	1	5/30/2015	b220	-116.956	34.85714
b222	Burrow	1	5/30/2015	Facing northeast, on 15 degrees slope near creosote, smaller burrow	-116.957	34.8573
s109	Carcass	4	5/30/2015	Carcass at bottom of side desert wash bottom intact, male	-116.958	34.85717
s110	Shell	5	5/30/2015	At bottom of steep side of desert wash	-116.96	34.85718
b223	Burrow	2	5/30/2015	Facing east under creosote, bottom of slope adjacent to side channel	-116.96	34.85715
b224	Burrow	2	5/30/2015	Steep area	-116.96	34.85712
b225	Burrow	1	5/30/2015	Facing north on rocky slope	-116.961	34.85784
b226	Burrow	3	5/30/2015	Northeast facing at bottom of slope	-116.956	34.85794
s111	Shell	5	5/30/2015	Around 20 pieces under creosote	-116.956	34.85839
s112	Carcass	4	5/30/2015	Male in desert wash	-116.957	34.85877
s113	Shell	5	5/30/2015	Scattered	-116.954	34.85868
b227	Burrow	3	5/30/2015	Definitely tortoise but deteriorating, facing north in flat area	-116.884	34.88327
Notes: Refer to Table 2 for definition of classes.						



Desert Tortoise Survey Results - Range West
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
7

4.3 Range Main Supply Route

Twenty-one transects provided 100 percent coverage of the Range Main Supply Route and resulted in 128 signs of desert tortoise (Table 5, Figure 8). Specifically, 13 scat, 85 burrows, 33 shells (with 15 carcasses), and six (6) live tortoises were recorded.

Two (2) of the live tortoises were observed in burrows and four (4) were observed under or near shrubs. A female tortoise was observed under a parked car. She had moisture around the mouth and had some white spots and bone showing on marginal scute. She was observed later in the afternoon with vegetation coming out of her mouth and appeared outwardly to be in excellent health. Another live tortoise (of undetermined sex) had an irregular shell with a deep depression on its rear right costal scute (Appendix B).

Carcasses were comprised of five (5) adult males, two (2) adult females, and eight (8) of undetermined sex. Fresh scat that was glistening and still had odor was also observed. Reproduction was noted in the form of eggshell fragments, which were observed at the mouth of a burrow that was underneath a creosote bush on the side of a slope (Appendix B). The condition of the fragments indicated this observation was a reproductive event from earlier this season or late last year.

Table 5. Desert Tortoise Sign and Locations in the Range Main Supply Route Survey Area

Field Code	Type	Class	Date	Range West Desert Tortoise Sign Notes	Latitude	Longitude
live 6	Live Tortoise	--	4/30/2015	Female tortoise under car approximately 20L centimeters, wet around the mouth, some white spots on carcass, observed later in the day, bone showing on marginal scute, vegetation coming out of her mouth, seems healthy	-116.925	34.85868
b64	Burrow	2	4/30/2015	Small burrow, under Lycium pallidum, schismus in front	-116.926	34.85882
b65	Burrow	2	4/30/2015	Burrow on berm that is on side of road, old track	-116.93	34.85898
s45	Shell	5	4/30/2015	Scattered	-116.927	34.8606
b66	Burrow	2	4/30/2015	Some tracks, northwest facing, in small gully next to debris	-116.93	34.85814
s46	Carcass	3	4/30/2015	18.5L × 14W centimeters	-116.941	34.85967
b68	Burrow	2	5/1/2015	Directly adjacent to road, on bank underneath cheesebush, old collapsed burrow 2 miles away	-116.927	34.85957
b69	Burrow	1	5/1/2015	Burrow in open area at end of small eroded gully, shallow burrow, tracks present but at head of small gully	-116.924	34.8599
b70	Burrow	2	5/1/2015	Burrow in open flat area, physical structure intact, no recent use, between class 2 and 3 facing south	-116.924	34.85971
b71	Burrow	1	5/1/2015	Burrow under Ephedra californica on bank of eroded gully	-116.925	34.86021
b72	Burrow	2	5/1/2015	Shallow facing northwest, on side of eroded channel, creosote nearby	-116.925	34.86029
b73	Burrow	2	5/1/2015	In eroded area, 1 foot deep, no shrubs nearby, has cobwebs	-116.925	34.86031
b74	Burrow	1	5/1/2015	Nearby 73, on eroded area around 50 feet away, probably same tortoise, similar size and depth, Ambrosia salsola above	-116.925	34.86013

Table 5. Desert Tortoise Sign and Locations in the Range Main Supply Route Survey Area

Field Code	Type	Class	Date	Range West Desert Tortoise Sign Notes	Latitude	Longitude
scat 4	Scat	3	5/1/2015	Scat 4 found outside entrance of burrow 75	-116.925	34.86012
b75	Burrow	1	5/1/2015	Scat in entrance, fairly shallow burrow, on eroded gully in rocky soils, cobweb at entrance	-116.927	34.86014
b76	Burrow	1	5/1/2015	Deep under creosote, nice burrow in flat area, fresh tracks into burrow. Burrow is really deep. Ambrosia dumosa adjacent.	-116.929	34.86047
b77	Burrow	2	5/1/2015	Burrow on side of gravelly rocky slope, shallow northeast, chaeanactis in front of burrow	-116.929	34.86047
s47	Carcass	3	5/1/2015	Male upright, scutes peeling off bone still present in small desert wash 20L × 16W centimeters, could have peck mark in rear scute but hard to tell	-116.93	34.85863
scat 5	Scat	5	5/1/2015	Scat 5 in open area adjacent to ambrosia salsola and erodium. Scat dry and bleaching.	-116.924	34.8605
scat 5b	Scat	5	5/1/2015	Scat 6, nearby 5 really bleached	-116.924	34.86051
b79	Burrow	4	5/1/2015	On road bank, adjacent to 78	-116.941	34.85924
b78	Burrow	2	5/1/2015	On side of road in berm at bottom of slope, very rocky	-116.927	34.86014
s48	Carcass	3	5/1/2015	On its back, in desert wash, 21L ×16 W centimeters, scutes peeling off bone, female	-116.93	34.85961
b80	Burrow	5	5/1/2015	On rocky slope	-116.934	34.85927
b81	Burrow	3	5/1/2015	Definitely tortoise but deteriorating	-116.934	34.85942
b82	Burrow	2	5/1/2015	Not too recent at finger of slope	-116.934	34.85913
b83	Burrow	1	5/1/2015	Facing east, burrow active, on side of slope at the toe around 1.5 feet off the ground. In rocky friable soil, some schismus in front of burrow.	-116.933	34.85915
Scat 6	Scat	3	5/1/2015	Scat 6, dried no glaze, near burrow 83 in desert wash	-116.933	34.85915
b84	Burrow	3	5/1/2015	Burrow on top of steep, rocky slope adjacent to creosote	-116.934	34.85974
b85	Burrow	3	5/1/2015	Burrow in desert wash starting to deteriorate, definitely tortoise	-116.941	34.85992
b86	Burrow	1	5/1/2015	Burrow on disturbed area side of eroded hill, looks like it has been recently used, friable soil	-116.94	34.8601
b87	Burrow	1	5/1/2015	Scat inside of burrow, in disturbed area	-116.939	34.86032
scat 7	Scat	4	5/1/2015	scat 7	-116.939	34.86031
b88	Burrow	1	5/1/2015	Burrow on top of gravelly slope adjacent to creosote facing northeast, fresh tracks	-116.94	34.86053
b89	Burrow	1	5/1/2015	Sisymbrium in front of burrow, disturbed area	-116.936	34.86031
scat 8	Scat	1	5/1/2015	Fresh, glistening, still has odor, really fresh class 1	-116.936	34.86031
b90	Burrow	2	5/1/2015	b90 in desert wash facing northwest, rocky substrate in flat area. Looks like it has not been recently used.	-116.936	34.86005
scat 9	Scat	2	5/1/2015	Scat 9 in disturbed area, scat on east-facing slope, 3 pieces	-116.933	34.86013
b91	Burrow	2	5/1/2015	b91 in bank west, on steep eroded bank, around 6 feet up slope, friable soil	-116.933	34.86071
b92	Burrow	4	5/1/2015	b92 on eroded bank near road	-116.934	34.86068

Table 5. Desert Tortoise Sign and Locations in the Range Main Supply Route Survey Area

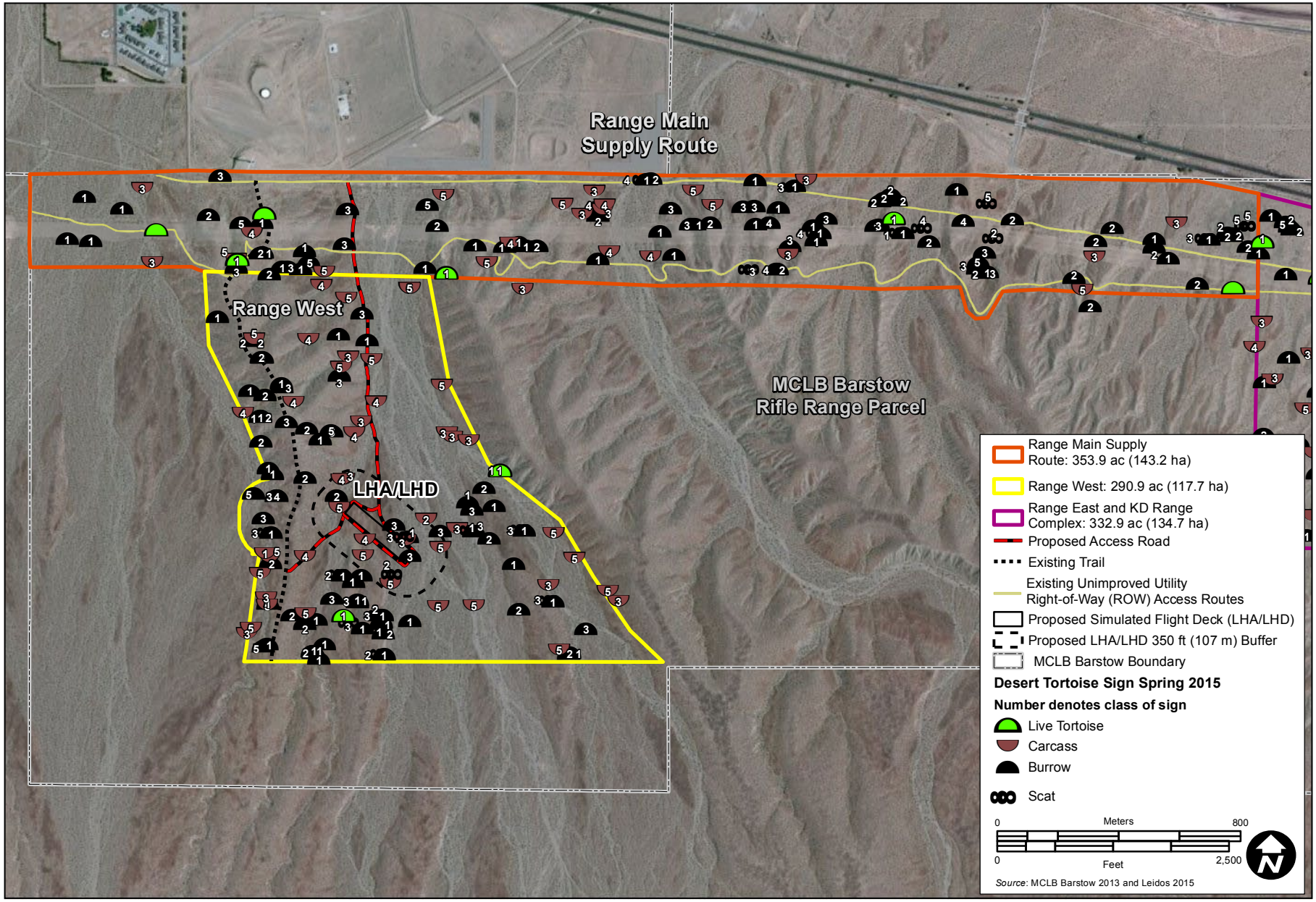
Field Code	Type	Class	Date	Range West Desert Tortoise Sign Notes	Latitude	Longitude
scat 10	Scat	4	5/1/2015	Scat 10 in disturbed area, brown, no odor	-116.936	34.86043
b93	Burrow	1	5/1/2015	Live, 7 desert tortoises in burrow, on rocky slope burrow, bursage is adjacent, facing northeast	-116.937	34.86073
live 7	Live Tortoise		5/1/2015	Live tortoise in burrow 93	-116.937	34.86075
b94	Burrow	3	5/1/2015	On rocky slope, mustard in front	-116.937	34.86055
b95	Burrow	1	5/1/2015	Deep, west facing, could be 1	-116.937	34.86053
b96	Burrow	3	5/1/2015	Under creosote facing southeast	-116.939	34.86075
b97	Burrow	4	5/1/2015	Facing east, on bank at 4 feet from ground, possible tortoise	-116.941	34.86063
b98	Burrow	1	5/1/2015	West-facing base of slope, clear tracks on bottom of burrow	-116.941	34.86107
b99	Burrow	2	5/1/2015	Under Senna facing west, on side of desert washes, branches hanging over burrow on side of small desert wash adjacent to road	-116.937	34.86127
b100	Burrow	2	5/1/2015	On rocky slope below Ambrosia dumosa	-116.937	34.86135
b101	Burrow	2	5/1/2015	Facing northeast on top of gravelly slope	-116.937	34.86128
scat 11	Scat	5	5/1/2015	Bleached on desert pavement, lizard scat adjacent	-116.933	34.86116
b102	Burrow	1	5/26/2015	Fresh soil moved, under creosote, north-northeast	-116.935	34.86161
b103	Burrow	2	5/26/2015	Under creosote on rocky slope	-116.937	34.86146
s49	Carcass	3	5/26/2015	Male, scutes peeling off	-116.94	34.8619
b104	Burrow	1	5/26/2015	On slope 35 to 40 degrees, rocky	-116.94	34.86171
scat 12	Scat	3	5/26/2015	Scat 12 on slope, light brown	-116.94	34.86166
b105	Burrow	1	5/26/2015	Fresh tracks, facing southeast	-116.942	34.86188
s50	Shell	5	5/26/2015	Two scattered bones, female	-116.944	34.86158
b106a	Burrow	2	5/26/2015	--	-116.946	34.86193
b107	Burrow	1	5/26/2015	With scat, facing north	-116.946	34.86191
scat 13	Scat	4	5/26/2015	--	-116.946	34.86189
s51	Carcass	3	5/26/2015	Scutes peeling off, 13L × 11W centimeters, female on side of desert wash, no sign of cause of death	-116.948	34.86156
s52	Shell	5	5/26/2015	Holes in scutes, broken shell, on side of desert wash	-116.953	34.86144
b108	Burrow	3	5/26/2015	Northwest facing, somewhat collapsed	-116.961	34.86202
s53	Carcass	3	5/26/2015	Half carcass in-between class 3 and 4	-116.964	34.86165
b109	Burrow	1	5/26/2015	Upper terrace	-116.966	34.8614
b110	Burrow	5	5/26/2015	Under Bebbia juncea, facing north, good condition	-116.954	34.86117
s54	Shell	5	5/26/2015	On upper terrace of desert wash	-116.949	34.86118
b111	Burrow	4	5/26/2015	Deteriorated condition, under Senna on side of desert wash facing south	-116.948	34.86108
s55	Carcass	3	5/26/2015	Male 23L × 20W centimeters, scutes peeling off	-116.947	34.86102
s56	Carcass	4	5/26/2015	Close to 55, male, 29L × 18W centimeters	-116.947	34.86115
b112	Burrow	3	5/26/2015	b111, black widow web in front of burrow, with mouse stuck inside facing north	-116.945	34.86105
s57	Shell	5	5/26/2015	On hillside more than 14 pieces, on rocky slope	-116.943	34.86113

Table 5. Desert Tortoise Sign and Locations in the Range Main Supply Route Survey Area

Field Code	Type	Class	Date	Range West Desert Tortoise Sign Notes	Latitude	Longitude
b113	Burrow	3	5/26/2015	Burrow deteriorating, recently collapsed	-116.942	34.8611
b114	Burrow	3	5/26/2015	Burrow deteriorating, recently collapsed, rocky hillside	-116.942	34.86112
b115	Burrow	1	5/27/2015	On top of slope nice fresh tracks, west	-116.942	34.86059
b116	Burrow	2	5/27/2015	b115 on top of slope under creosote, facing southeast good condition, east	-116.943	34.86062
b117	Burrow	1	5/27/2015	b116, smaller burrow, tracks at entrance and inside on rocky hill toward bottom of the slope on edge of desert wash, burrow curves around	-116.944	34.86057
b118	Burrow	3	5/27/2015	Similar size to 116, deteriorated, not recently used and starting to collapse	-116.944	34.86057
b119	Burrow	1	5/27/2015	Larger burrow on rocky 15-degree slope	-116.945	34.86036
b120	Burrow	2	5/27/2015	--	-116.947	34.86083
s58	Carcass	3	5/27/2015	Male 3. Scutes peeling off	-116.948	34.86088
b121	Burrow	2	5/27/2015	b120 class 2, facing east on side of eroded gully, smaller burrow looks really good further in, east	-116.953	34.86055
b122	Burrow	3	5/27/2015	Facing northwest	-116.956	34.86103
live 8	Live Tortoise	live tort 8	5/27/2015	Female can tell by tail, on side of access road to LHA/LHD on rocky, flat areas in creosote 74 out	-116.959	34.86089
b123	Burrow	1	5/27/2015	b122 on slope above creosote, probably used by live tortoise, facing northwest, nibble off beavertail nearby	-116.96	34.86064
b124	Burrow	5	5/27/2015	b123, good condition, possible tortoise, top a little high and round	-116.96	34.86063
b125	Burrow	2	5/27/2015	--	-116.961	34.86086
b126	Burrow	1	5/27/2015	Facing northwest	-116.965	34.86105
b127	Burrow	1	5/27/2015	b126 flat area under creosote, fresh track, southeast	-116.967	34.86015
b128	Burrow	1	5/27/2015	Facing northeast side of desert wash under Ambrosia dumosa	-116.966	34.8601
live 9	Live Tortoise	live tort 9	5/27/2015	Tortoise with irregular, deep depression on rear right costal scute, tortoise under Stephanomeria	-116.963	34.86041
s59	Carcass	4	5/27/2015	Shell bone falling apart	-116.96	34.86033
b129	Burrow	3	5/27/2015	Under creosote, definitely tortoise, deteriorating on side of small desert wash	-116.957	34.86
b130	Burrow	1	5/27/2015	b129, eggshell fragments outside of burrow, under creosote on side of slope, likely hatched late last year	-116.952	34.85995
b131	Burrow	1	5/27/2015	Bank on side of road under creosote, tracks	-116.951	34.85991
s60	Carcass	4	5/27/2015	Shell bone falling apart	-116.951	34.86002
b132	Burrow	1	5/27/2015	On side of slope under creosote, tracks, another burrow about 5 feet away	-116.95	34.86005
b133	Burrow	1	5/27/2015	Under creosote facing east	-116.95	34.85994
b134	Burrow	1	5/27/2015	Burrow facing northeast on slope about 20 degrees	-116.95	34.85993
scat 14	Scat	2	5/27/2015	scat 14	-116.95	34.85993
scat 15	Scat	3	5/27/2015	scat 15	-116.942	34.85921
b135	Burrow	1	5/27/2015	Facing west	-116.945	34.85968

Table 5. Desert Tortoise Sign and Locations in the Range Main Supply Route Survey Area

Field Code	Type	Class	Date	Range West Desert Tortoise Sign Notes	Latitude	Longitude
s61	Carcass	4	5/27/2015	Shell bone falling apart	-116.946	34.85963
s62	Carcass	4	5/27/2015	Shell bone falling apart	-116.947	34.85976
b136	Burrow	1	5/27/2015	Under creosote, recently used, track and movement of dirt visible	-116.947	34.85954
s63	Shell	5	5/27/2015	Scattered on side of desert wash, around 20 pieces	-116.951	34.85945
b137	Burrow	1	5/27/2015	Tracks into and out of burrow adjacent to utility access road at base of rocky slope	-116.954	34.85929
s64	Shell	5	5/27/2015	Male on desert pavement, around 20 pieces.	-116.957	34.85918
b138	Burrow	1	5/27/2015	Facing southwest in creosote	-116.958	34.8598
b139	Burrow	5	5/27/2015	Definitely tortoise	-116.958	34.85946
b140	Burrow	3	5/27/2015	Definitely tortoise, deteriorating	-116.959	34.85931
b141	Burrow	1	5/27/2015	Facing south	-116.96	34.85975
b142	Burrow	2	5/27/2015	Facing southeast	-116.96	34.85973
b143	Burrow	1	5/27/2015	b142 live tortoise inside	-116.96	34.85952
live 10	Live Tortoise	--	5/27/2015	Inside 142 burrow, facing southwest on rocky slope around 15 degrees, large healthy tortoise adult	-116.96	34.85952
s65	Shell	5	5/27/2015	Scattered	-116.96	34.85955
b144	Burrow	3	5/27/2015	Under creosote facing northwest, definitely tortoise	-116.96	34.8593
s66	Carcass	3	5/27/2015	Scutes starting to peel off	-116.963	34.85946
b145	Burrow	2	5/27/2015	On bottom of slope on side of desert wash facing northwest	-116.959	34.85911
b146	Burrow	1	5/27/2015	On side adjacent to creosote, tracks present	-116.959	34.85931
b147	Burrow	1	5/27/2015	Facing northwest, tracks clear, recently been used. Another burrow 146b directly adjacent and is a class 3. Rocks in front of 146b, partially collapsed, two burrows, class 3 and class 1.	-116.958	34.85926
s67	Shell	5	5/27/2015	In desert wash, some pieces intact	-116.954	34.8587
b148	Burrow	1	5/27/2015	Live tortoise inside burrow, northeast facing on slope around 20 degrees	-116.953	34.85912
live 11	Live Tortoise	--	5/27/2015	In burrow 142, nice coloration	-116.953	34.85913
s68	Carcass	3	5/27/2015	Just outside survey area, male 18L x 16W centimeters, scutes peeling off on desert pavement	-116.95	34.85865
Notes: Refer to Table 2 for definition of classes.						



Desert Tortoise Survey Results - Range Main Supply Route
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

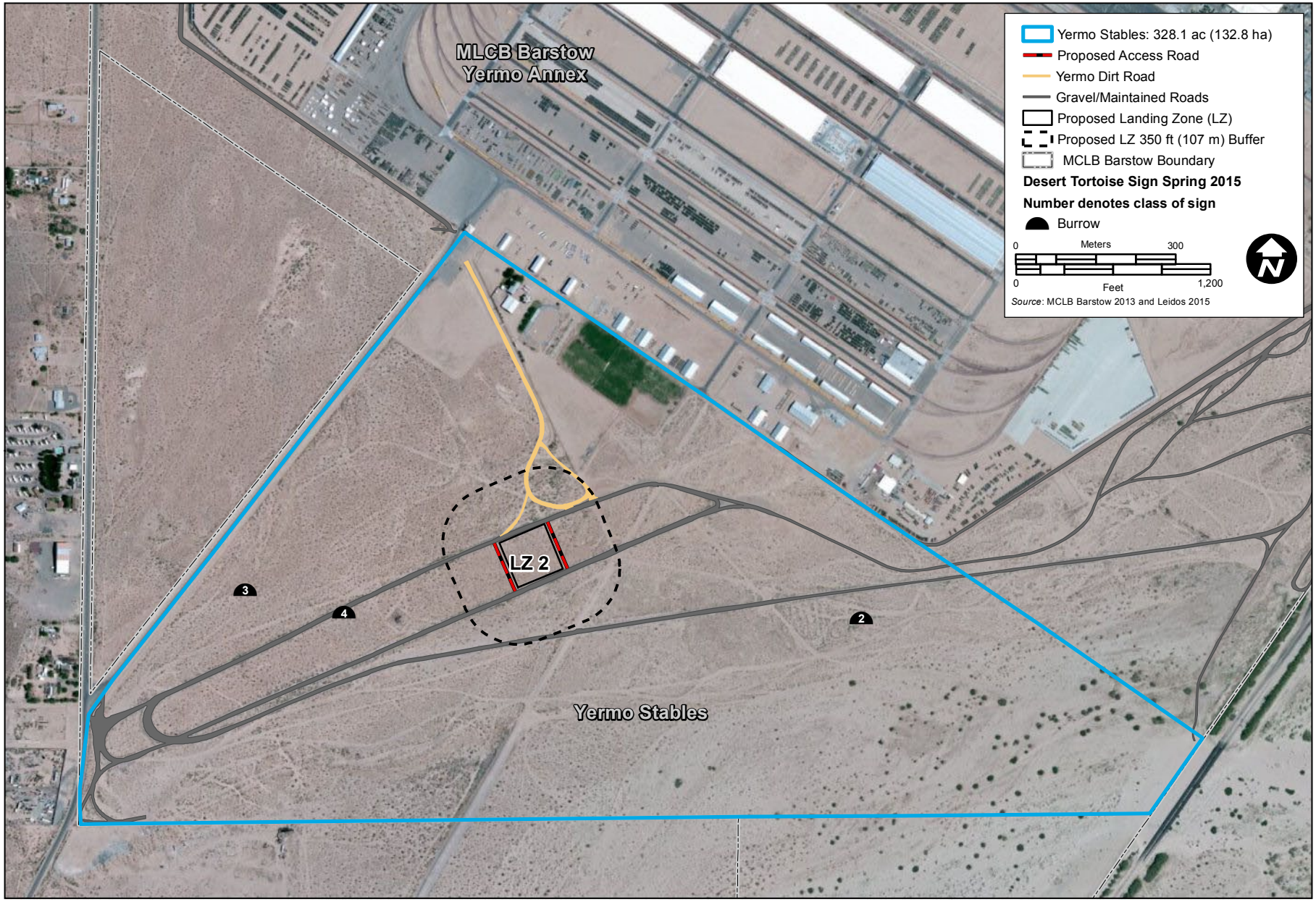
FIGURE
8

4.4 Yermo Stables

Twenty-four transects provided 100 percent coverage and resulted in the detection of three (3) desert tortoise burrows within the Yermo Stables survey area (Table 6, Figure 9). All burrows were class 2, which are tortoise but did not appear to be recently used. Human disturbance and domestic dog sign was abundant throughout this survey area.

Table 6. Desert Tortoise Sign and Locations in the Yermo Stables Survey Area

Field Code	Type	Class	Date	Yermo Stables Desert Tortoise Sign Notes	Latitude	Longitude
b214	Burrow	2	5/29/2015	Burrow has been back filled, adjacent to test track	-116.959	34.85552
b215	Burrow	2	5/29/2015	Facing northeast on sand bank, nice shape, no evidence of recent use, under Atriplex	-116.882	34.88288
b228	Burrow	2	5/29/2015	Tortoise burrow, no recent use	-116.871	34.88278
Notes: Refer to Table 2 for definition of classes.						



Desert Tortoise Survey Results - Yermo Stables
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
9

4.5 Calculations

USFWS protocol calculations were used to estimate the number of tortoises within the total survey area (USFWS 2010). The equation accounts for tortoises that are below ground at the time of surveys and for above-ground tortoises that are cryptic and which may have been missed by the survey team. The calculation only incorporates the number of live tortoises observed during the surveys that were over 6.3 inches (16 centimeters) carapace length. Since the survey areas received more than 1.5 inches (40 millimeters) of winter rain the previous year, a value of 0.80 was used for probability that a tortoise is above ground (Pa) (Weather DB 2015). The USFWS standard value of 0.63 was used for the probability of detecting a tortoise if above ground (Pd) (USFWS 2010).

Calculations used are as follows:

$$N = \frac{\text{(\#of live tortoises observed above ground)}}{(P_a)(P_d)}$$

$$N = \frac{\text{(13 live tortoises)}}{(0.80)(0.63)} = \frac{13}{0.504} = 25.8 \text{ estimated tortoises}$$

5 Conclusions and Discussion

Agassiz's desert tortoise sign was observed in all four survey areas (i.e., Range East and KD Range Complex, Range West, Range Main Supply Route, and Yermo Stables). Sign observed included carcasses, shell remains, scat, burrows, eggshell fragments, and live tortoises. A total of 13 live tortoises (12 adults and 1 juvenile), 112 carcasses, 227 burrows, and 27 scat were observed during the 2015 surveys. Forty-four percent (101) of the burrows documented were class 1, which are currently active with tortoise or recent tortoise sign and thirty percent (67) were class 2, which are definitely tortoise but no evidence of recent use (Table 7). Less than one percent (11) of the burrows were noted as class 5, which are good condition, possibly tortoise. These results suggest the majority of desert tortoise burrows observed during the surveys were recent and active.

All 13 live tortoises appeared to be healthy except one live tortoise (of undetermined sex) had an irregular shell with a deep depression on rear right costal scute. One juvenile tortoise was observed on Range East and KD Range Complex. The tortoise was approximately three (3) years old and observed close to the KD Rifle Range. This is evidence that there has been successful reproduction in the past. One tagged tortoise, and one tortoise that appeared to have epoxy remnants on several marginal scutes near the rear of the carapace, indicating previous handling and/or study, was observed. Most of the live tortoise and sign were observed in Creosote bush-white bursage scrub habitats with the highest proportion of sign found on rocky hillslopes followed by low terrace, desert wash, and desert pavement (Table 8). Recent evidence of tortoises (class 1 or class 2 burrows) were also noted within disturbed vegetation, developed areas, and on man-made berms. Burrows occurred on friable soils and in caliche substrates/caves, on low terraces, banks, and rocky slopes that were sometimes greater than 40 degrees. These areas consisted of suitable substrate for burrow construction, areas of high forage quality, and numerous desert washes offering increased plant diversity and topographic variation.

Table 7. Desert Tortoise 2015 Survey Results

Sign Type / Training Area	Sign Class				
Burrows	Class 1 Currently active with tortoise or recent tortoise sign	Class 2 Good condition, definitely tortoise but no evidence of recent use	Class 3 Deteriorated condition but is definitely tortoise	Class 4 Deteriorated condition, possibly tortoise (no other corroborating sign)	Class 5 Good condition, possibly tortoise (no other corroborating sign)
Range West	40	20	13	1	3
Range East and KD Range Complex	22	23	12	4	4
Range Main Supply Route	39	23	14	1	4
Yermo Stables	0	1	1	1	0
Total	101	67	40	7	11
Scat	Class 1 Wet or moist but not from rain or dew or dried but with obvious odor	Class 2 Dry, dark brown, has a glaze, and some odor	Class 3 Dry, has no glaze or odor, is slightly bleached, is light brown, and plant fibers are tightly packed	Class 4 Dry, has no glaze or odor, is somewhat bleached, is light brown to pale yellow, plant fibers are not tightly packed, and has a scaly appearance	Class 5 Dry, has no glaze or odor, is bleached, is white, and consists only of plant fibers
Range West	0	3	8	0	0
Range East and KD Range Complex	1	0	2	0	0
Range Main Supply Route	1	2	4	3	3
Yermo Stables	0	0	0	0	0
Total	2	5	14	3	3
Carcass/ Shell Remains	Class 1 Fresh or putrid	Class 2 Fresh or putrid, is of normal color and the scutes adhere to the bone	Class 3 Scutes are peeling from the bone	Class 4 Shell bone is falling apart and the growth rings on the scutes are peeling	Class 5 Disarticulated and scattered
Range West	1	1	12	9	20
Range East and KD Range Complex	0	2	12	4	26
Range Main Supply Route	0	0	10	5	9
Yermo Stables	0	0	0	0	0
Total	2	3	34	18	55
Live tortoise					
Range West	2	--	--	--	--
Range East and KD Range Complex	5	--	--	--	--
Range Main Supply Route	6	--	--	--	--
Yermo Stables	0	--	--	--	--
Total	13	--	--	--	--

Table 8. Desert Tortoise Occurrence and Associated Habitat within the Survey Area

Vegetation Community	Live Tortoise	Burrows	Scat	Carcass/ Shell remains	Total
Creosote bush-white bursage scrub					
Rocky Hillslope	6	121	12	30	170
Low Terrace	2	38	3	45	88
Desert Pavement	1	13	1	20	35
Desert wash	0	20	3	14	37
Disturbed Creosote bush-white bursage scrub	2	20	3	1	26
Disturbed vegetation	2	9	4	2	17
Developed	0	3	1	0	4
Creosote Bush-allscale scrub	0	2	0	0	2
Allscale Scrub	0	1	0	0	1
California joint fir scrub	0	0	0	0	0
Desert willow woodland	0	0	0	0	0
Scale broom scrub	0	0	0	0	0
Total	13	227	27	112	380

Habitat suitability within the survey areas ranged from poor to excellent, and varied widely within and between the sites.

Human impacts in the survey area ranged from low to high and included routinely maintained dirt access roads, cleared and grubbed areas, active military facilities (e.g., shooting range and storage facilities), trash and debris, and evidence of recent military training activities.

A total of 112 shell remains were observed during the 2015 survey. The cause of death for these tortoises is unknown. Disease may have been introduced into the wild populations via release of a sick, captive tortoise, or other factors such as precipitation and productivity of plants, which could also be related to tortoise survival (Longshore et al. 2003). Further investigation is required to determine the cause of death for tortoises in the survey area. A total of 227 burrows were observed throughout the survey area.

A single observation of reproduction (eggshell fragments) was observed and a juvenile was observed, but no neonate (i.e., hatchling) tortoises were observed. Reproduction in the survey area is present.

Using the USFWS calculations, an estimated 25.8 adult desert tortoises above 6.3 inches (160 millimeters) occupy the total survey area (Table 9). The tortoise density from the 2015 surveys was estimated to be 6.5 tortoises per square kilometer or 0.03 tortoises per acre.

Table 9. Estimated Desert Tortoise Density within the Survey Area

Year	Live Tortoise	Survey Area (acres)	Survey Area (km^2)	Density Live Tortoise/km^2 Observed	Density Live Tortoises /km^2 Corrected[1]	Total Estimated Desert Tortoise in Survey Area[1]
Spring 2015	13	977	4.0	3.3	6.5	25.8
Notes: [1] Based on USFWS Protocol (USFWS 2010).						

6 References

Longshore, K. M., J. R. Jaeger, and J. M. Sappington. 2003. Desert Tortoise (*Gopherus agassizii*) Survival at Two Eastern Mojave Desert Sites: Death by Short-Term Drought? *Journal of Herpetology* **37**: 169–177.

United States Fish and Wildlife Service (USFWS). 2010. Preparing for Any Action That May Occur within the Range of the Mojave Desert Tortoise (*Gopherus agassizii*). Website: http://www.deserttortoise.org/documents/2010DTPre-projectSurveyProtocol.pdf.

Weather DB. 2015. Average rainfall 2015 for Barstow, California. Website: http://average-rainfall.weatherdb.com/1/1778/Barstow-California.

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Appendix A

Field Survey Data Sheets

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Tara Schoenwetter, tara.schoenwetter@leidos.com (805)-535-8257

Dean Nerhus dnerhus@endemicenvironmental.net, (949)-424-4

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 27 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus, bnerhus@endemicenvironmental.net, (714)39[illegible] 62 (name, email, and phone number)

Site description: NAVFAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.909310 34.858396 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 1 Transect length: _____

GPS Start-point: -116.909310, 34.858396, 647m (easting, northing, elevation in meters) Start time: 14:16 am/pm

GPS End-point: -116.909412, 34.850771, 687m (easting, northing, elevation in meters) End time: 14:35 am/pm

Start Temp: 79.2 °C End Temp: 80.1 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow: all of tortoise beneath plane of burrow opening, or not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

Tara Schoenwetter, tara.schoenwetter@leidos.com, (805)-535-
Dean Nerhus, dnerhus@endemicenvironmental.net, (949)-424-41

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 27 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus, bnerhus@endemicenvironmental.net, (71 393-624 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.909310, 34.858396 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1306ac Transect #: 2 Transect length: _____

GPS Start-point: -116.910159, 34.850759 686m (easting, northing, elevation in meters) Start time: 14:38 am/pm

GPS End-point: -116.910068, 34.858563 645m (easting, northing, elevation in meters) End time: 15:09 am/pm

Start Temp: 80.1 °C End Temp: 79.8 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.910022	34.85319725	Carcass -1	scattered and disarticulated
2				
3				
4				
5				
6				
7				
8				

2015 Field Season

Tara Schoenwetter, Tara.Schoenwetter@leidos.com, (805)-535-8267
Dean Nerhus, dnerhus@endemicenvironmental.net, (949)-424-41.

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 27 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus, bnerhus@endemicenvironmental.net (714)-393-6249 (name, email, and phone number)

Site description: NAVFAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.909310, 34.858396 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: (100% coverage) or Sampling Area size to be surveyed: 1,306 ac. Transect #: 3 Transect length: _____

GPS Start-point: -116.910725, 34.858689 647 m (easting, northing, elevation in meters) Start time: 15:11 am/pm

GPS End-point: -116.910827, 34.850794 685 m (easting, northing, elevation in meters) End time: 16:08 am/pm

Start Temp: 79.8 °C End Temp: 81.2 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1	~~-116.912352~~	~~34.85832448~~	~~15:11~~			
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.912352	34.85832448	Burrow - 1	On side of wash - class 2
2	-116.9105618	34.85297802	Burrow - 2	burrow partial filled - no recent use Class 5
3	-116.9106707	34.85296608	Burrow-3	collapsed; class 3
4	-116.910842	34.85089926	Burrow-4	eroded by wash; class 4
5	-116.9111946	34.8551879	Carcass - 2	Scutes peeling off; Class 3
6	-116.9109961	34.85484974	Carcass 3	Scutes peeling off; Class 3
7	-116.9109639	34.85141022	Carcass-4	Scattered fragments Class-5
8	-116.9110126	34.85116403	Carcass-5	Scattered in wash; Class 5

Not Field Season

Tara Schoenwetter, Tara.Schoenwetter@leidos.com, (805)-535-8267
Dean Nerhus, dnerhus@endemicenvironmental.net, (949)-424-412

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 27 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus, bnerhus@endemicenvironmental.net (714)-393-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.909310, 34.858796 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 4 Transect length: _____

GPS Start-point: -116.911489, 34.850797 684m (easting, northing, elevation in meters) Start time: 16:21 am/pm

GPS End-point: -116.911358, 34.858823 644m (easting, northing, elevation in meters) End time: 17:14 am/pm

Start Temp: 81.2 °C End Temp: 80.5 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9112318	34.85090306	Carcass-6	Scattered and disarticulated; class 5
2	-116.911361	34.85247483	Carcass-7	Scattered and disarticulated; class 5
3	-116.9116577	34.8510649	~~Carc~~ Burrow-5	Near Wash; Class 2
4	-116.9117204	34.85226605	Burrow-6	bank under Creosote; Class 2
5	-116.9115977	34.85255254	Burrow-7	Scat found in entrance
6	-116.9115936	34.85255359	Scat-1	Out side dry; Class 3
7				
8				

2015 Field Season

Tara Schoenwetter, Tara.Schoenwetter@leidos.com, (805)-535-8
Dean Nerhus dnerhus@endemicenvironmental.net, (949)-424-41

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 27 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus, bnerhus@endemicenvironmental.net, (714) 393-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.912058, 34.858966 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac. Transect #: 5a Transect length: _____

GPS Start-point: -116.912058, 34.858966 1042m (easting, northing, elevation in meters) Start time: 17:17 am/pm

GPS End-point: -116.912038, ~~34.858~~ 34.854326 (easting, northing, elevation in meters) End time: 17:47 am/pm

Start Temp: 80.5 °C End Temp: 82.2 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

Tara Schoenwetter, Tara.Schoenwetter@leidos.com, (805)-535, 8267
Dean Nerhus, dnerhus@endemicenvironmental.net, (949)-424-4124

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 28 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus, bnerhus@endemicenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.912058, 34.858966 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1.306ac Transect #: 5b Transect length: 406m

GPS Start-point: -116.912060, 34.854299 (easting, northing, elevation in meters) Start time: 07:19 am/pm

GPS End-point: -116.912133, 34.850802 (easting, northing, elevation in meters) End time: 07:49 am/pm

Start Temp: 62.5 °C End Temp: 64.7 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.914379	34.85331848	Burrow - 8	
2				
3				
4				
5				
6				
7				
8				

2015 Field Season

Tara Schoenwetter, Tara.Schoenwetter@leidos.com, (805)-535-82
Dean Nerhus dnerhus@endemicenvironmental.net, (949)-424-41

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 28 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus, bnerhus@endemicenvironmental.net (714)-393-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.912658, 34.858966 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 Transect #: 6 Transect length: ~~405m~~ 1002m

GPS Start-point: -116.912798, 34.850754 (easting, northing, elevation in meters) Start time: 07:54 am/pm

GPS End-point: -116.912681, 34.859095 (easting, northing, elevation in meters) End time: 08:28 am/pm

Start Temp: 62.5 °C End Temp: 65.4 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1	~~-116.9122509~~	~~3~~				
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9122509	34.85316774	Carcass - 8	Shell bone apart; class 4
2	-116.9130449	34.85131539	Carcass - 9	Scattered and disarticulated; class 5
3				
4				
5				
6				
7				
8				

2015 Field Season

Tara Schoenwetter, Tara.Schoenwetter@leidos.com, (805)-535-826
Dean Nerhus, dnerhus@endemicenvironmental.net, (949)-424-4124

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

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Date of survey: 28 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus, bnerhus@endemicenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.912058, 34.858966 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 7 Transect length: 999 m

GPS Start-point: -116.913354, 34.859236 (easting, northing, elevation in meters) Start time: 08:33 am/pm

GPS End-point: -116.913425, 34.850812 (easting, northing, elevation in meters) End time: 09:24 am/pm

Start Temp: 65.4 °C End Temp: 74.3 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9136103	34.85745994	Carcass-11	Class 3; Scutes peeling off
2	-116.9136933	34.85106574	Carcass-12	Class 5; Scattered
3	-116.9136933	34.85106574	Carcass-13	Outside transect on desert pavement class 3
4				
5				
6				
7				
8				

2015 Field Season

Tara Schoenwetter, Tara.Schoenwetter@leidos.com, (805)-535-826
Dean Nerhus dnerhus@endemicenvironmental.net (949)-424-412

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 28 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus, bnerhus@endemicenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAV FAC. SW Desert Tortoise. Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.912058, 34.858966 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: (100% coverage) or Sampling Area size to be surveyed: 1,300 ac Transect #: 8 Transect length: 1040 m

GPS Start-point: -116.914114, 34.850731 1085 m. (easting, northing, elevation in meters) Start time: 09:32 am/pm

GPS End-point: -116.913958, 34.859360 1040 m (easting, northing, elevation in meters) End time: 10:28 am/pm

Start Temp: 76.3 °C End Temp: 83.6 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9138282	34.85187466	Carcass - ~~10~~ 14	Scutes peeling off; class 3
2	-116.9137965	34.85828276	Burrow - 9	Class 5
3	-116.914379	34.85331848	Burrow - 8	Class 3; Side of wash previously noted
4				
5				
6				
7				
8				

2015 Field Season

Tara Schoenwetter, Tara.Schoenwetter@leidos.com, (805)-535-8267
Dean Nerhus, dnerhus@endemicenvironmental.net (949)-42
4120

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: Apr 28 2015 (day, month, year) Survey biologist(s): Barry Nerhus bnerhus@endemicenvironmental.net (71 393-62 (name, email, and phone number)

Site description: NAVFAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.912058, 34.858966 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306m Transect #: 9 Transect length: 1145m

GPS Start-point: -116.914661, 34.859474 (easting, northing, elevation in meters) Start time: 10:30 am/pm

GPS End-point: -116.914821, 34.850832 (easting, northing, elevation in meters) End time: 11:19 am/pm

Start Temp: 83.6 °C End Temp: 81.1 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9150732	34.85853411	Burrow-10	Class 2
2	-116.9150789	34.8584948	Burrow-11	Class 3
3	-116.9143695	34.85884808	Carcass-15	Class 5; old wood rat midden
4				
5				
6				
7				
8				

Field Season

Tara Schoenwetter, Tara.Schoenwetter@leidos.com (805)-535-824
Dean Nerhus dnerhus@endemicenvironmental.net (949)-424-412

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 28 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus bnerhus@endemicenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAVFAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.915355, 34.854200 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 10a Transect length: 399

GPS Start-point: -116.915355, 34.854200 (easting, northing, elevation in meters) Start time: 11:22 am/pm

GPS End-point: -116.915271, 34.859635 (easting, northing, elevation in meters) End time: 11:59 am/pm

Start Temp: 81.1 °C End Temp: 86.5 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*In burrow*; all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9154379	34.85204344	Carcass - 16	Scattered and disarticulated; class 5
2				
3				
4				
5				
6				
7				
8				

2015 Field Season

Tara Schoenwetter, Tara.Schoenwetter@leidos.com (805)-535-8
Dean Nerhus dnerhus@endemicenvironmental.net (949)-424-4121

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

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Date of survey: 28 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus bnerhus@endemicenvironmental.net (714)-393-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.915356, 34.854189 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 106 Transect length: 672 m

GPS Start-point: -116.915356, 34.854189 (easting, northing, elevation in meters) Start time: 13:31 am/pm

GPS End-point: -116.915414, 34.850924 (easting, northing, elevation in meters) End time: 13:51 am/pm

Start Temp: 86.5 °C End Temp: 88 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.915309	34.856555817	Carcass-17	Scattered in midden; class 5
2	-116.915549	34.857039311	Carcass-18	scattered; class 5
3				
4				
5				
6				
7				
8				

2015 Field Season

Tara Schoenwetter Tara.Schoenwetter@leidos.com (805) 535-826
Dean Nerhus dnerhus@endemicenvironmental.net (949) 424-4121

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

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Date of survey: 28 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus bnerhus@endemicenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.91552249, 34.85703931 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: (100% coverage) or Sampling Area size to be surveyed: 1,306ac Transect #: 11 Transect length: 1112m

GPS Start-point: -116.915963, 34.859758 (easting, northing, elevation in meters) Start time: 13:53 am/pm

GPS End-point: -116.918672, 34.850870 (easting, northing, elevation in meters) End time: 14:53 am/pm

Start Temp: 88 °C End Temp: 87.5 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1	-116.9161292	34.85191248	14:45	In burrow	unk	unk
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9159597	34.85664635	Carcass-19	Scutes peeling off; class 3
2	-116.9158139	34.85662166	Carcass-20	Shell bare apart; broken bottom; class 4
3	-116.916445	34.8557892	Carcass-21	Scattered; Class 5
4	-116.915801	34.8530286	Burrow-12	freshly dug out; class 1
5	-116.9161292	34.85191248	Burrow-13	under creosote; live tortoise
6				
7				
8				

Field Season

Tara Schoenwetter, Tara.Schoenwetter@leidos.com (805)-535-8267
Dean Nerhos dnerhos@endemicenvironmental.net (949)-424-4124

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 28 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhos bnerhos@endemicenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.916734, 34.850926 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,301 acre Transect #: 12 Transect length: 1,163 m

GPS Start-point: -116.916734, 34.850926, 696 m (easting, northing, elevation in meters) Start time: 14:55 am/pm

GPS End-point: -116.916603, 34.859906, 633 m (easting, northing, elevation in meters) End time: 15:35 am/pm

Start Temp: 87.5 °C End Temp: 92.3 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9164593	34.85182447	S-22	Scattered disarticulated; class 5
2	-116.9167386	34.85497504	B-14	Edge of Channel; class 2
3	-116.9166076	34.85702186	B-15	Under creosote; class 2
4				
5				
6				
7				
8				

2015 Field Season

Transect number: 12

Tara Schoenwetter, Tara.Schoenwetter@leidos.com (805)-535-826
Dean Nerhus dnerhus@endemicenvironmental.net (949)-424-412

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

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Date of survey: 28 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus bnerhus@endemicenvironmental.net (714) (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA 393-6249 (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.917273, 34.860030 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 13 Transect length: 1117

GPS Start-point: -116.917273, 34.860030 633m (easting, northing, elevation in meters) Start time: 15:38 am/pm

GPS End-point: -116.917371, 34.850877 (easting, northing, elevation in meters) End time: 16:17 am/pm

Start Temp: 92.3 °C End Temp: 94 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2015 Field Season

Transect number: 13

Tara Schoenwetter, Tara.Schoenwetter@leidos.com, (805)535-826
Dean Nerhus dnerhus@endemicenvironmental.net (949)-424-4

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 28 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus bnerhus@endemicenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAVFAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.918581, 34.860306 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 14 Transect length: 1082m

GPS Start-point: -116.918581, 34.860306 (easting, northing, elevation in meters) Start time: 17:01 am/pm

GPS End-point: -116.918607, 34.854051 (easting, northing, elevation in meters) End time: 17:19 am/pm

Start Temp: 94 °C End Temp: 93.1 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9181402	34.85127359	S-23	Appears crushed; class 5
2	-116.918027	34.85147196	B-17	On side of hill SE facing; Class 2
3	-116.9177869	34.85238699	B-17	On slope facing east; class 2
4				
5				
6				
7				
8				

2015 Field Season

Tara Schoenwetter, Tara.Schoenwetter@lexdos.com (805)-535-82
Dean Nechus dnechus@endemicenvironmental.net (949)-424 4124

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 28 Apr 2015 (day, month, year) Survey biologist(s): Barry Nechus bnechus@endemicenvironmental.net (714) 343-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.918581, 34.860306 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 Transect #: 15 Transect length: 726m

GPS Start-point: -116.918581, 34.860306 (easting, northing, elevation in meters) Start time: 17:01 am/pm

GPS End-point: -116.918607, 34.854057 (easting, northing, elevation in meters) End time: 17:19 am/pm

Start Temp: 93.1 °C End Temp: 93.2 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

Tara Schoenwetter, Tara.Schoenwetter@leidos.com, (855)-53 82-67

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus bnerhus@endemicenvironmental.net (714) - 343-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.918615, 34.854033 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 Transect #: 16 Transect length: 1195m

GPS Start-point: -116.918615 34.854033 (easting, northing, elevation in meters) Start time: 07:44 am/pm

GPS End-point: -116.918667, 34.850884 (easting, northing, elevation in meters) End time: 08:04 am/pm

Start Temp: 70.8 °C End Temp: 74.3 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.918846	34.85220742	S-24	Scattered; Class 5
2	-116.918476	34.85082965	S-25	Scattered; Class 5
3	-116.9185221	34.85184677	B-18	On bottom of slope facing West; Class 2
4				
5				
6				
7				
8				

2015 Field Season

Tara Schoenwetter, Tara.Schoenwetter@leidos.com (805)-535-82

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus bnerhus@endemicenvironmental.net (714 (name, email, and phone number) 393-6249

Site description: NAVFAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.919345, 34.850904 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 Transect #: 17 Transect length: 1251m

GPS Start-point: -116.919345, 34.850904, 699m (easting, northing, elevation in meters) Start time: 08:00 am/pm

GPS End-point: -116.919231, 34.850909, 633m (easting, northing, elevation in meters) End time: 09:34 am/pm

Start Temp: 72.3 °C End Temp: 78.4 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >180-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9193626	34.85323281	S-26	Scattered; class 5
2	-116.9195445	34.85591799	S-27	Scutes peeling off; class 3
3	-116.9185671	34.85749445	B-19	Class 5
4	-116.9193833	34.85566493	B-20	inside of channel; class 3
5	-116.9190871	34.85749723	B-21	under caliche layer; class 2
6				
7				
8				

DRAFT Field Season

Tara Schoenwetter Tara.Schoenwetter@leidos.com (805)-535-8267

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29 Apr 2015 (day, month, year) Survey biologist(s): Barry Nechos bnechus@endemicenvironmental.net (714)-393-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.919785, 34.860560 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: (100% coverage) or Sampling Area size to be surveyed: 1,306 ac Transect #: 18 Transect length: 211 m

GPS Start-point: -116.919785, 34.860560, 633m (easting, northing, elevation in meters) Start time: 09:13 am/pm

GPS End-point: -116.919879, 34.850923, 694m (easting, northing, elevation in meters) End time: 10:30 am/pm

Start Temp: 72.3 °C End Temp: 78.4 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1	-116.919842	34.85613	09:39	Not in burrow	No	NO
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9198853	34.85749875	B-22	Near top of bank; Class 3
2	-116.9197662	34.85658455	B-23	Below Caliche; Class 2
3	-116.9198916	34.8551716	B-24	On Bank; Class 4
4	-116.9199393	34.85350806	B-25	Under bush; Class 4
5	-116.9203393	34.85556246	S-29	Scutes peeling off; class 3
6	-116.9199699	34.85291313	S-28	Shell fragments in wash under Senna 2 fragments; Class 5
7				
8				

Field Season

Tara Schoenwetter, Tara.Schoenwetter@leidos.com (805) 535-8267

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus bnerhus@endemicenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.920797, 34.850986 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 19 Transect length: 1260 m

GPS Start-point: -116.920797, 34.850986 (easting, northing, elevation in meters) Start time: 10:25 am/pm

GPS End-point: -116.920330, 34.860673, 633 m (easting, northing, elevation in meters) End time: 11:55 am/pm

Start Temp: 88.8 °C End Temp: 91 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9201599	34.85132097	B-26	Small at edge of bluff; Class 2
2	-116.9207337	34.85342054	B-27	Under caliche; Class 1
3	-116.9204357	34.85555171	B-28	Under Creosote bush; Class 3
4	-116.9206496	34.85610459	B-29	Under lycum; Class 3
5	-116.9203749	34.85762287	B-30	Grained scrapped; Class 1
6	-116.9206549	34.85201645	S-30	woodrat Midden; class 5
7	-116.9204207	34.85648856	S-31	Under Creosote Bush; Class 2
8	-116.920932	34.85711644	S-32	In wash; Class 5;

Field Season

Tara Schoenwetter Tara.Schoenwetter@leidos.com (805) 535-8267

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

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Date of survey: 29 Apr 2015 (day, month, year) Survey biologist(s): Barry Nechas bnechas@endemicenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.920863, 34.860783 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 20 Transect length: 873 m

GPS Start-point: -116.920863, 34.860783, 633m. (easting, northing, elevation in meters) Start time: 11:57 am/pm

GPS End-point: -116.920953, 34.853822, 677m (easting, northing, elevation in meters) End time: 12:32 am/pm

Start Temp: 91.4 °C End Temp: 91 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1	-116.9208296	34.8581796	12:08	In Burrow	Unk	Unk
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9208296	34.8581796	Burrow-31	live tortoise, Class 1
2	-116.9207559	34.85490029	Burrow-32	Class 3
3	-116.9209097	34.85398929	Burrow-33	Class 1; Scat outside
4	-116.9205002	34.85398929	Burrow-34	Under ephedra - Class 2
5	-116.9209067	34.85477877	Scat-2	Out side burrow-33; Class 3
6				
7				
8				

Not Field Season

Tara Schoenwetter Tara.Schoenwetter@ledos.com (805) 535-8267

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29 Apr 2015 (day, month, year) Survey biologist(s): Barry Nethos bnethos@enterprisenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.887048, 34.879668 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 21 Transect length: 1879 m

GPS Start-point: -116.887048, 34.879668, 604 m (easting, northing, elevation in meters) Start time: 15:02 am/pm

GPS End-point: -116.865132, 34.879467, 592m (easting, northing, elevation in meters) End time: 15:56 am/pm

Start Temp: _____°C End Temp: _____°C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

Tara Schoenwetter tara.schoenwetter@leidos.com (805)-535-8267
Dean Nerhus dnerhus@endemicenvironmental.net (949)-424-4124

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus bnerhus@endemicenvironmental.net (714 393-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow CA (project name and size; general location)

County: San Bernardino Quad: Daggett Location: -116.864717, 34.879931 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 22 Transect length: 2128m

GPS Start-point: -116.864717, 34.879931 (easting, northing, elevation in meters) Start time: 16:00 am/pm

GPS End-point: -116.887033, 34.880148 605m (easting, northing, elevation in meters) End time: 16:45 am/pm

Start Temp: 95 °C End Temp: 97.3 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

Tara Schoenwetter Tara.Schoenwetter@leidos.com (805)-535-826
Dean Nerhus dnerhus@endemicenvironmental.net (414)-424-412

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus bnerhus@endemicenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.886935, 34.880589 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,310 ac Transect #: 23 Transect length: 782m

GPS Start-point: -116.886935, 34.880589 606m (easting, northing, elevation in meters) Start time: 16:50 am/pm

GPS End-point: -116.878595, 34.880484 596m (easting, northing, elevation in meters) End time: 17:08 am/pm

Start Temp: 97.3 °C End Temp: 102.2 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

Tara Schoenwetter Tara.Schoenwetter@leidos.com (805)-535-826
Dean Neihus dneihus@endemicenvironmental.net (949)-424-4124

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 Apr 2015 (day, month, year) Survey biologist(s): Barry Neihus bneihus@endemicenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.878265, 34.880954 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac. Transect #: 24 Transect length: _____

GPS Start-point: -116.878265, 34.880954, 597m (easting, northing, elevation in meters) Start time: 17:10 am/pm

GPS End-point: -116.886950, 34.881029, 605m (easting, northing, elevation in meters) End time: 17:29 am/pm

Start Temp: 101.8 °C End Temp: 95.5 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

Tara Schoenwetter Tara.Schoenwetter@leidos.com (805) 535-8267
Dean Nerhus dnerhus@endemicenvironmental.net (949) 424-41

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 Apr 2015 (day, month, year) Survey biologist(s): Darcy Nerhos bnerhus@endemicenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAV FAC SLJ Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.920970, 34.853767 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 26 Transect length: 1165 ft

GPS Start-point: -116.920970, 34.853767 (easting, northing, elevation in meters) Start time: 08:47 am/pm

GPS End-point: -116.920974, 34.850917 (easting, northing, elevation in meters) End time: 09:13 am/pm

Start Temp: 78.1 °C End Temp: 80.6 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9211661	34.85342979	B-35	On wash bank; west facing; Class 3
2	-116.9207681	34.85226734	B-36	on side slope; west facing; Class 2
3	-116.9208893	34.85152437	B-37	Under creosote deteriorted; Class 3
4	-116.9208313	34.85134833	B-38	Class 4
5	-116.9213315	34.85339743	S-33	Class 5; Shell remains disarticulated and scattered
6				bottom is 3.4
7				
8				

2015 Field Season

Tara Schoenwetter Tara.Schoenwetter@kiebs.com (805) 535-8267
Dean Nerhus dnerhus@endemicenvironmental.net (949) 424-412

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus bnerhus@endemicenvironmental.net (714)-303-6249 (name, email, and phone number)

Site description: NAVFAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.921660, 34.850919 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 27 Transect length: 1230m

GPS Start-point: -116.921660, 34.850919 (easting, northing, elevation in meters) Start time: 09:15 am/pm

GPS End-point: -116.921487, 34.850914 (easting, northing, elevation in meters) End time: 10:34 am/pm

Start Temp: 80.6 °C End Temp: 93.2 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1	-116.9214734	34.85896906	10:13	In Burrow	Unknown	Unknown
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9219492	34.85137457	B-39	On side slope; Class 1
2	-116.925703	34.85317687	B-40	facing North; Class 1
3	-116.9215271	34.8556184	B-41	In creosote; Class 2
4	-116.9214734	34.85896906	B-42	live Desert tortoise; Class 1
5	-116.9217439	34.85193156	S-34	Scattered; Class 5
6	-116.9216929	34.85378188	S-35	Scattered; Class 5
7	-116.921785	34.85672432	S-36	Scutes peeling off; Class 3
8	-116.9208483	34.85851092	Scat-3	Class 1; in road squished by tire

2015 Field Season

Tara Schoenwetter Tara.Schoenwetter@leidos.com (805)-535-8267
Dean Nerhus dnerhus@endemicenvironmental.net (949)-424-4124

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus bnerhus@endemicenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAVFAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.922183, 34.861060 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 28 Transect length: 1234m

GPS Start-point: -116.922183, 34.861060, 634m (easting, northing, elevation in meters) Start time: 10:36 am/pm

GPS End-point: -116.922317, 34.850949, 705 (easting, northing, elevation in meters) End time: 11:38 am/pm

Start Temp: 87.3 °C End Temp: 93.2 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9227129	34.86062553	B-43	on side of wash; Class 5
2	-116.9225571	34.8604867	B-44	facing south; Class 2
3	-116.9224615	34.86041072	B-45	Class 2
4	-116.9222515	34.85408544	B-46	On side slope; Class 2
5	-116.9224512	34.851983124	B-47	Side Slope; Class 1
6	-116.9220063	34.85508436	S-37	Class 5; disarticulated; scattered on low
7				terrace near creosote; 2 spts many fragments
8				

Not Field Season

Tara Schoenwetter Tara.Schoenwetter@leidos.com (805)-535-826
Dean Nerhus dnerhus@endemicenvironmental.net (949)-424-4124

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus bnerhus@endemicenvironmental.net (714)-393-6249 (name, email, and phone number)

Site description: NAVFAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.922974, 34.850858 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 29 Transect length: 964m

GPS Start-point: -116.922974, 34.850858 (easting, northing, elevation in meters) Start time: 11:41 am/pm

GPS End-point: -116.922908, 34.858522 (easting, northing, elevation in meters) End time: 13:03 am/pm

Start Temp: 93.2 °C End Temp: 97.7 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9224608	34.85088197	B-48	under creosote; Class 2
2	-116.9232827	34.85139991	B-49	old; Class 3
3	-116.9227894	34.85188181	B-50	Near top of ridge; Class 1
4	-116.9227681	34.85207436	B-51	deep burrow; Class 1
5	-116.9226456	34.8521381	B-52	deep burrow; Class 1
6	-116.9233313	34.85246116	B-53	Near ridge top; Class 2
7	-116.9228216	34.85~~24~~5438	B-54	Near ~~ridge~~ wash; class 2
8	-116.9235433	34.85387531	B-55	Class 2
9	-116.9225938	34.85661238	B-56	under creosote; class 1
10	-116.9229054	34.85194188	S-38	Scattered; Class 5
11	-116.9228721	34.85250411	S-39	Scutes peeling; class 3
12	-116.9231782	34.85595421	S-40	Class 3

Not Field Season

Tara Schoenwetter Tara.Schoenwetter@leidos.com (805) 535-8267
Dean Nethus dnethus@endemicenvironmental.net (414) 424-4124

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 Apr 2015 (day, month, year) Survey biologist(s): Barry Nethus bnethus@endemicenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAVFAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.922857, 34.858549 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 30 Transect length: 349 m

GPS Start-point: -116.922857, 34.858549, 653m (easting, northing, elevation in meters) Start time: 14:17 am/pm

GPS End-point: -116.922850, 34.861203, 632m (easting, northing, elevation in meters) End time: 14:29 am/pm

Start Temp: 97.7 °C End Temp: 99.6 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9226967	34.8590956	B-57	in utility corridor; Class 1
2	-116.9232323	34.86081724	B-58	Tracks; class 1
3				
4				
5				
6				
7				
8				

2015 Field Season

Tara Schoenwetter Tara.Schoenwetter@tetrdos.com (805) 535-826
Dear Nerhus dnerhus@endemicenvironmental.net (949) 424-4124

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus bnerhus@endemicenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAVFAC SW Desert Tortoise Survey MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.923356, 34.861291 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 Transect #: 31 Transect length: 1,297

GPS Start-point: -116.923356, 34.861291, 635m (easting, northing, elevation in meters) Start time: 14:30 am/pm

GPS End-point: -116.923489, 34.850936, 720m (easting, northing, elevation in meters) End time: 15:50 am/pm

Start Temp: 99.6 °C End Temp: 96.4 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9235522	34.86003201	B-59	Large in burrow; Class 1
2	-116.9234591	34.85587647	B-60	Fresh tracks; Class 1
3	-116.9235065	34.85433738	B-61	Class 2
4	-116.9238881	34.85385277	B-62	
5	-116.9235192	34.85388555	B-63	Side of hill; Class 2
6	-116.9238308	34.85692405	S-41	Shell bone apart; Class 4
7	-116.923883	34.85291313	S-42	Shell bone apart; Class 4
8	-116.9238308	34.85692405	S-43	Normal color; Class 2
9	-116.9235504	34.86004025	LiveT-5	Live tortoise in burrow 59 underneath large creosote
10	-116.9235721	34.85765585	S-44	~~Sc~~ Juvenile; 10.5w x 12L cm

2015 Field Season

Tara Schoenwetter Tara.Schoenwetter@ledos.com (805) 535-8267
Dean Nerhus dnerhus@endemicenvironmental.net (949) 424-4124

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus bnerhus@endemicenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Survey MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.923765, 34.858739 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 32 Transect length: 635 m

GPS Start-point: -116.923765, 34.858739 (easting, northing, elevation in meters) Start time: 16:18 am/pm

GPS End-point: _____ (easting, northing, elevation in meters) End time: 17:21 am/pm

Start Temp: 98.7 °C End Temp: _____ °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1	-116.9246014	34.85868	16:25	Not in burrow		
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9258743	34.85881597	B-64	Class 2
2	-116.9303082	34.85897732	B-65	old tracks; Class 2
3	-116.929939	34.85814075	B-66	Class 2
4	-116.926276	34.8605979	~~Burrow~~ Carcass-45	Class 5
5				
6				
7				
8				

2010 Field Season

Tara Schoenwetter Tara.Schoenwetter@leidos.com (805) 535-8267
Dean Nerhus dnerhus@endemicenvironmental.net (949)-424-4124

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 Apr 2015 (day, month, year) Survey biologist(s): Barry Nerhus bnerhus@endemicenvironmental.net (714) 393-6249 (name, email, and phone number)

Site description: NAV FAC SW Desert Tortoise Surveys MCLB Barstow, CA (project name and size; general location)

County: San Bernadino Quad: Daggett Location: -116.929957, 34.859336 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 AC Transect #: 33 Transect length: ~~30m~~ 555m

GPS Start-point: -116.929957, 34.859336 (easting, northing, elevation in meters) Start time: 17:28 am/pm

GPS End-point: -116.923726, 34.~~8593~~ 859251 (easting, northing, elevation in meters) End time: 17:42 am/pm

Start Temp: _____ °C End Temp: 92.3 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9406086	34.85967361	Carcass-46	Scutes peeling off; Class 3
2				
3				
4				
5				
6				
7				
8				

2015 Field Season

Bnerhus@endemicenvironmental-ne
~~Tara Sh~~ 714-393-6249
Tara-Schoenwetter@leidos-com
805-535-8267

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 01 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.930048, 34.859866 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 34 Transect length: 634 m

GPS Start-point: -116.930048, 34.859866, 656m (easting, northing, elevation in meters) Start time: 0752 am/pm

GPS End-point: -116.923713, 34.859803, 645m (easting, northing, elevation in meters) End time: 0824 am/pm

Start Temp: 70 °C °F End Temp: 77 °C °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9274304	34.85984616	BURROW 67	class 2; on bank facing South
2	-116.9269364	34.85956544	BURROW 68	class 2; old burrow near road
3	-116.9240172	34.85984775	BURROW 69	class 1; at head of small gully
4	-116.9236794	34.85970884	BURROW 70	class 2; facing South
5	-116.924655	34.86021218	BURROW 71	class 1; Under ephedra
6				
7				
8				

Post Field Season

(714) 393-6244 BARRY NERHUS / BNERHUS@endemicenvironmental.net

(805) 535-8267 TARA SCHOENWETTER / TARA.SCHOENWETTER@LEIDOS.COM

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 01 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS; TARA Schoenwetter (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEY MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.923567, 34.860259 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 35 Transect length: 642 m

GPS Start-point: -116.923567, 34.860259, 641 m (easting, northing, elevation in meters) Start time: 0832 am/pm

GPS End-point: -116.930041, 34.860341, 650 m (easting, northing, elevation in meters) End time: 0910 am/pm

Start Temp: 77 °C °F End Temp: 75 °C °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1	~~-116.9246313~~	~~34.86028612~~				
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9246313	34.86028612	BURROW 72	Class 2; shallow facing NW
2	-116.9247999	34.86030999	BURROW 73	Class 2
3	-116.9254664	34.86012574	BURROW 74	Class 1
4	-116.927431	34.86014188	BURROW 75	Class 1; Scat in opening
5	-116.9254703	34.86012287	SCAT #4	Class 3
6	-116.9289492	34.86047056	BURROW 76	Class 1; Under Creosote Bush
7	-116.9289491	34.86047056	BURROW 77	Class 2; shallow facing NE
8				

Not Field Season

Transect number: 35

(714) 3936244 barry.nerhus@enseminc.com
(805) 535-8608267 Tara-Schoenwetter@Leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 01 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEY MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.929925, 34.860782 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 36 Transect length: _____

GPS Start-point: -116.929925, 34.860782, 647 m (easting, northing, elevation in meters) Start time: 0912 am/pm

GPS End-point: -116.923637, 34.860708, 638 m (easting, northing, elevation in meters) End time: 0932 am/pm

Start Temp: 75 °C °F End Temp: 80 °C °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9300147	34.8586275	Carcass 47	Class 3; MALE UPRIGHT; 16cm L x 20c
2	-116.9240214	34.8604952	Scat #5	Class 5
3	-116.9240213	34.86051222	Scat #6	Class 5
4				
5				
6				
7				
8				

2015 Field Season

Transect number: 36

(714) 393-6249 bnerhus@endemicenvironmental.net
(805) 535-8267 TARA.SCHOENWETTER@LEIDOS.COM

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 01 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEY MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: BAGGET Location: -116.923575, 34.861152 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 AC Transect #: 37 Transect length: 645 m

GPS Start-point: -116.923575, 34.861152, 635 m (easting, northing, elevation in meters) Start time: 0939 am/pm

GPS End-point: -116.930068, 34.861269 (easting, northing, elevation in meters) End time: 0958 am/pm

Start Temp: 80 °C °F End Temp: 82 °C °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*In burrow: all of tortoise beneath plane of burrow opening, or not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

(714) 545-6211 [illegible]
(805) 535-8267 TARA.SCHOENWETTER@Leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 01 MAY 2015 (day, month, year) Survey biologist(s): BARRY NEKHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEY MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.930007, 34.861586 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 38 Transect length: _____

GPS Start-point: -116.930007, 34.861586, 641 m (easting, northing, elevation in meters) Start time: 1000 am/pm

GPS End-point: -116.924521, 34.861536, 633 m (easting, northing, elevation in meters) End time: 1014 am/pm

Start Temp: 82 °C °F End Temp: 81 °C °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

(714)393-6249 Bnerhus@endemicenvironmental.net
(805) 535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

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Date of survey: 01 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.930257, 34.858771 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 39 Transect length: 1103 m

GPS Start-point: -116.930257, 34.858771, 670m (easting, northing, elevation in meters) Start time: 1059 am/pm

GPS End-point: -116.941521, 34.858894, 709m (easting, northing, elevation in meters) End time: 1134 am/pm

Start Temp: 81 °C °F End Temp: 82 °C °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

714-393-0249 Brechus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 01 MAY 2015 (day, month, year) Survey biologist(s): BARRY NECHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.941581, 34.859338 (UTM coordinates, lat/long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 40 Transect length: 1168 m

GPS Start-point: -116.941581, 34.859338, 706 m (easting, northing, elevation in meters) Start time: 11:36 am/pm

GPS End-point: -116.930030, 34.859194 (easting, northing, elevation in meters) End time: 12:06 am/pm

Start Temp: 82 °C °F End Temp: 91 °C °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.927431	34.86014188	BURROW 78	Class 2, IN ROAD BANK
2	-116.940982	34.85923724	BURROW 79	Class 4, ON ROAD BANK
3	-116.929573	34.8596089	CARCASS 48	Class 3
4	-116.933789	34.85926706	BURROW 80	Class 5
5	-116.9337717	34.85942006	BURROW 81	Class 3
6	-116.9336076	34.8591273	BURROW 82	Class 2
7	-116.9334293	34.85915151	BURROW 83	Class 1, facing east
8	-116.9334276	34.85914794	SCAT #6	Class 3

2010 Field Season

714-393-6249 Bnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 01 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.929965, 34.859690 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 41 Transect length: 1124 m

GPS Start-point: -116.929965, 34.859690, 1055 m (easting, northing, elevation in meters) Start time: 13:06 am/pm

GPS End-point: -116.941537, 34.859791, 704 m (easting, northing, elevation in meters) End time: 13:39 am/pm

Start Temp: 91 °C °F End Temp: 90 °C °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9335399	34.859 4306	Burrow 84	class 3
2	-116.9405312	34.85991896	Burrow 85	class 3, in wash
3	~~-116.9399493~~	~~34.8018954~~	~~CARCASS 49~~	~~class 3, male~~
4				
5				
6				
7				
8				

2015 Field Season

714-393-6249 Bnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 01 MAY 2015 (day, month, year) Survey biologist(s): BARRY NEERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.941571, 34.860255 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 42 Transect length: 1172 m

GPS Start-point: -116.941571, 34.860255, 694 m (easting, northing, elevation in meters) Start time: 13:41 am/pm

GPS End-point: -116.930101, 34.860070, 653 m (easting, northing, elevation in meters) End time: 14:38 am/pm

Start Temp: 89 °C °F End Temp: 96 °C °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9395809	34.86010476	Burrow 86	class 1
2	-116.9394528	34.8603246	Burrow 87	class 1; Scat in burrow
3	116.9391443.7 ~~-116.9397276~~	34.8603187 ~~34.8591147994~~	Scat #7	~~class 3;~~ class 4
4	-116.9397063	34.86052578	Burrow 88	class 1; facing west
5	-116.930474	34.86031266	Burrow 89	class 1; Near Scat
6	-116.9364688	34.86031291	Scat #8	class 1
7	-116.9355298	34.86005439	Burrow 90	class 2
8	~~-116.9440147~~	~~34.86158166~~	~~CARCASS 50~~	~~class 5~~
	-116.9330933	34.86012845	SCAT #9	class 2
	~~-116.947565~~	~~34.86156368~~	~~CARCASS 51~~	~~class 3~~
	~~-116.9512998~~	~~34.86143748~~	~~CARCASS 52~~	~~class 5~~

Transect number: 42

2015 Field Season

714-393-6249 Bnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 01 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGETT Location: -116.929967, 34.860588 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1306 ac Transect #: 45 Transect length: 1137 m

GPS Start-point: -116.929967, 34.860588, 649 m (easting, northing, elevation in meters) Start time: 14:40 am/pm

GPS End-point: -116.941541, 34.860670, 686 m (easting, northing, elevation in meters) End time: 15:35 am/pm

Start Temp: _____ °C °F End Temp: _____ °C °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1	-116.9367937	34.86075112	15:12	in burrow	Unknown	N/A
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.93252621	34.86071137	BURROW 91	class 2; in bank facing west
2	-116.9342905	34.86068052	BURROW 92	class 4
3	-116.9367978	34.86073311	BURROW 93	class 1; with live tortoise #7 in burrow
4	~~-116.9356233~~	~~34.86065089~~	~~CARCASS 53~~	~~class 3~~
5	-116.93734456	34.86054535	BURROW 94	class 3
6	-116.9374383	34.86052829	BURROW 95	class 1; deep, facing west
7	-116.9392261	34.86074621	BURROW 96	class 3; under creosote bush facing SE
8	-116.941288	34.86063077	BURROW 97	class 4; facing east
	-116.9356693	34.86042852	SCAT #10	class 4

Photo Field Season

714-393-6249 Bnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 01 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.941495 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 44 Transect length: _____

GPS Start-point: -116.941495, 34.86450, 685 m (easting, northing, elevation in meters) Start time: 15:38 am/pm

GPS End-point: -116.930039, 34.860984, 64 m (easting, northing, elevation in meters) End time: 16:22 am/pm

Start Temp: 96 °C°F End Temp: 96 °C°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >180-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9409444	34.86106548	Burrow 98	facing west; class 1
2	-116.9373012	34.86127359	Burrow 99	class 2; under senna; facing west
3	-116.9371457	34.86135494	Burrow 100	class 2; facing west
4	-116.9367004	34.86128493	Burrow 101	class 2; facing northeast
5	-116.9333329	34.86115899	Scat # 11	Class 5
6				
7				
8				

2010 Field Season

714-393-6249 Bnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 26 MAY 2015 (day, month, year) Survey biologist(s): BARRY NEKHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.929869, 34.861572 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 45 Transect length: 1155 m

GPS Start-point: -116.929869, 34.861572, N/A (easting, northing, elevation in meters) Start time: 12:30 am/pm

GPS End-point: -116.94559, 34.861721, N/A (easting, northing, elevation in meters) End time: 13:46 am/pm

Start Temp: 88 °C °F End Temp: 95 °C °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9345232	34.86160743	BURROW 102	class 1; facing northeast
2	-116.9369071	34.86146052	BURROW 103	class 2; facing North
3	-116.9403653	34.86170656	BURROW 104	class 1;
4			~~BURROW 105~~	
5	-116.9399493	34.86189554	CARCASS 49	class 3
6	-116.9403829	34.86166494	SCAT # 12	class 3
7				
8				

Not Field Season

Transect number: 45

714-393-6249 Bnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 26 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB. BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.941562, 34.861775 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 46 Transect length: 2519

GPS Start-point: -116.941562, 34.861775, 675M (easting, northing, elevation in meters) Start time: 13:51 am/pm

GPS End-point: -116.967861, 34.861997, N/A (easting, northing, elevation in meters) End time: 15:18 am/pm

Start Temp: 95 °C °F End Temp: 95 °C °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9417869	34.86187955	BURROW 105	class 1; with fresh tracks
2	-116.9455304	34.86193116	BURROW 106	class 2;
3	-116.9456891	34.86190812	BURROW 107	class 1; facing north
4	-116.9610166	34.862022	BURROW 108	class 3; collapsed
5	-116.9440197	34.86158106	CARCASS 50	class 5
6	-116.947565	34.86156368	CARCASS 51	class 3; small
7	-116.952998	34.86143798	CARCASS 52	class 5;
8	-116.9638233	34.86165089	CARCASS 53	class 3
	-116.9456858	34.86189417	SCAT # 13	class 4

2015 Field Season

714-393-6249 Brerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 26 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB, BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.967849, 34.861449 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 47 Transect length: 2555 m

GPS Start-point: -116.967849, 34.861449, 694 m (easting, northing, elevation in meters) Start time: 15:23 am/pm

GPS End-point: -116.941516, 34.861230, 686 m (easting, northing, elevation in meters) End time: 16:58 am/pm

Start Temp: 95 °C°F End Temp: 95 °C°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9659143	34.86140279	BURROW 109	Class 1, facing East
2	-116.9535658	34.86116714	BURROW 110	Class 5
3	-116.9475401	34.86108368	BURROW 111	Class 4
4	-116.9448143	34.86105173	BURROW 112	Class 3
5	-116.9422209	34.8611002	BURROW 113	Class 3
6	-116.9418145	34.86111564	BURROW 114	Class 3
7	-116.9487178	34.8611778	CARCASS 54	Class 5
8	-116.9472677	34.86102183	CARCASS 55	Class 3
	-116.9471997	34.86114881	CARCASS 56	Class 4
	-116.9433144	34.86112943	CARCASS 57	Class 5

Not Field Season

Transect number: 47

714-393-6249 Bnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 27 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.94672, 34.860682 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 48 Transect length: 2540 m

GPS Start-point: -116.941672, 34.860682, 692 m (easting, northing, elevation in meters) Start time: 07:40 am/pm

GPS End-point: -116.967854, 34.860925, 697 m (easting, northing, elevation in meters) End time: 09:29 am/pm

Start Temp: 68 °C°F End Temp: 80 °C°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1	-116.9594352	34.860890946	08:51 A.M.	LIVE #8		
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.941764	34.86058979	BURROW 115	class 1; facing west
2	-116.9434086	34.86061782	BURROW 116	class 2; facing east
3	-116.943947	34.86057371	BURROW 117	class 1
4	-116.9440967	34.86057332	BURROW 118	class 3
5	-116.9451966	34.86035993	BURROW 119	class 1
6	-116.9474324	34.86083154	BURROW 120	class 2
7	-116.9532155	34.86055485	BURROW 121	class 2; facing east
8	-116.9564439	34.86102687	BURROW 122	class 3

Not Field Season

714-393-6249 Bnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter.leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 27 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.94672, 34.860682 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 48 Transect length: 2540 m

GPS Start-point: -116.941672, 34.860682, 692 m (easting, northing, elevation in meters) Start time: 07:40 am/pm

GPS End-point: -116.967854, 34.860925, 697 m (easting, northing, elevation in meters) End time: 09:29 am/pm

Start Temp: 68 °F End Temp: 80 °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.959525	34.86063552	BURROW 123	class 1
2	-116.9602715	34.86063167	BURROW 124	class 5
3	-116.9614472	34.86085908	BURROW 125	class 2
4	-116.9645552	34.861048	BURROW 126	class 1
5	-116.9486023	34.86087753	CARCASS 58	class 3; MALE
6	-116.9594352	34.86089096	Live 8	Female (ID by tail), on side of access road
7				to LZ/LHA on rocky flat areas in Creosote
8				

2015 Field Season

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USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 27 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB, BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGETT Location: -116.967861, 34.860370 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 49 Transect length: 2535 m

GPS Start-point: -116.967861, 34.860370, 698 m (easting, northing, elevation in meters) Start time: 09:31 am/pm

GPS End-point: -116.941543, 34.860172, 695 m (easting, northing, elevation in meters) End time: 11:17 am/pm

Start Temp: 80 °C/°F End Temp: 89 °C/°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9665292	34.86015251	BURROW 127	facing Southeast; class 1
2	-116.9656708	34.86010366	BURROW 128	class 1
3	-116.9565506	34.85999918	BURROW 129	class 3
4	-116.9518577	34.85995114	BURROW 130	class 1; egg shells
5	-116.9507915	34.85991452	BURROW 131	class 1
6	-116.9502913	34.86005452	BURROW 132	class 1
7	-116.9500172	34.85993857	BURROW 133	class 1
8	-116.9496327	34.85992819	BURROW 134	class 1; with scat, facing west

Field Season

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805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 27 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.967861, 34.860370 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 49 Transect length: 2535 m

GPS Start-point: -116.967861, 34.860370, 698 m (easting, northing, elevation in meters) Start time: 09:31 am/pm

GPS End-point: -116.941543, 34.860172, 695 m (easting, northing, elevation in meters) End time: 11:17 am/pm

Start Temp: 80 °C/°F End Temp: 89 °C/°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1	-116.9633318	34.8604128	09:49 A.M.	Live TORTOISE #9 ~~Not in burrow~~	Unknown	
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.949644	34.859932	SCAT #14	~~class 3~~ class 2
2	-116.9598852	34.86033076	CARCASS 59	Class 4
3	-116.9505933	34.86002055	CARCASS 60	Class 4
4				
5				
6				
7				
8				

2015 Field Season

714-393-6249 Brerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 27 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.941590, 34.859597 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 50 Transect length: 2647 m

GPS Start-point: -116.941590, 34.859597, 703 m (easting, northing, elevation in meters) Start time: 12:13 am/pm

GPS End-point: -116.967872, 34.859831, 703 m (easting, northing, elevation in meters) End time: 14:13 am/pm

Start Temp: 89 °C/°F End Temp: 94 °C/°F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*In burrow: all of tortoise beneath plane of burrow opening, or not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1	-116.9604147	34.85951597	13:46	LIVE TORTOISE # 10		
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9446993	34.859676	BURROW 135	class 1
2	-116.9474361	34.85953863	BURROW 136	class 1; facing north west
3	-116.9536633	34.85924251	BURROW 137	Class 1, facing SW in creosote bush
4	-116.9519948	34.85979652	BURROW 138	class 1
5	-116.9578463	34.85946349	BURROW 139	class 5
6	-116.9585965	34.85931015	BURROW 140	class 3, facing South
7	-116.9595058	34.85975281	BURROW 141	class 1, facing South east
8	-116.9595688	34.8597319	BURROW 142	class 2,

2015 Field Season

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USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 27 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.941590, 34.859597 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 50 Transect length: 2647 m

GPS Start-point: -116.941590, 34.859597, 703 m (easting, northing, elevation in meters) Start time: 12:13 am/pm

GPS End-point: -116.967872, 34.859831, 703 m (easting, northing, elevation in meters) End time: 14:13 am/pm

Start Temp: 89 °C °F End Temp: 94 °C °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*In burrow: all of tortoise beneath plane of burrow opening, or not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9604179	34.85951869	BURROW 143	class 1
2	-116.9604371	34.85929604	BURROW 144	class 3
3	~~-116.9595563~~	~~34.8591252~~	~~BURROW 145~~	~~class 2~~
4	-116.9455553	34.85963077	CARCASS 61	Class 4
5	-116.9470328	34.85975892	CARCASS 62	class 4
6	-116.9514345	34.85944677	CARCASS 63	class 5
7	-116.957299	34.85918213	CARCASS 64	class 5
8	-116.9604506	34.8595505	CARCASS 65	Class 5
	-116.9418775	34.85920509	SCAT #15	class 3

Not Field Season

714-393-6249 Bnerhus@endemic environmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 27 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.967852, 34.859300 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 51 Transect length: 2590 m

GPS Start-point: -116.967852, 34.859300, 704 m (easting, northing, elevation in meters) Start time: 14:18 am/pm

GPS End-point: -116.941577, 34.859044, N/A (easting, northing, elevation in meters) End time: 16:18 am/pm

Start Temp: 94 °C °F End Temp: 94 °C °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1	-116.952883	34.8591939	15:17	Live Tortoise #11 in burrow	unknown	
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9542563	34.8591125	BURROW 145	class 2
2	-116.9587984	34.859314	BURROW 146	class 1
3	-116.9581173	34.8592639	BURROW 147	class 1 & class 3; two burrows
4	-116.9528848	34.8591232	BURROW 148	class 1; with live tortoise #11
5	-116.9634788	34.8594563 4	CARCASS 66	class 3
6	-116.9542266	34.8586995	CARCASS 67	class 5
7	-116.9501617	34.8586541	CARCASS 68	class 3
8				

Post Field Season

714-393-6249 Bnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@letidos.com
~~949-424-4124 Bnerhus@endemicenvironmental.net~~

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 27 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.934251, 34.858435 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 52 Transect length: 116 m

GPS Start-point: -116.934251, 34.858345, 695 m (easting, northing, elevation in meters) Start time: 16:31 am/pm

GPS End-point: -116.933023, 34.858402, 682 m (easting, northing, elevation in meters) End time: 16:35 am/pm

Start Temp: 94 °C °F End Temp: 94 °C °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2015 Field Season

Transect number: 52

714-393-6249 Bnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 27 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.933313, 34.857897 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 53 Transect length: 62 m

GPS Start-point: -116.933313, 34.857847, 692 m (easting, northing, elevation in meters) Start time: 16:38 am/pm

GPS End-point: -116.933944, 34.857907, 697 m (easting, northing, elevation in meters) End time: 16:40 am/pm

Start Temp: 94 °C/°F End Temp: 94 °C/°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

949-424-4124 D nerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 28 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.960051, 34.847978 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1306ac Transect #: 54 Transect length: 1422 m

GPS Start-point: -116.960051, 34.847978, 742 m (easting, northing, elevation in meters) Start time: 07:59 am/pm

GPS End-point: -116.945455, 34.847863, 749 m (easting, northing, elevation in meters) End time: 09:03 am/pm

Start Temp: 76 °C °F End Temp: 81 °C °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9577096	34.8479233	BURROW 149	~~-116.9~~ class 1; facing west
2	-116.9576948	34.8479013	BURROW 150	class 1; facing west
3	-116.9576736	34.8478674	BURROW 151	class 2; facing west
4	-116.957488	34.847695	BURROW 152	class 1; facing west
5	-116.9551225	34.8478171	BURROW 153	class 1; facing east; with scat # 16
6	-116.9551344	34.84781733	SCAT #16	class 2
7	-116.9484912	34.8478381	BURROW 154	class 1; facing east
8	-116.9484563	34.8478641	BURROW 155	class 2; facing east
	-116.9488532	34.84796262	CARCASS 69	class 5

2015 Field Season

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805-535-8257 Tara-Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 28 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.946104, 34.848389 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 55 Transect length: 1403 m

GPS Start-point: -116.946104, 34.848389, 743 m (easting, northing, elevation in meters) Start time: 09:07 am/pm

GPS End-point: -116.959986, 34.848499, 741 m (easting, northing, elevation in meters) End time: 10:18 am/pm

Start Temp: 81 °C°F End Temp: ~~93~~ 89 °C°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9478737	34.8485786	BURROW 156	class 3; facing east
2	-116.9551684	34.8484504	BURROW 157	class 2; facing east
3	-116.9559046	34.8486035	BURROW 158	class 1; facing north east
4	-116.9572766	34.8481293	BURROW 159	class 1; facing west
5	-116.9593443	34.8481342	BURROW 160	class 1; facing north
6	-116.9594742	34.8480551	BURROW 161	class 5; facing north
7	-116.9600017	34.8484347	CARCASS 70	class 3
8	-116.9599231	34.8486146	CARCASS 71	class 5

Not Field Season

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USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 28 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.959874, 34.849066 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 56 Transect length: 1361 m

GPS Start-point: -116.959874, 34.849066, 740 m (easting, northing, elevation in meters) Start time: 10:24 am/pm

GPS End-point: -116.946643, 34.848961, 739 m (easting, northing, elevation in meters) End time: 11:34 am/pm

Start Temp: 89 °F End Temp: 93 °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1	-116.956599	34.8489606	10:43 AM.	LIVE TORTOISE #12 in burrow	Unknown	
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.958448	34.8489861	BURROW 162	class 2; facing east
2	-116.9579808	34.8487371	BURROW 163	class 2; facing east
3	-116.9575844	34.8488505	BURROW 164	class 1; facing west
4	-116.9565975	34.8489688	BURROW 165	class 1; facing north east; with live tortoise
5	-116.9553125	34.8489903	BURROW 166	class 2; facing north east
6	-116.9552489	34.8487317	BURROW 167	class 1; facing north east
7	-116.955231	34.8487143	BURROW 168	class 1; facing east
8	-116.9557939	34.8489751	BURROW 169	class 1; with scat

2015 Field Season

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USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 28 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.959874, 34.849066 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 56 Transect length: 1361 m

GPS Start-point: -116.959874, 34.849066, 740m (easting, northing, elevation in meters) Start time: 10:24 am/pm

GPS End-point: -116.946643, 34.848961, 739 m (easting, northing, elevation in meters) End time: 11:34 am/pm

Start Temp: 89 °C°F End Temp: 93 °C°F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No, or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.954213	34.8488084	BURROW 170	class 1; facing north west
2	-116.950297	34.849148	BURROW 171	class 2; facing west
3	-116.9579567	34.84940268	CARCASS 72	class 5
4	-116.9467159	34.84940268	CARCASS 73	class 3; MALE 17cm long x 20cm wide
5	-116.9562812	34.84874316	SCAT #17	class 3
6	-116.9551958	34.84897267	SCAT #18	class 3
7				
8				

2015 Field Season

949-424-4124 dnerhus@endemic environmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 26 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.947011, 34.849501 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 57 Transect length: 1278 m

GPS Start-point: -116.947011, 34.849501, 734 m (easting, northing, elevation in meters) Start time: 11:44 am/pm

GPS End-point: -116.959836, 34.849560, 739 m (easting, northing, elevation in meters) End time: 12:51 am/pm

Start Temp: 93 °C°F End Temp: 96 °C°F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9490676	34.8493449	BURROW 172	Class 1; with SCAT #19; facing east
2	-116.9560953	34.8493707	BURROW 173	Class 1; with SCAT #20;
3	-116.9560942	34.8494504	BURROW 174	Class 1
4	-116.9570204	34.8494823	BURROW 175	Class 3
5	-116.9593054	34.8493403	BURROW 176	Class 1; facing west
6	-116.9470938	34.8497074	CARCASS 74	Class 5
7	-116.9519082	34.8492868	CARCASS 75	Class 5
8	-116.9531928 ~~-116.9593772~~	34.8492461 ~~34.8495144~~	CARCASS 76	Class 5
	-116.9593772	34.8495144	CARCASS 77	Class 3; Female
	-116.9593415	34.8492913	CARCASS 78	Class 5
	-116.9490727	34.8494058	SCAT #19	Class 3

Transect number: 57

2015 Field Season

949-424-4124 Dnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 28 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.959751, 34.850116 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 58 Transect length: 1063 m

GPS Start-point: -116.959751, 34.850116, 736m (easting, northing, elevation in meters) Start time: 12:54 am/pm

GPS End-point: -116.947564, 34.850046, 733m (easting, northing, elevation in meters) End time: 14:30 am/pm

Start Temp: 96 °F End Temp: 96 °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.956631	34.8501732	BURROW 177	Class 1; with SCAT #20; facing east on s
2	-116.9562348	34.8499852	BURROW 178	class 1; facing east on slope
3	-116.955966	34.850179	BURROW 179	class 1; facing north east
4	-116.9595925	34.85023434	CARCASS 79	class 5
5	-116.9549098	34.8499185	CARCASS 80	class 5
6	-116.9492243	34.84987572	CARCASS 81	class 3
7	-116.9560969	34.8493961	SCAT #20 ~~CARCASS 82~~	class 3
8	-116.9566362	34.85017815	SCAT #21	class 2
	-116.9547226	34.85018447	SCAT #22	class 2

Transect number 58

Field Season

949-424-4124 Dnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 26 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.947926, 34.850563 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 59 Transect length: 1120 m

GPS Start-point: -116.947926, 34.850563, 732m (easting, northing, elevation in meters) Start time: 14:32 am/pm

GPS End-point: -116.959622, 34.850650, 733m (easting, northing, elevation in meters) End time: 15:17 am/pm

Start Temp: 96 °C°F End Temp: 100 °C°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9504699	34.8505011	BURROW 180	class 1; facing northeast; slight slop
2	-116.954219	34.8507427	BURROW 181	class 3; facing SW; in wash
3	-116.9592161	34.8505294	BURROW 182	class 2; facing West in wash
4	-116.9482965	34.85067344	CARCASS 82	class 5
5	-116.9558989	34.8507534	CARCASS 83	class 5
6	-116.9579805	34.85074067	CARCASS 84	class 4; on western slope
7	-116.9592662	34.85071033	CARCASS 85	class 5; in wash
8	-116.9594096	34.850824	CARCASS 86	class 1; in wash

2015 Field Season

949-424-4124 Dnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 28 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.960223, 34.851215 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 60 Transect length: 1168 m

GPS Start-point: -116.960223, 34.851215, 733 m (easting, northing, elevation in meters) Start time: 15:22 am/pm

GPS End-point: -116.948379, 34.851123, 729 m (easting, northing, elevation in meters) End time: 16:11 am/pm

Start Temp: 100 °C °F End Temp: 102 °C °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9591943	34.8514266	BURROW 183	Class 2; facing northwest; with scat #23
2	-116.954298	34.8513023	BURROW 184	Class 2; facing east with scat #24
3	-116.9513568	34.8512545	BURROW 185	Class 2; facing north
4	-116.9591948	34.8514256 8	SCAT #23	Class 3
5	-116.9542924	34.8513039 4	SCAT #24	Class 3
6	-116.9558335	34.8512252 3	CARCASS 87	Class 4
7	-116.954369	34.8511997	CARCASS 88	Class 3; in wash; predated
8	-116.9531084	34.8509933 5	CARCASS 89	Class 5
	-116.9525084	34.8515575 7	CARCASS 90	Class 3

2015 Field Season

949-424-4124 Dnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 28 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.948815, 34.851638 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 61 Transect length: 1124 m

GPS Start-point: -116.948815, 34.851638, 728m (easting, northing, elevation in meters) Start time: 16:14 am/pm

GPS End-point: ~~-116.948815, 34.851638~~ -116.960294, 34.851723, 731m (easting, northing, elevation in meters) End time: 16:59 am/pm

Start Temp: 102 °C/°F End Temp: 103 °C/°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9500954	34.8515112	BURROW 186	class 1; facing east with scat #25
2	-116.9519124	34.8514848	BURROW 187	class 1; facing west in wash
3	-116.953104	34.8514741	BURROW 188	class 3; in wash
4	-116.9547761	34.8516707	BURROW 189	class 3; facing east
5	-116.9594751	34.851866	BURROW 190	class 3; facing south at base of slope
6	-116.9490354	34.85142344	CARCASS 91	class 5
7	-116.9536326	34.85183096	CARCASS 92	class 2; MALE in wash 23cm long X 21cm wi
8	-116.950098	34.85150918	SCAT # 25	class 3
	-116.9519102	34.85149688	SCAT # 26	class 3

Field Season

Transect number: 61

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USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

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Date of survey: 28 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.960271, 34.852294 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1306 ac Transect #: 62a Transect length: 195m

GPS Start-point: -116.960271, 34.852294 728m (easting, northing, elevation in meters) Start time: 17:03 am/pm

GPS End-point: -116.958331 (easting, northing, elevation in meters) End time: 17:08 am/pm

Start Temp: 102 °C °F End Temp: 100 °C °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9590123	34.8525282	BURROW 191	Class 3; facing north
2	-116.9589978	34.8525368	BURROW 192	Class 4; facing north
3				
4				
5				
6				
7				
8				

2015 Field Season

949-424-4124 Dnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@ieldos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.958353, 34.852278 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 62b Transect length: 857 m

GPS Start-point: -116.958353, 34.852278, 763 m (easting, northing, elevation in meters) Start time: 6:48 am/pm

GPS End-point: -116.949545, 34.822205 (easting, northing, elevation in meters) End time: 7:23 am/pm

Start Temp: 74 °C °F End Temp: 76 °C °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow: all of tortoise beneath plane of burrow opening, or not in burrow*)	Approx MCL >180-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.956837	34.8525273	BURROW 193	Class 2; in wash facing east
2	-116.952122	34.8523446	BURROW 194	Class 1; facing SW in wash
3	-116.959977	34.8521093	BURROW 195	class 3; Desert pavement; facing east
4	-116.951176	34.8522264	BURROW 196	class 1; facing east
5	-116.9567512	34.8521671	CARCASS 93	class 5
6				
7				
8				

Not Field Season

949-424-4124 Dnerhus@endemicenvironmental.net
805-535-8257 TaraSchoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAU FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.950292, 34.852742 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 63 Transect length: 921 m

GPS Start-point: -116.950292, 34.852742, 721 m (easting, northing, elevation in meters) Start time: 07:22 am/pm

GPS End-point: -116.959832, 34.852836, 727m (easting, northing, elevation in meters) End time: 07:58 am/pm

Start Temp: 76 ~~°C~~ °F End Temp: 81 ~~°C~~ °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >180-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.951546	34.9527607	BURROW 197	Class 2; facing west
2	-116.957973	34.8530548	BURROW 198	Class 2; facing northeast in wash
3	-116.956576	34.85303039	CARCASS 94	Class 3; male
4	-116.9566678	34.85300814	CARCASS 95	Class 4; male
5	-116.959828	34.8525847	BURROW 199	Class 5; facing South
6				
7				
8				

Not Field Season

949-424-4124 Dnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.959502, 34.853383 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 64 Transect length: 810 m

GPS Start-point: -116.959502, 34.853383, 723 m (easting, northing, elevation in meters) Start time: 0805 am/pm

GPS End-point: -116.951092, 34.853330, 717 m (easting, northing, elevation in meters) End time: 08:39 am/pm

Start Temp: 81 °C °F End Temp: 86 °C °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1	-116.9509608	34.8532606	08:43 a.m.	LIVE TORTOISE #13 in burrow	unknown	
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.959288	34.8533499	Burrow 200	class 1; facing west
2	-116.959141	34.8531848	Burrow 201	class 1; facing west
3	-116.950958	34.8532596	Burrow 202	class 1; facing west with live tortoise #1
4	-116.950983	34.85328167	Burrow 203	class 1; facing west
5				
6				
7				
8				

2015 Field Season

Transect number: 64

949-424-4124 Dnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.951757, 34.853850 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 Transect #: 65 Transect length: _____

GPS Start-point: -116.951757, 34.853850, 713 m (easting, northing, elevation in meters) Start time: 08:50 am/pm

GPS End-point: -116.959697, 34.853807 (easting, northing, elevation in meters) End time: 09:20 am/pm

Start Temp: 86 ~~°C~~°F End Temp: ~~86~~ 87 ~~°C~~°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9574232	34.85419456	BURROW 204	Class 1; facing South
2	~~———~~	~~———~~	~~BURROW 205~~	~~Class 2; Facin~~
3				
4				
5				
6				
7				
8				

2015 Field Season

949-424-4124 Dnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.960087, 34.854364 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 66 Transect length: _____

GPS Start-point: -116.960087, 34.854364, 721 m (easting, northing, elevation in meters) Start time: 09:22 am/pm

GPS End-point: -116.952014, 34.854376, 715 m (easting, northing, elevation in meters) End time: 09:59 am/pm

Start Temp: 87 °F End Temp: 91 °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9595689	34.85413544	BURROW 205	Class 2; facing north west
2	-116.9579021	34.85451419	BURROW 206	Class 2; facing north
3	-116.9570393	34.85446368	BURROW 207	Class 5, facing northeast
4	-116.9570088	34.85443883	BURROW 208	Class 5; Kit fox den; possibly used by Tortoise
5	-116.9562044	34.85441291	CARCASS 96	Class 4
6	-116.9528772	34.85440148	CARCASS 97	Class 3
7	-116.9526993	34.85427076	CARCASS 98	Class 3
8	-116.9520878	34.854176	CARCASS 99	Class 3

Post Field Season

949-424-4124 Dnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.952345, 34.854942 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 67 Transect length: 781 m

GPS Start-point: -116.952345, 34.845942, 712 m (easting, northing, elevation in meters) Start time: 10:06 am/pm

GPS End-point: -116.960248, 34.854972, 721 m (easting, northing, elevation in meters) End time: 10:42 am/pm

Start Temp: 91 °F End Temp: 92 °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9586442	34.8542599	BURROW 209	class 3; facing west
2	-116.9595705	34.85489922	BURROW 210	class 2; facing northwest
3	-116.9595752	34.85488463	BURROW 211	class 1; facing north
4	-116.9595771	34.85487404	BURROW 212	class 1; facing north
5	-116.955967	34.85472609	CARCASS 100	class 3
6	-116.9602101	34.85498786	CARCASS 101	class 4
7	~~-116.96021~~		CARCASS 102	~~class 4~~
8				

Not Field Season

949-424-4124 Dnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.960676, 34.855558 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 68 Transect length: 167 m

GPS Start-point: -116.960676, 34.855558, 717 m (easting, northing, elevation in meters) Start time: 10:46 am/pm

GPS End-point: -116.958943, 34.855528, N/A (easting, northing, elevation in meters) End time: 10:51 am/pm

Start Temp: 92 °C/°F End Temp: 92 °C/°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9599597	34.85564708	BURROW 213	class 1; facing north
2	-116.9594068	34.85551592	BURROW 214	class 2; facing southwest
3				
4				
5				
6				
7				
8				

2015 Field Season

Transect number 68

949-424-4124 Dnerhus@endemicenvironmental.net
805-535-8257 Tara.schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.886858, 34.881204 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 69 Transect length: 829 M

GPS Start-point: -116.886858, 34.881204, N/A (easting, northing, elevation in meters) Start time: 12:05 am/pm

GPS End-point: -116.878089, 34.881096, 598 M (easting, northing, elevation in meters) End time: 12:18 am/pm

Start Temp: 92 °C°F End Temp: 94 °C°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1	~~-116.8710811~~	~~34.88278345~~		~~B-228~~		
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.8710811	34.88278345	B-228	No recent use
2				
3				
4				
5				
6				
7				
8				

2015 Field Season

949-424-4124 Dnerhus@endemicenvironmental.net
805-535-8257 Tara-Schoenwetter@letsos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.877790, 34.881479 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 70 Transect length: 835 m

GPS Start-point: -116.877790, 34.881479, 599 m (easting, northing, elevation in meters) Start time: 12:19 am/pm

GPS End-point: -116.886469, 34.881542, 606 m (easting, northing, elevation in meters) End time: 12:34 am/pm

Start Temp: 94 °C °F End Temp: 94 °C °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

949-424-4124 Dnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

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Date of survey: 29 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.877280, 34.882192 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 72 Transect length: 791 m

GPS Start-point: -116.877280, 34.882192, 601 m (easting, northing, elevation in meters) Start time: 12:53 am/pm

GPS End-point: -116.885734, 34.882281, 605 m (easting, northing, elevation in meters) End time: 13:15 am/pm

Start Temp: 102 °F End Temp: 101 °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

949-424-4124 Dnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.885080, 34.882996 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 73 Transect length: 794 m

GPS Start-point: -116.885080, 34.882966, 607 m (easting, northing, elevation in meters) Start time: 13:22 am/pm

GPS End-point: -116.876739, 34.882880, 599 (easting, northing, elevation in meters) End time: 13:46 am/pm

Start Temp: 101 °C °F End Temp: 101 °C °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.8817278	34.88288247	BURROW 215	class 4; facing northwest
2				
3				
4				
5				
6				
7				
8				

2015 Field Season

949-424-4124 ~~Dnechus@leidos.com~~
Dnechus@endemicenvironmental.net
805-535-8259 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29 MAY 2015 (day, month, year) Survey biologist(s): DEAN NECHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGETT Location: -116.864233, 34.881039 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 75 Transect length: 1280

GPS Start-point: -116.864233, 34.881039, 591 m (easting, northing, elevation in meters) Start time: 14:20 am/pm

GPS End-point: -116.877928, 34.881108, 598 m (easting, northing, elevation in meters) End time: 14:45 am/pm

Start Temp: 101 °C End Temp: 101 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

949-424-4124 Dnerhus@endemicenvironmental.net
805-535-8257 Tara_Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 24 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.877602, 34.881651 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 76 Transect length: 1123

GPS Start-point: -116.877602, 34.881651, 599 m (easting, northing, elevation in meters) Start time: 15:16 am/pm

GPS End-point: -116.865497, 34.881518, 593 m (easting, northing, elevation in meters) End time: 15:34 am/pm

Start Temp: 101 °C°F End Temp: 101 °C°F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

949-424-4124 Dnerhus@endemic environmental.net
805-535-8257 Tara. Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.866143, 34.882129 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: ~~100% coverage or Sampling~~ Area size to be surveyed: 1,306 m Transect #: 77 Transect length: 1022 m

GPS Start-point: -116.866143, 34.882129, 594 m (easting, northing, elevation in meters) Start time: 15:37 am/pm

GPS End-point: -116.877138, 34.882265, 598 m (easting, northing, elevation in meters) End time: 15:56 am/pm

Start Temp: 101 °C °F End Temp: 101 °C °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

949-424-4124 Dnerhus@encencentwest.com
805-535-8257 Tara-Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 24 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.876777, 34.882738 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 78 Transect length: 875 m

GPS Start-point: -116.876777, 34.882738, 600 m (easting, northing, elevation in meters) Start time: 15:58 am/pm

GPS End-point: -116.867411, 34.882616, 595 M (easting, northing, elevation in meters) End time: 16:16 am/pm

Start Temp: 101 °F End Temp: 101 °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*In burrow: all of tortoise beneath plane of burrow opening, or not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

Transect number: 78

949-424-4124 Dnerhus@endemicenvironmental.net
805-535-8257 Tara-Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

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Date of survey: 29 MAY 2015 (day, month, year) Survey biologist(s): DEAN NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.868153, 34.883238 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,346 ac Transect #: 79 Transect length: 771 m

GPS Start-point: -116.868153, 34.883238, 597 m (easting, northing, elevation in meters) Start time: 16:19 am/pm

GPS End-point: -116.876397, 34.883319, 599 m (easting, northing, elevation in meters) End time: 16:32 am/pm

Start Temp: 101 °C°F End Temp: 103 °C°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

Transect number 79

949-424-4124 Dnerhus@endemicenvironmental.net
714-393-6249 Bnerhus@endemicenvironmental.net
805-555-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.958932, 34.85553 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 80 Transect length: 613m

GPS Start-point: -116.958932, 34.855533, 746m (easting, northing, elevation in meters) Start time: 06:51 am/pm

GPS End-point: ~~[illegible]~~ -116.952582, 34.855501, 710m (easting, northing, elevation in meters) End time: 07:14 am/pm

Start Temp: 75 °C/°F End Temp: 79 °C/°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.958804	34.85574215	BURROW 216	Class 3, facing Southeast
2	-116.958344	34.85529504	CARCASS 102	class 4
3	-116.955421	34.85531341	CARCASS 103	class 4
4	-116.95306064	34.85580196	CARCASS 104	class 5
5				
6				
7				
8				

2010 Field Season

Bnerhus@endemicenvironmental.net 714-393-6249
Tara.Schoenwetter@leidos.com 805-535-8257

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

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Date of survey: 30 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.952684, 34.856019 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 81 Transect length: 808m

GPS Start-point: -116.952684, 34.856019, 707m (easting, northing, elevation in meters) Start time: 07:16 am/pm

GPS End-point: -116.960864, 34.856057, 717m (easting, northing, elevation in meters) End time: 07:44 am/pm

Start Temp: 79 °C °F End Temp: 79 °C °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9567375	34.8560983	BURROW 217	class 3; facing east
2	-116.9588304	34.85586834	BURROW 218	class; facing north east
3	-116.9566861	34.85636046	CARCASS 105	class 5;
4				
5				
6				
7				
8				

2015 Field Season

Bnerhus@endemicenvironmental.net 714-393-6249
Tara-Schoenwetter@leidos.com 805-535-8257

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

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Date of survey: 30 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGETT Location: -116.961267, 34.856625 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 82 Transect length: 848m

GPS Start-point: -116.961267, 34.856625, 714m (easting, northing, elevation in meters) Start time: 07:48 am/pm

GPS End-point: -116.952962, 34.856584, 704m (easting, northing, elevation in meters) End time: 08:13 am/pm

Start Temp: 79 °C °F End Temp: 84 °C °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9545394	34.85663545	BURROW 219	class 2; facing north
2	-116.959112	34.85663216	BURROW 220	class 2; facing north east
3	-116.956414	34.85665043	CARCASS 106	class 3
4	-116.9555847	34.85657431	CARCASS 107	class 5
5				
6				
7				
8				

2015 Field Season

714-393-6249 Bnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

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Date of survey: 30 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.953091, 34.857089 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,346 ac Transect #: 83 Transect length: 842 m

GPS Start-point: -116.953091, 34.857089, 703 m (easting, northing, elevation in meters) Start time: 08:15 am/pm

GPS End-point: -116.961476, 34.857166 (easting, northing, elevation in meters) End time: 08:52 am/pm

Start Temp: 84 °C°F End Temp: 85 °C°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9557365	34.85713626	BURROW 221	class 1; facing southeast
2	-116.9567814	34.8573012	BURROW 222	class 1; facing north east
3	-116.9598653	34.85714963	BURROW 223	class 2; facing south east
4	-116.9599221	34.85711651	BURROW 224	class 2; facing South
5	-116.957856	34.85716917	CARCASS 108	class 4
6	-116.9598135	34.85718407	CARCASS 109	class 5
7				
8				

Not Field Season

714-393-6249 Bnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

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Date of survey: 30 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.961594, 34.857710 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 84 Transect length: 803 m

GPS Start-point: -116.961594, 34.857710, 713 m (easting, northing, elevation in meters) Start time: 08:54 am/pm

GPS End-point: -116.953238, 34.857663, 701 m (easting, northing, elevation in meters) End time: 09:19 am/pm

Start Temp: 85 °F End Temp: 87 °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9611276	34.85783678	BURROW 225	class 1; facing west
2	-116.9559236	34.85793644	BURROW 226	class 3; facing north east
3				
4				
5				
6				
7				
8				

2015 Field Season

714-393-6249 Bnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.953308, 34.858185 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 85 Transect length: 798 m

GPS Start-point: -116.953308, 34.858185, 700 m (easting, northing, elevation in meters) Start time: 09:21 am/pm

GPS End-point: -116.961553, 34.858256, 723 m (easting, northing, elevation in meters) End time: 09:44 am/pm

Start Temp: 87 °C/°F End Temp: 90 °C/°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No, or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9564943	34.85839413	CARCASS 110	Class 5
2				
3				
4				
5				
6				
7				
8				

2015 Field Season

714-393-6249 Bnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 MAY 2015 (day, month, year) Survey biologist(s): BARRY NEKHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.961575, 34.858788 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,366 ac Transect #: 86 Transect length: 778 m

GPS Start-point: -116.961515, 34.858788, 720 m (easting, northing, elevation in meters) Start time: 09:49 am/pm

GPS End-point: -116.953510, 34.858759 (easting, northing, elevation in meters) End time: 10:12 am/pm

Start Temp: 90 °C/°F End Temp: 95 °C/°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No, or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.9573864	34.85877291	Carcass 111	Class 4
2	-116.9542074	34.85868139	CARCASS 112	Class 5
3				
4				
5				
6				
7				
8				

2015 Field Season

Transect number: 86

714-393-6249 Bnerhus@enbemkenvironmental-net
805-535-8257 Tara_Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.876426, 34.883296 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 87 Transect length: 788 m

GPS Start-point: -116.876426, 34.883296, 600m (easting, northing, elevation in meters) Start time: 11:08 am/pm

GPS End-point: -116.8847427, 34.883341 (easting, northing, elevation in meters) End time: 11:24 am/pm

Start Temp: 95 °C/°F End Temp: 98 °C/°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	-116.8837588	34.8832693	BURROW 229	Class 3
2				
3				
4				
5				
6				
7				
8				

2015 Field Season

714-393-6249 Bnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.884216, 34.883889 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 4306 ac Transect #: 88 Transect length: 1373 m

GPS Start-point: -116.884216, 34.883889, 603 m (easting, northing, elevation in meters) Start time: 11:26 am/pm

GPS End-point: -116.869434, 34.869434, 596 m (easting, northing, elevation in meters) End time: 11:47 am/pm

Start Temp: 98 °C °F End Temp: 98 °C °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2015 Field Season

714-393-6249 Bnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.870354, 34.884207 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 89 Transect length: 1245m

GPS Start-point: -116.870354, 34.884207, 596m (easting, northing, elevation in meters) Start time: 11:49 am/pm

GPS End-point: -116.883747, 34.884366, 602m (easting, northing, elevation in meters) End time: 12:10 am/pm

Start Temp: 98 °C°F End Temp: 98 °C°F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 MAY 2015 (day, month, year) Survey biologist(s): BARRY NEDHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.883282, 34.884863 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306ac Transect #: 97 Transect length: 1106 m

GPS Start-point: -116.883282, 34.884863, 599m (easting, northing, elevation in meters) Start time: 12:12 am/pm

GPS End-point: -116.871400, 34.884762 599m (easting, northing, elevation in meters) End time: 12:28 am/pm

Start Temp: 98 °C °F End Temp: 98 °C °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2015 Field Season

Transect number: 90

805-535-8257 Tara-Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: TAGGET Location: -116.872311, 34.885302 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1306 Transect #: 91 Transect length: 946m

GPS Start-point: -116.872311, 34.885302, 549m (easting, northing, elevation in meters) Start time: 12:33 am/pm

GPS End-point: -116.882757, 34.885405 (easting, northing, elevation in meters) End time: 12:47 am/pm

Start Temp: 98 °C °F End Temp: 100 °C °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*In burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2010 Field Season

Transect number: 91

714-393-6249 Bnerhus@endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAV FAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.882249, 34.885938 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 Transect #: 92 Transect length: ~~[illegible]~~ 744m

GPS Start-point: -116.882249, 34.885938, 603m (easting, northing, elevation in meters) Start time: 12:44 am/pm

GPS End-point: -116.873229, 34.885860, 600m (easting, northing, elevation in meters) End time: 13:03 am/pm

Start Temp: 100 °C°F End Temp: 101 °C°F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2015 Field Season

Transect number: 92

114-543-6249 bnerhus@endemicenvironmental.net
805-535-8257 Tara_Schoenwetter@ieldos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 30 MAY 2015 (day, month, year) Survey biologist(s): BARRY NERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.874036, 34.886310 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 M Transect #: 93 Transect length: ~~386 m~~ 462 m

GPS Start-point: -116.874036, 34.886310, 601 m (easting, northing, elevation in meters) Start time: 13:05 am/pm

GPS End-point: -116.881821, 34.886392 (easting, northing, elevation in meters) End time: 13:21 am/pm

Start Temp: 101 °C °F End Temp: 101 °C °F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2015 Field Season

714-393-6249 Bnerhus@~~leidos~~.endemicenvironmental.net
805-535-8257 Tara.Schoenwetter@leidos.com

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

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Date of survey: 30 MAY 2015 (day, month, year) Survey biologist(s): BACKY NEERHUS, TARA SCHOENWETTER (name, email, and phone number)

Site description: NAVFAC SW DESERT TORTOISE SURVEYS MCLB BARSTOW, CA (project name and size; general location)

County: SAN BERNARDINO Quad: DAGGET Location: -116.881398, 34.886835 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: 1,306 ac Transect #: 94 Transect length: 316 m

GPS Start-point: -116.881398, 34.886835, 604 m (easting, northing, elevation in meters) Start time: 13:22 am/pm

GPS End-point: -116.878006, 34.886824, 601 m (easting, northing, elevation in meters) End time: 13:27 am/pm

Start Temp: 101 °C°F End Temp: 102 °C°F

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

2015 Field Season

Appendix B

Representative Photographs

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Photograph 1. Desert tortoise in burrow.

Photograph 2. Desert tortoise eggshell fragments.

Photograph 3. Juvenile desert tortoise observed on rock in the Range East and KD Range Complex survey area.

Photograph 4. Tortoise with irregular shell with a deep depression on rear right costal scute.

Photograph 5. Tortoise class 1 burrow on rocky slope.

Photograph 6. Tortoise scat, class 1, fresh and moist.

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Appendix D-3

Final Jurisdictional Determination Report

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DRAFT

Final Jurisdictional Determination Report for Barstow Training and Range Environmental Assessment, Marines Corps Logistics Base Barstow

Prepared for:

Marine Corps Logistics Base

Barstow, CA

Under Contract to:

U.S. Department of the Navy

Naval Facilities Engineering Command Southwest

1220 Pacific Highway, Building 1 CIPT

San Diego, CA 92132-5190

Phone; (619) 532-3844

Point of Contact: Jesse Martinez

Prepared by:

leidos

5464 Carpinteria Avenue, Suite K

Carpinteria, California 93013

May 2015

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Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
AMSL	above mean sea level
CFR	Code of Federal Regulations
cfs	cubic feet per second
CO	Commanding Officer
CWA	Clean Water Act
DOD	Department of Defense
EA	Environmental Assessment
GIS	Geographic Information System
GPS	Global Positioning System
I MEF	First Marine Expeditionary Force
KD	Known Distance
LHA	Simulated Landing Helicopter Assault
LHA/LHD	Landing Helicopter Assault/Landing Helicopter Dock
LHD	Landing Helicopter Dock
LZ	Landing Zone
MAGTF	Marine Air-Ground Task Force
MCLB	Marine Corps Logistics Base
NAVFAC SW	Naval Facilities Engineering Command Southwest
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
NWP	Nationwide Permit
NWPL	National Wetland Plant List
OHWM	Ordinary High Water Mark
ROW	utility right-of-way
RPW	Relatively Permanent Waters
RWQCB	Regional Water Quality Control Board
SWANCC	Solid Waste Agency of Northern Cook County
TNW	Traditional Navigable Waters
U.S.	United States
U.S.C.	United States Code
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USMC	United States Marine Corps
WIS	Wetland Indicator Status

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Executive Summary

Jurisdictional determination surveys were conducted in support of National Environmental Policy Act (NEPA) compliance for the Barstow Training and Range Environmental Assessment (EA), Marine Corps Logistics Base (MCLB) Barstow, California. The purpose of the surveys was to determine the occurrence of potential wetlands and other features (e.g., desert washes) that may be subject to the regulatory jurisdiction of the United States Army Corps of Engineers (USACE) under Sections 401 and 404 of the Clean Water Act (CWA) (33 Code of Federal Regulations [CFR] parts 320 – 330). Surveys were conducted in conjunction with habitat assessment surveys, the results of which are provided in a separate report.

The United States Marine Corps (USMC) is proposing to enhance and update operational capabilities of existing training ranges and areas, including establishing general aviation maneuver areas and designating rotary wing/tilt-rotor landing zones (LZs) and a Simulated Flight Deck (Landing Helicopter Assault [LHA] or Landing Helicopter Dock [LHD]) to accommodate components of regional Marine Air-Ground Task Force (MAGTF) training activities on MCLB Barstow. Jurisdictional determination surveys were conducted on 1 to 4 October 2013, 21 to 23 April 2014, 9 to 11 December 2014, and 20 to 23 April 2015. Wetlands were delineated following the 1987 *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) and *Arid West Regional Supplement* (USACE 2008b), per the requirements of the USACE Los Angeles District. No areas meeting the definition of USACE jurisdictional wetlands were identified in the survey area. The *USACE Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the United States* (Lichvar and McColley 2008) was referenced to determine the boundaries of the active floodplain and data were collected using the *Updated Datasheet for the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the United States* (Curtis and Lichvar 2010).

Based on the available evidence and recent jurisdictional determinations by the USACE in the project vicinity, the lower Mojave River adjacent to and downstream of MCLB Barstow appears to function as an isolated, intrastate system that lacks the presence of a Traditional Navigable Water (TNW). If the USACE determines that the Mojave River is a TNW or meets the (a)(3) criteria as defined by 33 CFR 328.3, then there would be a total of 90.0 acres (36.4 hectares) of active floodplain that could be USACE jurisdictional waters of the United States (U.S.) within the survey area, including 36.4 acres (14.7 hectares) in the Range West survey area, 30.7 acres (12.4 hectares) in the Range East and KD Range Complex survey area, 20.33 acres (8.2 hectares) in the Range Main Supply Route survey area, and 2.6 acres (1.1 hectares) in the Yermo Stables survey area. The determinations herein are subject to verification by the MCLB Barstow Environmental Division, Naval Facilities Engineering Command Southwest (NAVFAC SW), and ultimately by the USACE Los Angeles District. Any project related activities or construction within areas ultimately determined to be jurisdictional by the USACE Los Angeles District will require regulatory coverage as prescribed by Sections 401 and 404 of the CWA.

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1 Introduction

Leidos scientists conducted jurisdictional determination surveys in support of National Environmental Policy Act (NEPA) compliance for the Barstow Training and Range Environmental Assessment (EA), Marine Corps Logistics Base (MCLB) Barstow, California (hereinafter "proposed action"). The objective of the surveys was to determine the occurrence and extent of potential wetlands and other features (e.g., desert washes) that may be subject to the regulatory jurisdiction of the United States Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act (CWA) (33 Code of Federal Regulations [CFR] parts 320 – 330) or the Regional Water Quality Control Board (RWQCB) under Section 401 (Water Quality Certification) of the CWA.

The United States Marine Corps (USMC) is proposing to enhance and update operational capabilities of existing training ranges and areas, including establishing general aviation maneuver areas and designating rotary wing/tilt-rotor landing zones (LZs) and a Simulated Flight Deck (Landing Helicopter Assault [LHA] or Landing Helicopter Dock [LHD]) to accommodate components of regional Marine Air-Ground Task Force (MAGTF) training activities on MCLB Barstow. The proposed action is located in the western plain of the Mojave Desert at elevations ranging from 1,970 to 2,464 feet (601 – 751 meters) above mean sea level (AMSL). The total survey area is approximately 1,306 acres (528 hectares). This report summarizes the data collection and analysis conducted for the proposed action. The determinations herein are subject to verification by the MCLB Barstow Environmental Division, Naval Facilities Engineering Command Southwest (NAVFAC SW), and ultimately by the USACE Los Angeles District.

1.1 Organization of the Report

This report provides a summary of the overall results and detailed information specific to each survey area. A description of the project footprint and proposed action are included in Section 2. Regulatory setting, definitions, and an assessment of USACE jurisdiction are included in Section 3. Methods used to conduct the surveys and the results are included in Section 4. Section 5 is a review of exiting vegetation, climate, soils, and National Wetland Inventory (NWI) and Section 6 is the field survey results. Section 7 provides a summary and Section 8 is recommendations. For the purpose of this report, potential wetlands and other features (e.g., desert washes) are classified according to the *Cowardin Classification of Wetlands and Deepwater Habitat of the United States* (Cowardin et al. 1979), which is also used by the USACE for jurisdictional determination. Vegetation categories are described using Sawyer et al. (2009) and plant names follow *The Jepson Manual* (Baldwin et al. 2012); plants are also assigned a Wetland Indicator Status (WIS) following the 2013 National Wetland Plant List (NWPL) (Lichvar 2013). The flow characteristics of the Mojave River are provided in Attachment A. A list of plant species observed during the jurisdictional delineation surveys is provided in Attachment B. Attachment C includes copies of wetland delineation forms. Attachment D includes representative photographs of the survey area.

2 Project Location, Description, and Survey Area

2.1 Project Location

The proposed action is located on MCLB Barstow, which is in western San Bernardino County, California, approximately 3.5 miles (6 kilometers) east of the City of Barstow, in the Mojave Desert (Figure 2.1). The Mojave Desert is a large wedge-shaped, alluvial- filled basin situated between the Garlock fault to the north and the San Andreas Fault to the south. It is bounded by the Transverse Ranges to the southwest and by the Tehachapi Mountains and the southern Sierra Nevada to the northwest. To the east are the Colorado River, northwestern Arizona, and Las Vegas, Nevada. MCLB Barstow encompasses 5,400 acres (2,185 hectares) and is separated into three parcels: Nebo Annex; Range Complex; and Yermo Annex. The project footprint is located on the Range Complex and the Yermo Annex.

2.2 Project Description

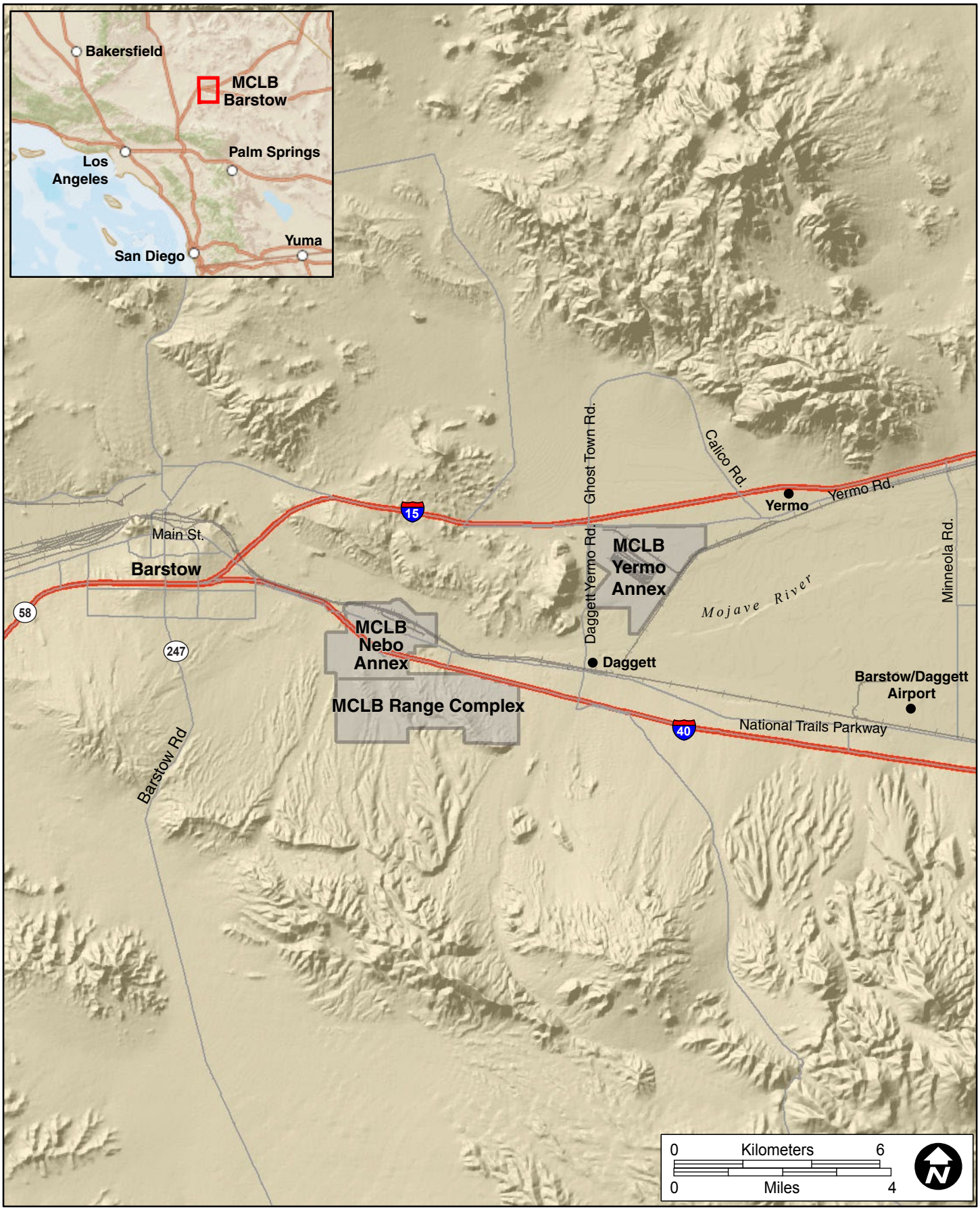
The proposed action would enhance and integrate independent and combined ground and aviation training on MCLB Barstow, California. The proposed action would update operational capabilities of existing training areas and ranges on MCLB Barstow to support combat readiness of USMC operating forces, including tenant, unit, and MAGTF-level training, in support of the First Marine Expeditionary Force (I MEF). Depending on the specific mission, ground training could range from a single company commander conducting maneuvers with three infantry platoons to battalion or larger headquarters/command post training (300 personnel), with integrated air and logistics support. All the training ranges and areas would support general aviation maneuver areas and designated LZs, including a LHA/LHD site. Aircraft would be allowed to land anywhere within the general aviation areas.

Three new aircraft landing areas – two proposed LZs and a LHA/LHD – and access routes/trails and roads to these landing areas would be established to support aviation training operations. The designated LZs would consist of an approximately 300-foot by 300-foot (91-meter by 91-meter) (i.e., 90,000-square-foot [8,361-square-meter]) landing area (i.e., where the aircraft would physically land). The proposed LZs would be rough graded/leveled and stabilized (e.g., application of dust palliatives [e.g., polymer emulsion or synthetic fluid]) to reduce impacts from dust and debris. The LHA/LHD landing platform would be approximately 850-foot by 150-foot (259-meter by 46-meter) and would resemble an amphibious assault ship deck. All LZs and the LHA/LHD landing platform would include a 350-foot (107-meter) buffer area to account for aircraft rotor wash.

Proposed improvements to existing access routes/trails and construction of new access roads to the LZs and LHA/LHD site would be required to support tactical aviation and ground training activities. All new access roads would be 12-feet to 18-feet (3.7-meters to 5.5-meters) wide and rough-graded and leveled. Ground disturbance (i.e., digging) associated with the new access roads would not exceed 18 inches (46 centimeters). Inspection and maintenance of all access roads/routes in the project footprint would occur twice a year (i.e., before and after the rainy season) and on an as needed emergency basis to fix any issues.

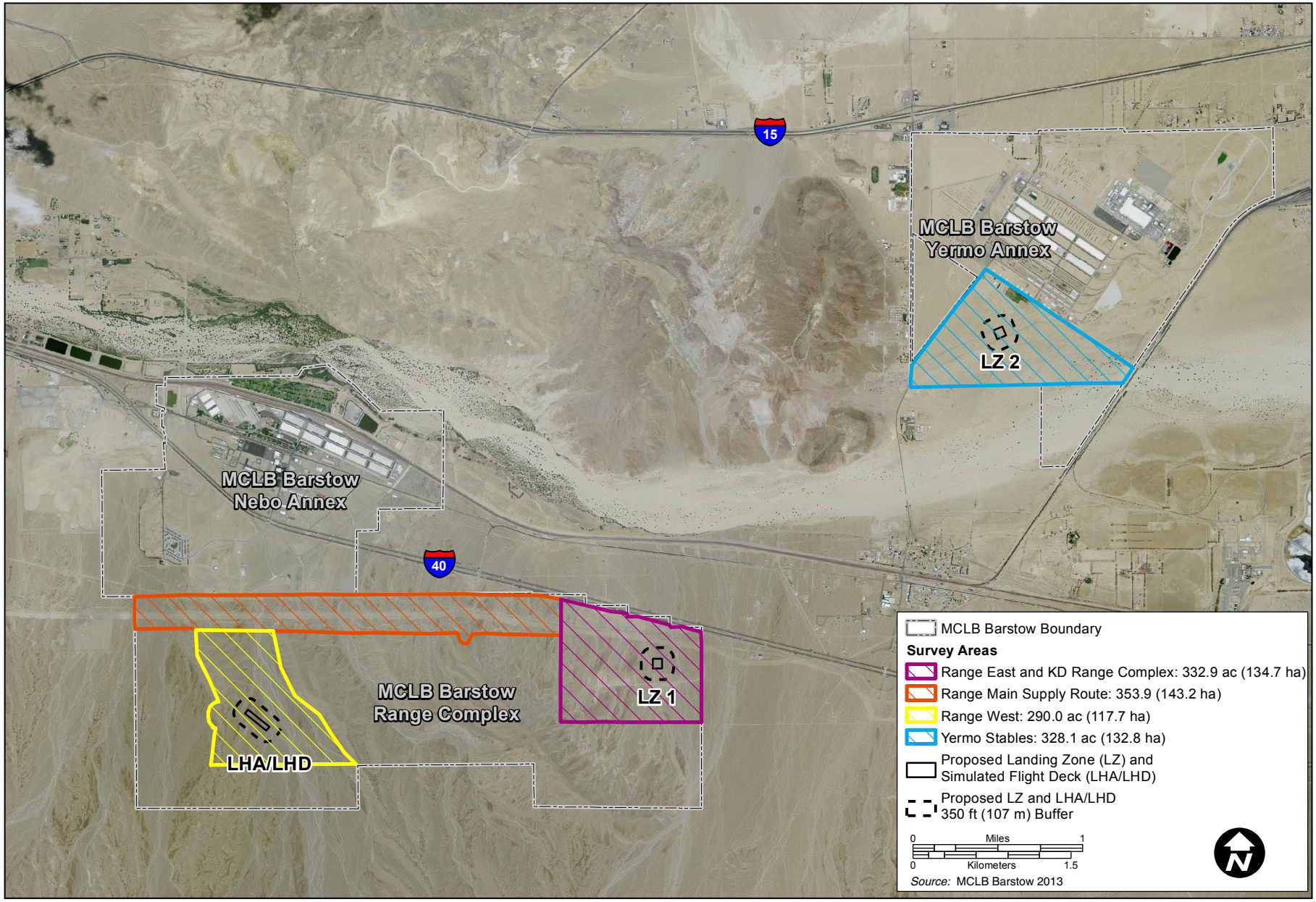
2.3 Survey Area

For the purpose of this report, the project footprint is separated into four survey areas: 1) Range West; 2) Range East and KD Range Complex; 3) Range Main Supply Route; and 4) Yermo Stables (Figure 2.2).



Location of Marine Corps Logistics Base Barstow
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE 2.1



Jurisdictional Determination Survey Area
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
2.2

3 Background

3.1 Regulatory Setting

Federal wetlands and other waters of the U.S. have legal protection in accordance with Sections 401 and 404 of the CWA (33 U.S. Code [U.S.C.] Section 1344). The USACE generally requires the issuance of an individual permit, or coverage under an existing Nationwide Permit (NWP), for all actions that have the potential to degrade or modify these features.

Section 401 of the CWA (33 U.S.C. 1341) requires all applicants that apply for a federal license or permit to conduct an activity that may result in a discharge of a pollutant into waters of the U.S. to obtain certification from the state in which the discharge originates. As a result, proposed fill or development in jurisdictional features requires coordination with the appropriate RWQCB that administers Section 401 and provides certification. The RWQCB also plays a role in review of water quality and wetland issues, including avoidance and minimization of impacts. Section 401 certification is required prior to issuance of a Section 404 permit.

3.2 Definitions

As defined under Section 404 of the CWA, wetlands are areas that are "inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands generally include swamps, marshes, bogs, and similar areas (Unites States Environmental Protection Agency [USEPA], 40 CFR 230.3 and USACE, 33 CFR 328.3). Wetlands are recognized as a special aquatic site under the Section 404(b)(1) guidelines, and a "no net loss" policy continues to guide federal regulatory actions affecting wetlands under Section 404. Jurisdictional wetland areas are identified and delineated according to the USACE's *Arid West Regional Supplement* (USACE 2008b), per the requirements of the USACE Los Angeles District.

Jurisdictional wetlands are a subset of waters of the U.S., which include, in addition to wetlands as defined above, areas subject to the ebb and flow of the tide and areas that are within the limits of ordinary high water. Waters are currently described as any areas that might be considered waterways, either for commerce or recreation, even on a limited scale. Frequently, the term "wetlands and other waters of the U.S." is used when describing areas under USACE jurisdiction. Jurisdictional boundaries of waters of the U.S. are determined with consideration of recent guidance from the USEPA and the USACE on implementing the Supreme Court's decision in the consolidated cases *Rapanos v. United States* and *Carabell v. United States* (USEPA and USACE 2007a). Under that decision, the USACE will assert jurisdiction over the features described below.

Traditional Navigable Waters. Traditional Navigable Waters (TNWs) are all waters subject to the ebb and flow of the tides, and waters that are presently used, have been used in the past, or may be susceptible for use to transport interstate or foreign commerce (33 CFR 328.3(a)(1)). An assessment of the navigability of the Mojave River is provided below in Section 3.3.

Wetlands adjacent to TNWs. Wetlands are defined as cited above. The term "adjacent" means bordering, contiguous, or neighboring, meeting one of the following criteria: 1) there is an unbroken surface or shallow sub-surface connection to the TNW; 2) the wetland is physically separated from the TNW artificially by a man-made dike, or by natural barrier such as a berm or dune; or 3) the wetland is reasonably close to the TNW, such that direct ecological interconnections are present.

Non-navigable, but Relatively Permanent Waters (RPWs) that are tributaries to TNWs. These are waters that typically flow year-round or continuously for at least three months. The boundaries of such waters are determined by the limits of ordinary high water (33 CFR Part 328.3).

Wetlands adjacent to RPWs. The guidance stipulates that a continuous surface connection must be present between the wetland and RPW. If such connection is not present, additional criteria must be satisfied.

Non-RPWs and adjacent wetlands with a significant nexus to TNWs. To establish a significant nexus requires an assessment of the flow characteristics and functions of the tributary and any adjacent wetland to determine if they significantly affect the chemical, physical, and biological integrity of downstream navigable waters.

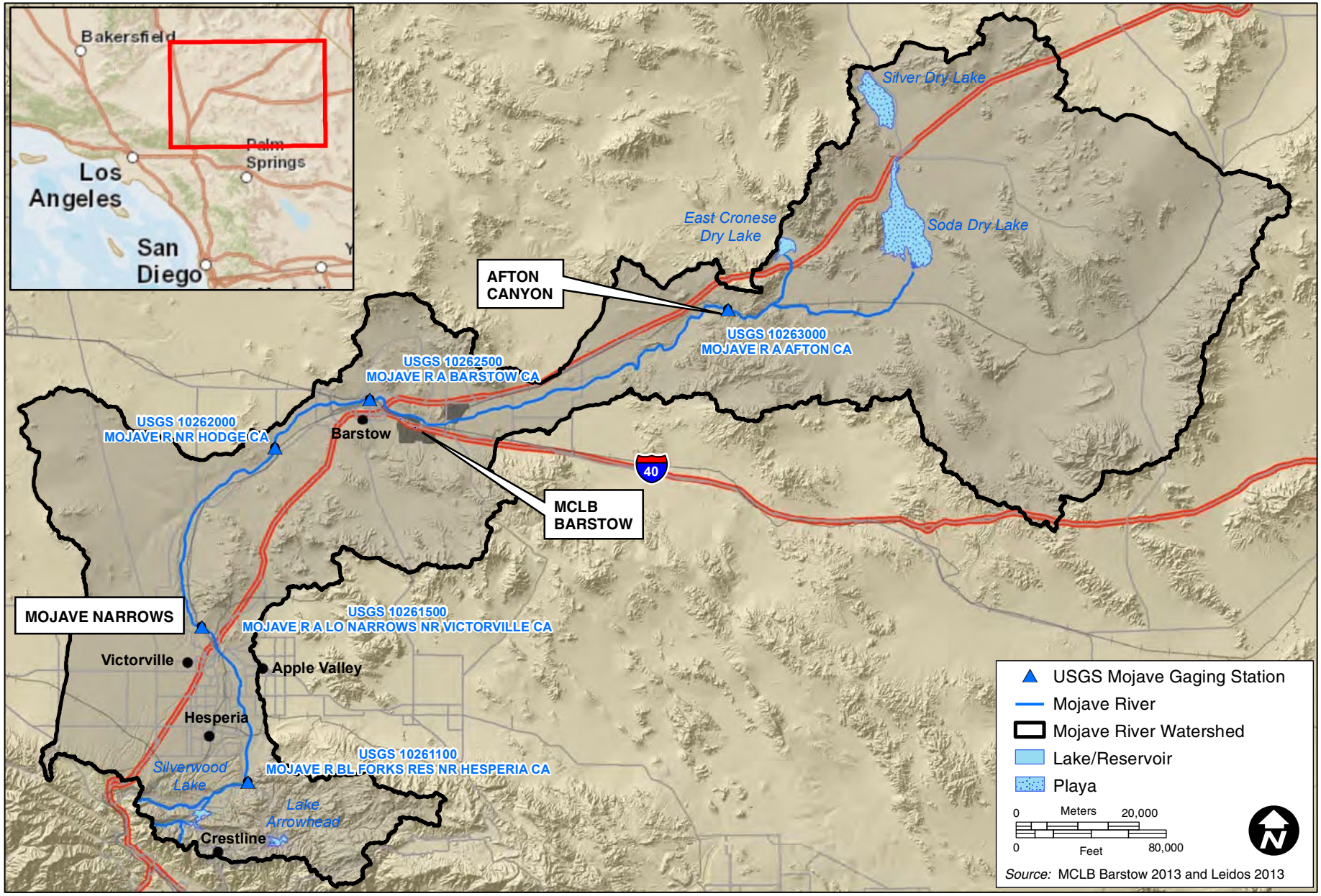
3.3 Assessment of the Navigability of the Mojave River

The Mojave River is the largest drainage system in the Mojave Desert (Figure 3.1). The river is formed at the junction of Deep Creek and the West Fork (at the Forks) near the base of the San Bernardino Mountains. The river flows northward from the Forks through the City of Victorville (Narrows), then northeastward through the City of Barstow and eventually through Afton Canyon. Downstream of Afton Canyon the river splits and separate channels lead to East Cronese Dry Lake and Soda Dry Lake (Figure 3.1). During very wet winters, water from Soda Lake can overflow into Silver Lake (Lines 1996). Several reservoirs regulate the flow of the Mojave River: Lake Arrowhead in the Deep Creek drainage (48,000 acre-feet capacity) built in 1922; Silverwood Lake on the West Fork Drainage (78,000 acre-feet) built in 1971; and the Mojave River Forks Reservoir (capacity 89,700 acre-feet) built in 1971 (Lines 1996).

Most of the Mojave River is intermittent with flow only occurring after large storm events; however, some sections where bedrock forces the water to the surface are perennial during some years (e.g. the Narrows and Afton Canyon). Water flowing from the Mojave River into Soda Dry Lake and Silver Dry Lake ultimately evaporates with no outlet to the ocean and therefore is defined as a closed basin. Therefore, the Mojave River and its tributaries are intrastate waters (e.g. not connected outside of the state) and isolated.

Historically, MCLB Barstow managed the desert washes at the Range Complex as potentially waters of the U.S. based on the Migratory Bird Rule (MCLB Barstow 2001, MCLB Barstow 2005). In 2001, the U.S. Supreme Court in Solid Waste Agency of Northern Cook County (SWANCC) vs. USACE invalidated the use of the Migratory Bird Rule to determine nexus of isolated waters because it exceeded the scope of the CWA. The U.S Supreme Court provided additional guidance in opinions following Rapanos v. United States & Carabell v. United States (Rapanos Guidance). Since the SWANCC case and Rapanos Guidance, the USACE made a determination that the terminus of the Mojave River at Soda Dry Lake is not a TNW (Soda Mountain Solar Project, SPL-2010-01042-SLP, USACE 2013). A recent review of the USACE website indicated that over the last five years there have been no approved jurisdictional determinations on other portions of the Mojave River (USACE 2015). The USACE has also concluded that washes in closed basin watersheds adjacent or nearby the Mojave River Watershed, are isolated, intrastate, and not TNW and therefore not under their jurisdiction (USACE 2015).

The Rapanos Guidance indicates that the term TNW refers to those waters that are under the jurisdiction of USACE, pursuant to 33 C.F.R. § 328.3(a)(1), (i.e., “all waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide.”)



Mojave River Watershed
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE 3.1

As stated in Appendix D of the Rapanos Guidance: "when determining whether a water body qualifies as a "traditional navigable water" (i.e., an (a)(1) water), relevant considerations include whether a Corps District has determined that the water body is a navigable water of the United States pursuant to 33 C.F.R.§ 320.14, or the water body qualifies as a navigable water of the United States under any of the tests set forth in 33 C.F.R. Part 329, or a federal court has determined that the water body is navigable-in-fact under federal law for any purpose, or the water body is "navigable-in-fact" under the standards that have been used by the federal courts."

To determine whether the lower Mojave River is a TNW in accordance to 33 C.F.R. § 328.3(a)(1), the USACE would perform a case-specific analysis to evaluate whether the lower Mojave River is navigable-in-fact, including consideration of its potential susceptibility to support interstate and foreign commerce. A preliminary evaluation of the lower Mojave River is provided below, subject to verification from the USACE Los Angeles District.

1) *The physical characteristics of the lower Mojave River downstream of Barstow, California indicate that it has minimal capacity and susceptibility to be navigated by watercraft. Less than four percent of the time near Barstow and less than one percent of the time at Afton are flows above 63 cubic feet per second (cfs), the minimum range of the flow required for recreational watercraft (i.e., canoeing).*

   The lower Mojave River downstream of MCLB Barstow is approximately 60 miles (96.5 kilometers) long. According to the Arid West Classification System, the Mojave River would be classified as Basin, Hard Rock, Compound Channels with Sand-dominated Active Channels (Lefebvre et al. 2013). Approximately 40 miles (64 kilometers) downstream from MCLB Barstow the Mojave River has incised a canyon through the Cady Mountains forming Afton Canyon. There are two long-term gaging stations on the lower portion of the Mojave River: United States Geological Survey (USGS) 10262500 Mojave River at Barstow; and USGS 10263000-Mojave River at Afton (USGS 2015). In evaluating the navigability of the Santa Cruz River, Arizona, the USACE utilized a minimum flow required for canoeing, of 86 cfs with a 95 percent confidence interval of 63 to 118 cfs based on available studies (USACE 2008a). This would provide approximately 2 to 3 feet (0.6 and 0.9 meters) of water depth sufficient to float a canoe, kayak, or small boat. For comparison, based on the rating curve available for the USGS Afton Gaging Station, the flow at the gage would have a depth of 2 feet (0.6 meters) at 1,100 cfs. Based on this information, it is likely the Mojave River's wide, flat bottom may require flow in excess of the minimum flow requirements of 86 cfs float a canoe, kayak, or small boat.

   The flow characteristics of the Mojave River based on the USGS Barstow Gaging Station (10262500) and USGS Afton Gaging Station (10263000) records (USGS 2015) are graphically represented by raster hydrographs in Attachment A (Figures A-1 and A-2). A raster hydrograph is a graphic depiction of the daily stream flow in cfs for the period of record showing flows above the minimum flow requirements for navigability in blue, intermediate flows in green, low flow as yellow, and no flow as white. The flow duration curve is presented in Attachment A (Figure A-3) for both gaging stations. Streamflow statistics are presented in tabular format in Attachment A (Tables A-1 and A-2).

   USGS 10262500 Mojave River at Barstow: 93 percent of the time from 1 October 1930 to 1 March 2015, there has been no flow recorded in the Mojave River. There are periods in the record where the river has been dry for four (1948 to 1951) and five years (2000-2004). Flows generally occur from February to May and are associated mainly with storm runoff/spring snowmelt events from the San Bernardino Mountains. Flow has been recorded outside of that period in relation to

summer monsoons. Flows exceed the 63 cfs (the lower range of minimum flow requirement) less than four percent of the available record at Barstow.

USGS 10263000 Mojave River at Afton: 14 percent of the time from 1 October 1929 to 30 September 1932 and 1 October 1932 to 9 March 2015 there has been no flow recorded in the Mojave River at Afton. The river generally dries during the summer months of June, July, and August. However, in early years and during wet periods the river has historically had year-round flow recorded at the gaging station. Approximately 75 percent of the time however, the recorded discharge is 1 cfs or less. Flows exceed the 63 cfs (the lower range of minimum flow requirement) less than 1 percent of the available record at Afton.

2) *Navigation by watercraft of any type is not known to occur in recorded history or in recent times in the lower Mojave River.*

   There are no known records of watercraft navigation in the lower Mojave River. The only information regarding potential recreational water craft use near the lower Mojave River is in an artificial lake located adjacent to the river. Approximately 23 miles (37 kilometers) downstream of the USGS Barstow Gaging Station is a lake off of Camp Cherokee Road adjacent to the Mojave River that is utilized for church summer camps. In 1974, a church group initiated the excavation of the 10-acre (4-hectare) lake. The lake was lined with a clay liner and the water in the lake is supplied by a groundwater well (Ironwood 2015). The lake includes a water slide and several docks for the launch of canoes. Flows from the Mojave River to the lake would only occur in extreme flood events and the Mojave River does not contribute appreciable levels of flow to the lake.

3) *The lower Mojave River is accessible to the public through state and federal conservation areas along the riparian corridor. Activities for these public areas include hiking, hunting, camping, birding, and motorized vehicle use that could be used by out of state and international travelers. However, none of the recreational activities in these areas include swimming or use of recreational water craft.*

   Located approximately 21 miles (34 kilometers) downstream of the USGS Barstow Gaging Station is the Camp Cady Wildlife Area operated by the California Department of Fish and Wildlife (formerly the California Department of Fish and Game). It includes 1,870 acres (757 hectares) of riparian habitat along the Mojave River and three artificial ponds supplied by on-site groundwater wells. The ponds are important habitat for the endangered Mojave tui chub. The wildlife area is open for hunting, hiking, birding, and camping.

   Located 46 miles (74 kilometers) downstream of the USGS Barstow Gaging Station is the Afton Canyon Natural Area, which is a designated Area of Critical Environmental Concern by the Bureau of Land Management to protect plants and wildlife. Afton Canyon recreational activities include hiking, hunting, camping, birding, and motorized vehicle use.

   None of the recreational activities in these areas include swimming or use of recreational water craft.

4) *The Mojave River was part of the historic Mojave Trail which was used by Native Americans, Spanish missionaries, explorers, and pioneers cross the Mojave Desert. Sections of the Mojave River which had perennial water (e.g. Afton Canyon and the Narrows) provided key watering holes to allow passage across the Mojave Desert. However, the Mojave River was not utilized by watercraft for waterborne commerce or recreational purposes.*

   The Mojave Trail or Mojave Road was a trade route for the Native Americans that ran between water sources across the Mojave Desert between the Colorado River and the San Bernardino Mountains. It was later used by Spanish missionaries, explorers, and settlers in the 18th and 19th century. The U.S. military established posts along the route in the 1860s at Fort Mojave on the Colorado River and Camp Cady on the lower Mojave River to protect the route. Coming from the Colorado River, the trail connected various springs until it reached the Mojave River, at which point it continued up-river to the San Bernardino Mountains (NPS 2001).

Based on the available evidence and recent jurisdictional determinations by the USACE in the project vicinity, the lower Mojave River adjacent to and downstream of MCLB Barstow appears to function as an isolated, intrastate system that lacks the presence of a TNW. USACE and USEPA in their 2003 guidance following the SWANCC case, determined that uncertainty remains concerning jurisdiction over isolated waters that are both intrastate and non-navigable based on the criteria listed in 33 CFR 328.3 (a) (3) (i)–(iii) (USEPA and USACE 2003). The Mojave River does not appear to meet the criteria for (a)(3) waters as defined by 33 CFR 328.3, as it: i) does not have use for surface water recreation or other purposes by foreign or interstate travelers; ii) does not have harvesting activities of fish or shellfish that may be sold in interstate or foreign commerce; and iii) does not have surface water industrial usage by industries in interstate commerce. Formal USACE and USEPA Headquarters approval would be needed prior to asserting jurisdiction over such waters as the lower Mojave River based solely on the (a)(3) criteria (USEPA and USACE 2003). Under the proposed rule by the USEPA and USACE (USEPA and USACE 2014), regarding the definition of ‘‘Waters of the United States’’ under the CWA, the case-by-case determination solely on the (a)(3) criteria would be eliminated.

Given the uncertainty regarding the jurisdictional status of the Mojave River, field delineations and surveys of potential wetlands and desert washes were conducted in accordance with USACE wetland delineation methodology. It is ultimately the responsibility of the USACE to determine the jurisdictional status of the lower Mojave River, and subsequently any potential wetlands or other features (e.g., desert washes) identified within the survey area.

4 Methods

This section provides a description of methods used to conduct field delineations and surveys of potential wetlands and other features (e.g., desert washes). For the purposes of this report, the term active floodplain is used to identify the features that would meet the criteria for potential waters of the U.S. if the USACE determines that the lower Mojave River meets the 33 C.F.R. § 328.3(a)(1) or CFR § 328.3 (a)(3) criteria and is under the jurisdiction of the USACE.

Prior to conducting the wetland delineation field surveys the following literature and materials were reviewed:

- Aerial photography of the project site to determine the potential locations of USACE jurisdictional wetlands or other waters of the U.S.;
- Rainfall records to determine if seasonal conditions were normal;

- United States Fish and Wildlife Service (USFWS) NWI to identify areas mapped as wetland features (USFWS 2013);
- United States Department of Agriculture Natural Resources Conservation Service [NRCS] soil mapping data (NRCS 2013); and
- Previous studies conducted in the survey area (e.g. MCLB Barstow 2005).

Surveys were conducted by Leidos biologists Tara Schoenwetter, Lauren Brown, and Joel Degner during 1 to 4 October 2013, 21 to 23 April 2014, 9 to 11 December 2014, and 20 to 23 April 2015 in conjunction with the habitat assessment surveys. The survey area included the Range West training area, Range East and KD Range Complex training area, Range Main Supply Route training area, and Yermo Stables training area.

The jurisdictional determination field surveys were conducted by walking the survey area and visually observing areas of potential wetlands or other features (e.g., desert washes) based on the presence of hydrophytic plants, standing water or saturated soils, or other soil surface features that indicate surface water or saturated conditions recently occurred (e.g., low spots, darker soils, cracks in the soil surface, and dried algae). Areas identified as potential wetlands or other features (e.g., desert washes) were further investigated using the wetland delineation method following the 1987 *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) and *Arid West Regional Supplement* (USACE 2008b). Where wetland delineations are performed, a narrow pit up to 24 inches (61 centimeters) in depth is dug to look for indicators of wetland conditions in each of three parameters: hydrophytic vegetation; hydric soils; and wetland hydrology. Survey points were mapped electronically using a Trimble Geo XT2005 sub-meter Differential Global Positioning System (GPS) unit and plotted in the field on ortho-rectified aerial photos. Data were recorded on wetland determination data forms for the arid west region (USACE 2008b). Positive indicators for each of three parameters are required for a wetland to meet the USACE criteria for jurisdictional wetland determination, as follows:

1) *Hydrophytic vegetation* is defined as macrophytic vegetation that is adapted to, and occurs in, areas where soils are frequently or permanently saturated of sufficient duration to exert a controlling influence on the plant species present. Plant species adjacent to the delineation pit were identified and included following the "50/20 rule," meaning that plant species in each layer of the vegetation (herb, shrub, tree, and vine) were included in order of abundance until at least 50 percent of the total vegetation cover was accounted for, and all species with at least 20 percent relative cover were included. Plants are assigned a WIS based on their frequency of occurrence in wetland habitats following the NWPL (Lichvar 2013), which is an update of the 1988 *National List of Plant Species that Occur in Wetlands* (Reed 1988). The USACE issued a Final Notice requiring the use of the 2012 NWPL for delineations conducted after 1 June 2012 (USACE 2012). A list of plant species observed during the jurisdictional delineation surveys is provided in Attachment B, including the WIS from the 2012 NWPL with changes from the previous Reed (1988) list noted in parentheses. The WIS categories (USACE 2012; Lichvar and Gillrich 2011) are defined as:

    - UPL (Obligate Upland) = Plants that almost never occur in water or saturated soils;
    - FACU (Facultative Upland) = Plants that typically occur in xeric (dry) or mesic (moist) non-wetland habitats but may frequently occur in standing water or saturated soils;
    - FAC (Facultative) = Plants that occur in a variety of habitats, including wetland and mesic to xeric non-wetland habitats but often occur in standing water or saturated soils;
    - FACW (Facultative Wetland) = Plants that nearly always occur in areas of prolonged flooding or require standing water or saturated soils but may, on rare occasions, occur in non-wetlands; and
    - OBL (Obligate Wetland) = Plants that always occur in standing water or in saturated soils.

The hydrophytic vegetation parameter is met when at least one of the following tests is fulfilled:

- The prevalent vegetation (more than 50 percent of the dominant plant species) is typically adapted to areas having wetland hydrology and hydric soil conditions and rated OBL, FACW, or FAC;
- The prevalence index, which is a value determined by accounting for the relative cover and WIS and ranges from 1 (only OBL species present) to 5 (only UPL species present), is less than or equal to 3; and/or
- Vegetation has morphological adaptations to growing in inundated or saturated conditions.

2) *Hydric soils*, which are indicative of wetlands, are defined as soils that are sufficiently ponded, flooded, or saturated throughout the growing season to produce anaerobic conditions that favor the growth of hydrophytic vegetation (Environmental Laboratory 1987). Hydric soils are identified based on observable properties that result from prolonged saturated-anaerobic conditions. To assess whether hydric soil is present at each sample point, a soil pit is excavated to a depth of 24 inches (61 centimeters) (when possible), and soil attributes (including color, mottling, texture, grain size, structure, streaking, degree of saturation) are recorded on the delineation forms. Soil colors were assessed using *Munsell Soil Color Charts* (Munsell Color 1992). Other than direct observation of saturated conditions, low chroma (dark) soil colors are among the most conspicuous indicators of hydric soils.

3) *Wetland hydrology* refers to inundation and/or saturation of the soil by flooding or a shallow water table for a prolonged period during the growing season, such that the character of the soil and vegetation are substantially different from areas that do not experience inundation/saturation in this manner. The identification of wetland hydrology follows the Environmental Laboratory (1987) delineation manual and *Arid West Regional Supplement* (USACE 2008b). Geomorphic features associated with flooding (e.g., channels and shorelines) and sediment deposits are among the indicators of wetland hydrology.

The location of the active floodplain was determined with consideration of recent guidance from the USEPA and the USACE on implementing the Supreme Court's decision in the consolidated cases *Rapanos v. United States* and *Carabell v. United States* (USEPA and USACE 2007a). Under that decision, the USACE will assert jurisdiction over TNWs, wetlands adjacent to TNWs, relatively permanent non-navigable tributaries to TNWs that flow at least seasonally (typically defined as supporting continuous flow for at least three months), and wetlands that abut such tributaries. The USACE may also assert jurisdiction over tributaries to features that do not have seasonal flow only if there is a specific nexus for doing so, such as if the flow characteristics and functions of the tributary significantly affect the chemical, physical, and biological integrity of downstream navigable waters, or if adjacent wetlands are present. The USACE will not assert jurisdiction over swales and erosional features.

The *USACE Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the United States* (Lichvar and McColley 2008) was referenced to determine the boundaries of the active floodplains. Data were collected using the *Updated Datasheet for the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the United States* (Curtis and Lichvar 2010). To determine OHWM the floodplain and channels were walked throughout the survey area to develop an understanding of the site characteristics. Cross-sections were selected that were perpendicular to channels that represented overall site characteristics. The hydrogeomorphic surfaces for each transect were mapped and data was taken on the evidence of water flow, sediment texture, and vegetation.

5 Review of Existing Information

5.1 Vegetation

Vegetation in the survey area consists of widely spaced shrubs typical of the western Mojave. Vegetation in the Range East and KD Range Complex and Range West survey areas is dominated by creosote bush and white bursage scrub with cheesebush scrub and developed area less common (Leidos 2015). The Yermo Stables survey area consists of allscale scrub with some developed areas.

Range West, which includes the LHA/LHD site, has a rocky substrate, with steeper slopes on the western and eastern ends that terminate into a large basin with various washes. The terrain is undulating with desert pavement on the flat areas and ridges. Desert pavement consists of gravel or larger stones that remain after wind has blown upper layers of silt and sand away. The soil surface becomes armored with pebbles left behind and cemented with calcium carbonate residual from water evaporation. Shrubs are sparsely distributed with creosote bush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*) dominant and purple heather (*Krameria erecta*), Englemann's hedgehog cacti (*Echinocereus englemannii*), branched pencil cholla (*Cylindropuntia ramosissima*), and sweetbush (*Bebbia juncea*) less common. Cheesbush (*Hymenoclea salsola*), box thorn (*Lycium* spp.), spiny senna (*Senna armata*), Mojave indigo bush (*Psorothamnus arborescens*) and catclaw (*Senegalia greggii*) are mainly restricted to the desert washes. Native summer annual species frequent in the understory include sandmat spurge (*Chamaesyce micromera*) and chinch weed (*Pectis papposa* var. *papposa*), less common are fringed spurge (*Chamaesyce setiloba*), fringed amaranth (*Amaranthus fimbriatus*), and six weeks grama (*Bouteloua* spp.).

Range East and KD Range Complex, which includes LZ 1, has a similar distribution and composition of plant species to Range West. The KD Range Complex also has developed areas (e.g., KD Rifle Range, KD Pistol Range, and 100-yard shotgun range) and cheesebush scrub is present in the previously disturbed areas adjacent to the KD Range Complex. The terrain is generally flat with exception to the man-made berms in the KD Rifle Range, KD Pistol Range, and 100-yard shotgun range. Throughout the survey area there are numerous shallow sandy, cobble washes that slope to the north.

The Range Main Supply Route is disturbed creosote bush – white bursage scrub habitat. The two existing unimproved, four-wheel drive utility right-of-way (ROW) access routes within this training area are dirt with vegetation along the border and sometimes growing in the road. There are several buried gas pipelines on the edges of the existing access routes. In some areas, the buried pipelines have created berms that have changed the natural drainage patterns. The terrain is undulating and the substrate is sandy with rocks and cobbles throughout the training area. Various areas have eroded after the recent rain events and parts of the access routes have washed away exposing many pipelines. Shrubs are sparsely distributed with creosote bush and white bursage dominant.

The Yermo Stables survey area includes LZ 2, the Yermo Dirt Road, proposed access roads, the existing gravel test track, and portions of the Mojave River flood plain. The northern portion of the site is flat and the southern portion of the site has numerous undulating sandy mounds and includes the floodplain of the Mojave River. Allscale (*Atriplex polycarpa*) is the dominant shrub throughout the site and creosote bush is occasional. Sparsely disturbed shrubs include box thorn (*Lycium* spp.), California ephedra, cheesbush, and climbing milkweed (*Funastrum hirtellum*). The floodplain adjacent to the low flow channel of the Mojave River also had large hummocks supporting desert willow (*Chilopsis linearis*) and salt cedar (*Tamarix ramosissima*) interspersed with flat areas that had indications of flooding closer to the river (i.e., cracked soil surfaces or small, shallow flow channels).

A list of plant species found during surveys is included in Attachment B. Plant species were identified using the Jepson Manual (Baldwin et al. 2012).

5.2 Climate/Hydrology

The Mojave Desert is the northernmost "hot" desert in North America, occurring between the cold-steppe of the Great Basin and the subtropical Sonoran Desert. MCLB Barstow experiences an arid desert climate characterized by hot, dry summers, warm springs and autumns, and mild winters. The area has mean summer temperatures of 77 to 102 degrees Fahrenheit (°F), (25 to 39 degrees Celsius [°C]). Temperatures fluctuate throughout a 24 hour period with high temperatures during the day and cool temperatures at night, and daytime and nighttime temperatures varying as much as 77°F (25° C) (Beck and Haase 1974). Winter temperatures can be cold, and may drop below freezing.

MCLB Barstow experiences relatively strong winds throughout the year. Prevailing winds are out of the west and south, tending to a west to east flow across the Mojave Desert. During the summer, strong winds are bolstered by uneven heating and rapid temperature changes. During the winter, strong winds occur as a result of storm fronts moving in from the Pacific Coast.

The majority of the rainfall occurs from mid-latitude Pacific cyclonic storms during the winter. However, summer thunderstorms occur frequently in July, August, and September. Most of the major flooding events on record occur due to heavy thunderstorms in the summer. Flash floods result from strong, localized thunderstorms which produce considerable rain in a short period of time, fueling a surge of runoff in dry washes. In the Mojave Desert, the main erosion and sedimentation process is caused by flash floods and debris flows which move with tremendous force which can move massive loads of sediment (USGS 2004).

Understanding when the most recent flood events occurred is an important step in determining the location of the OHWM in the arid desert region. Previous years (2011 and 2012) were dry with less than 2 inches (5.1 centimeters) of rainfall and no major flooding events. Prior to 2011, the most recent storms were on 21 January 2010, with over 1 inch (2.5 centimeters) of rainfall (a 2 to 5 year storm event), and in December 2010 there was a large storm where 5 inches (12.7 centimeters) of rain fell over the course of 3 days (10 to 25 year storm event). As a result, 2010 was wetter than normal.

One month prior to the October 2013 survey, on 3 September 2013, an intense thunderstorm caused widespread flooding of MCLB Barstow. Buildings were flooded near the front gate, portions of Interstate 40 were closed, and sections of the unpaved roads on the Range Complex were damaged. Approximately 0.5 inches (1.3 centimeters) of rain fell over the span of 20 minutes. While low in overall volume, the short-term intensity of the storm lead to flood damage. Based on the estimated precipitation frequency for the location, using the 30-minute time interval, this storm was between a 10 and 25 year storm event (National Oceanic and Atmospheric Administration [NOAA] 2013). During the October 2013 surveys there was widespread evidence of the recent storm event throughout the survey area.

The tributaries and drainages in the survey area all flow into the Mojave River. The Mojave River is the largest drainage system in the Mojave Desert. Most of the Mojave River is intermittent with flow only occurring after large storm events; however, some sections where bedrock forces the water to the surface are perennial (e.g. the Narrows and Afton Canyon). Currently, the Mojave River terminates in Soda Dry Lake and Silver Dry Lake near the town of Baker, California (Figure 3.1). Water flowing from the Mojave River into Soda Dry Lake and Silver Dry Lake ultimately evaporates with no outlet to the ocean and therefore is defined as a closed basin. Therefore, the Mojave River and its tributaries are intrastate waters (e.g. not connected outside of the state) and isolated waters.

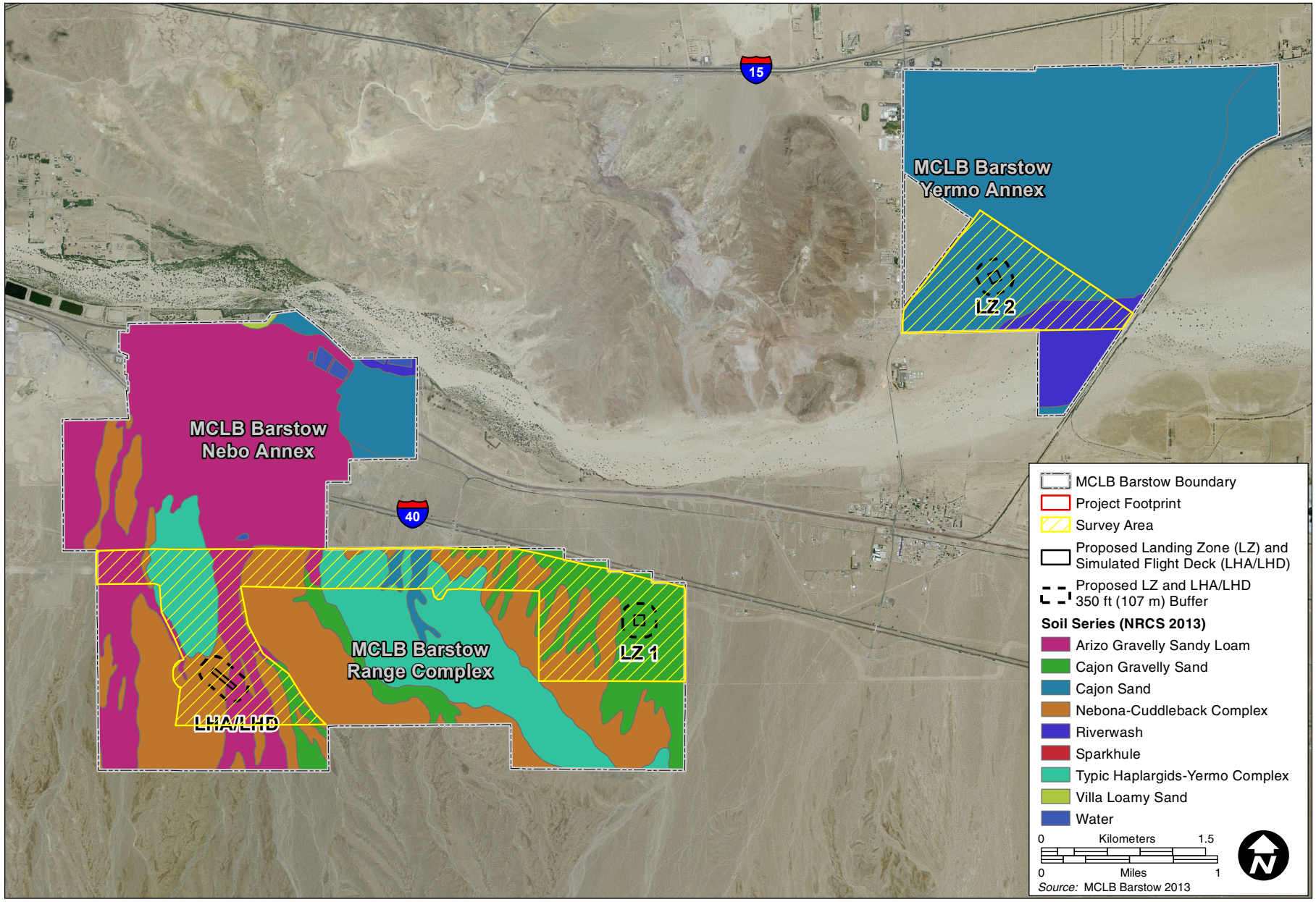
The tributaries and drainages within the survey area have evidence of a surface water connection to the Mojave River. Roadside ditches and berms on the KD Range Complex and culverts along Interstate 40 and the Pendleton Frontage Road have altered the natural flow patterns. During a significant runoff event, most drainages would have a surface connection to the Mojave River. However, during the September 2013 storm event some drainages were temporarily blocked with sediment, causing flooding and sedimentation on the Pendleton Frontage Road. In an extreme runoff event, drainages with blocked culverts may connect to the Mojave River by flooding the roadways as occurred during the September 2013 storm event.

5.3 Soils

Sand and gravelly sand textured soils are found on low river terraces and recent alluvial fans on the Range Complex. These include the Cajon sand, Cajon gravelly sand, and Arizo sand soil units (Figure 5.1). These young soils on the alluvial fans consist of a mixture of sands, gravelly sands, and loamy sands that formed in Holocene alluvium, derived primarily from granitic parent material. They are very deep, somewhat excessively drained to excessively drained and are characterized by low available water capacity, rapid permeability, and slow runoff. Soils on old alluvial fans and terraces formed in alluvium are derived from mixed sources. On MCLB Barstow these soil types include Nebona-Cuddback and Typic Haplagrids-Yermo complexes. The soils of these complexes are generally older and more developed. They may support desert pavement of varnished gravel and cobbles on their surfaces. Varnished desert pavement has developed on the stable terraces of Pleistocene nonmarine deposits (NRCS 2013).

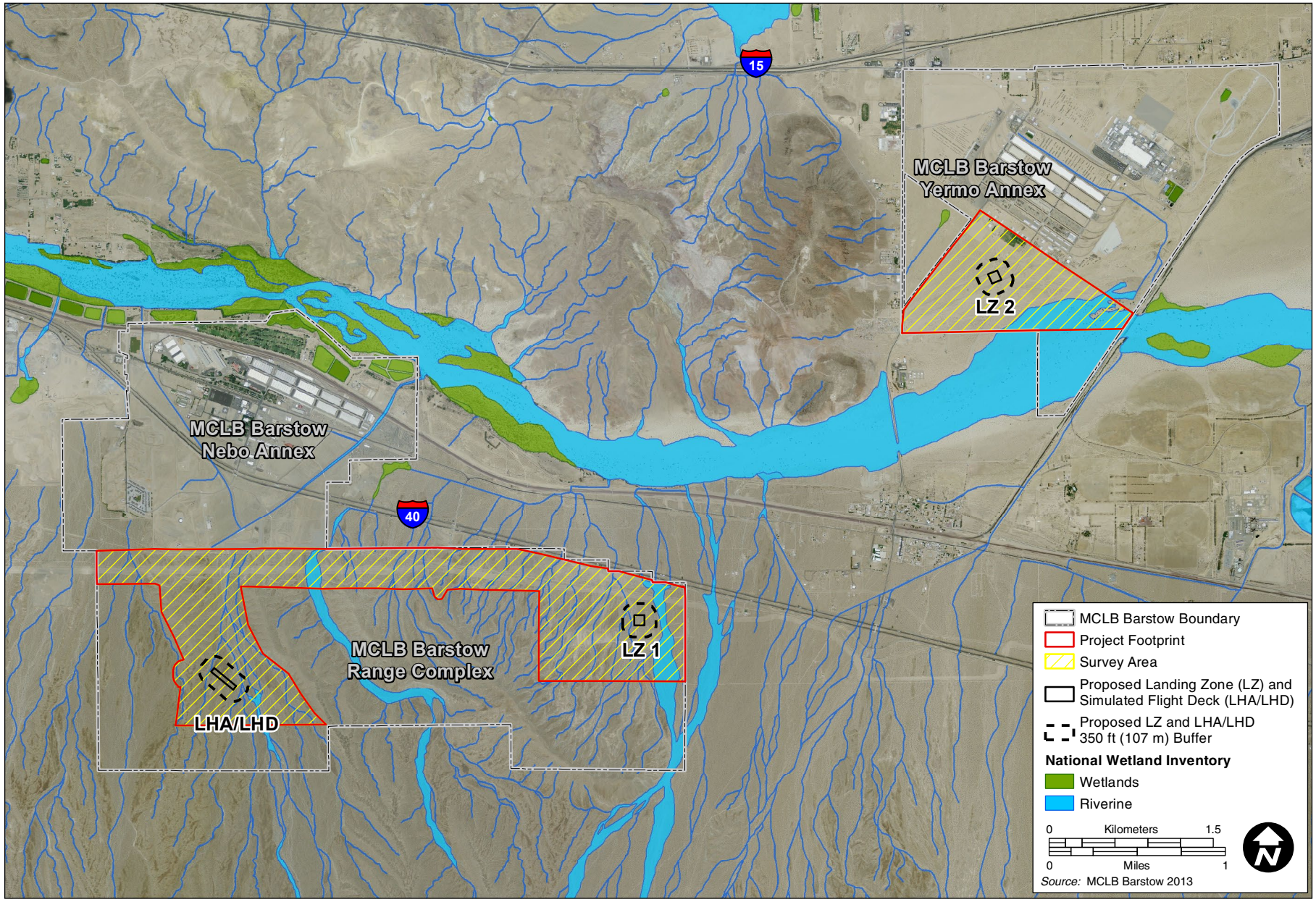
5.4 National Wetlands Inventory

The USFWS is the principal federal agency that provides information to the public on the extent and status of the Nation's wetlands. The agency has developed a series of topical maps to show wetlands and deepwater habitats, referred to as the NWI. The NWI uses high altitude imagery and identifies wetlands based on the visible presence of wetland vegetation or hydrology. The NWI is not intended to define limits of jurisdiction of any federal, state, or local agency (USFWS 2013), but is used as a tool that contributes to the existing information available for the survey area. Figure 5.2 depicts wetlands in the project vicinity identified by the NWI, which are primarily associated with the Mojave River floodplain.



Soils at MCLB Barstow
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
5.1



National Wetland Inventory
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
5.2

6 Field Survey Results

6.1 Active Floodplain Mapping

Based on the available evidence and recent jurisdictional determinations by the USACE in the project vicinity, the lower Mojave River adjacent to and downstream of MCLB Barstow appears to function as an isolated, intrastate system that lacks the presence of a TNW (refer to Section 3.3 for details). The USACE will determine the jurisdictional status of the lower Mojave River. If the USACE determines that the lower Mojave River is under its jurisdiction, the mapping of the active floodplain in the survey area can be utilized in the permitting process. The OWHM method was used to determine the lateral limits of the active floodplain. In the Arid West region, the OHWM is generally the edge of the flows during low to moderate discharge events, but can be challenging to map due to the flashy storm systems and shifting channel morphology (Curtis and Lichvar 2010).

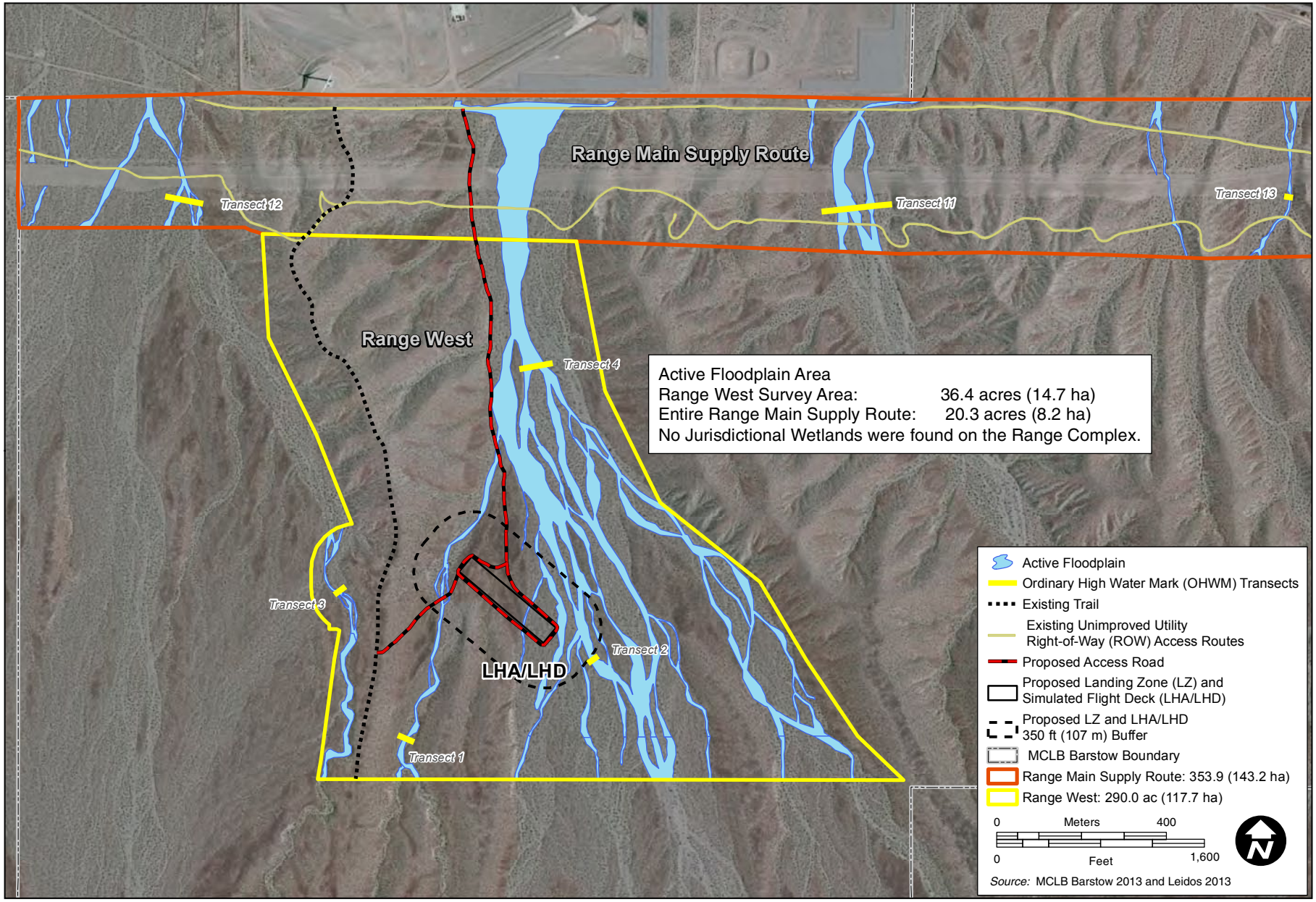
In the Arid West, three distinctive hydrogeomorphic surfaces are used to delineate the OHWM: the low-flow channel; the active floodplain; and the low terrace. The boundary between the active floodplain and low terrace as defined by the OHWM is used to determine the edge of the potential non-wetland waters of the U.S. The low flow channel changes course frequently and often is too undefined to be delineated (Curtis and Lichvar 2010).

Overall, 14 cross section transects were performed to determine the limit of the OHWM in the survey area (Table 6.1). Transects 1 through 4 are in the Range West survey area (Figure 6.1), Transects 5 through 10 are in the Range East and KD Range Complex survey area (Figure 6.2), Transects 11 through 13 are in the Range Main Supply Route survey area, and Transect 14 is in the Yermo Stables survey area (Figure 6.3). Copies of OHWM determination forms are included in Attachment C.

Table 6.1. Summary of Ordinary High Water Mark Transect Data for the Survey Area

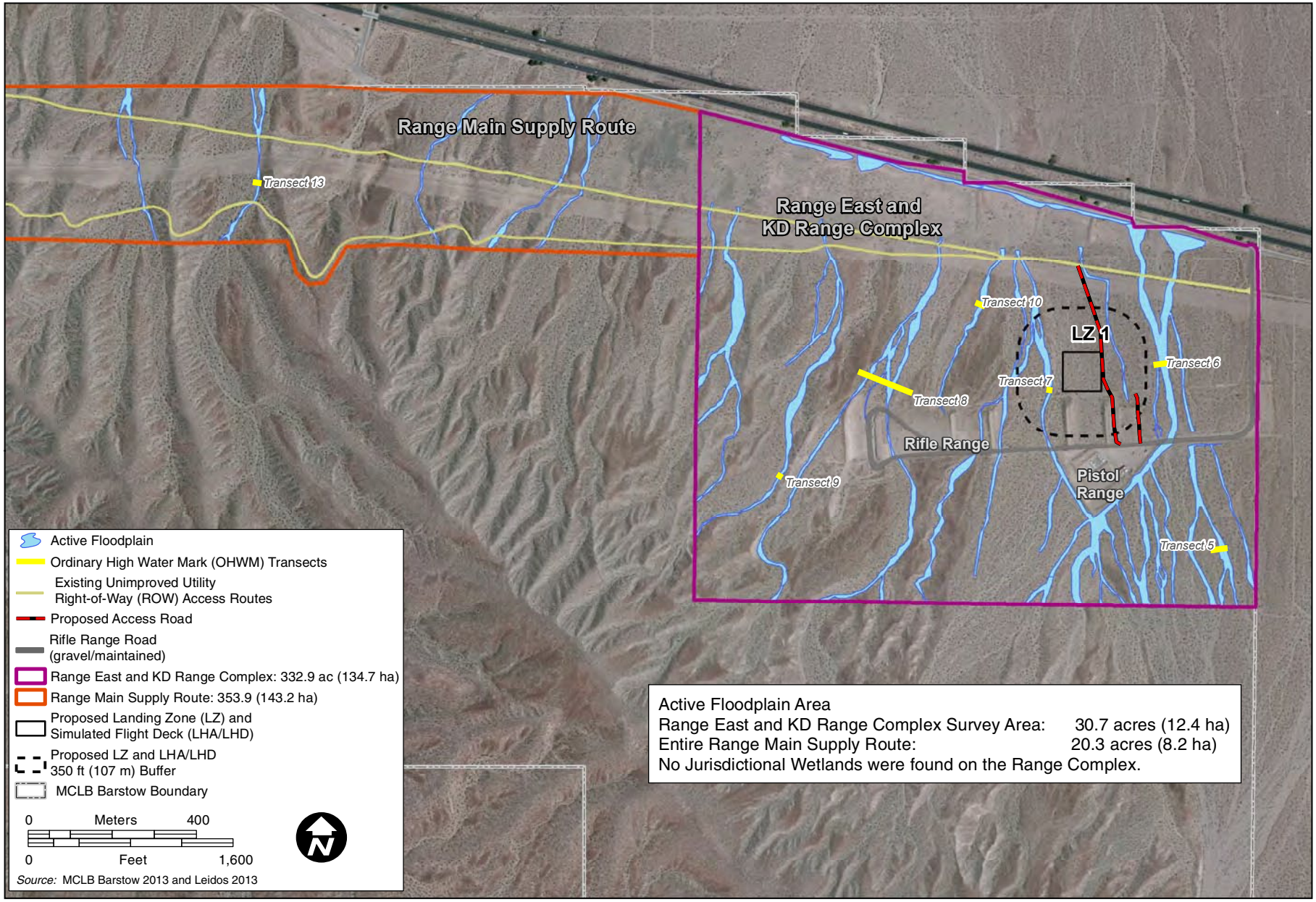
Transect	*Low Flow Channel*	*Active Floodplain*	*Low Terrace*	*Significant Nexus*	*Comments*
1	Yes	Yes	Yes	Yes	Recent flow evident
2	Yes	Yes	Yes	Yes	Change in vegetation/sediment marks edges
3	Yes	Yes	Yes	Yes	Paleochannels on low terrace
4	Yes	Yes	Yes	Yes	Numerous low flow channels
5	Yes	Yes	Yes	Yes	Channel on steeper slope
6	Yes	Yes	Yes	Yes	Steep banks on edges
7	Yes	Yes	Yes	Yes	Low terrace may not flood
8	Yes	Yes	Yes	Yes	Compound with numerous small channels
9	Yes	Yes	Yes	Yes	Singe-thread channel
10	Yes	Yes	Yes	Yes	Steep banks and sides confine channel
11	Yes	Yes	Yes	Yes	Compound with main and side threads
12	Yes	Yes	Yes	Yes	Compound with main and side threads
13	Yes	Yes	Yes	Yes	Single thread, disturbed
14	Yes	Yes	Yes	Yes	Mojave River next to bridge

.



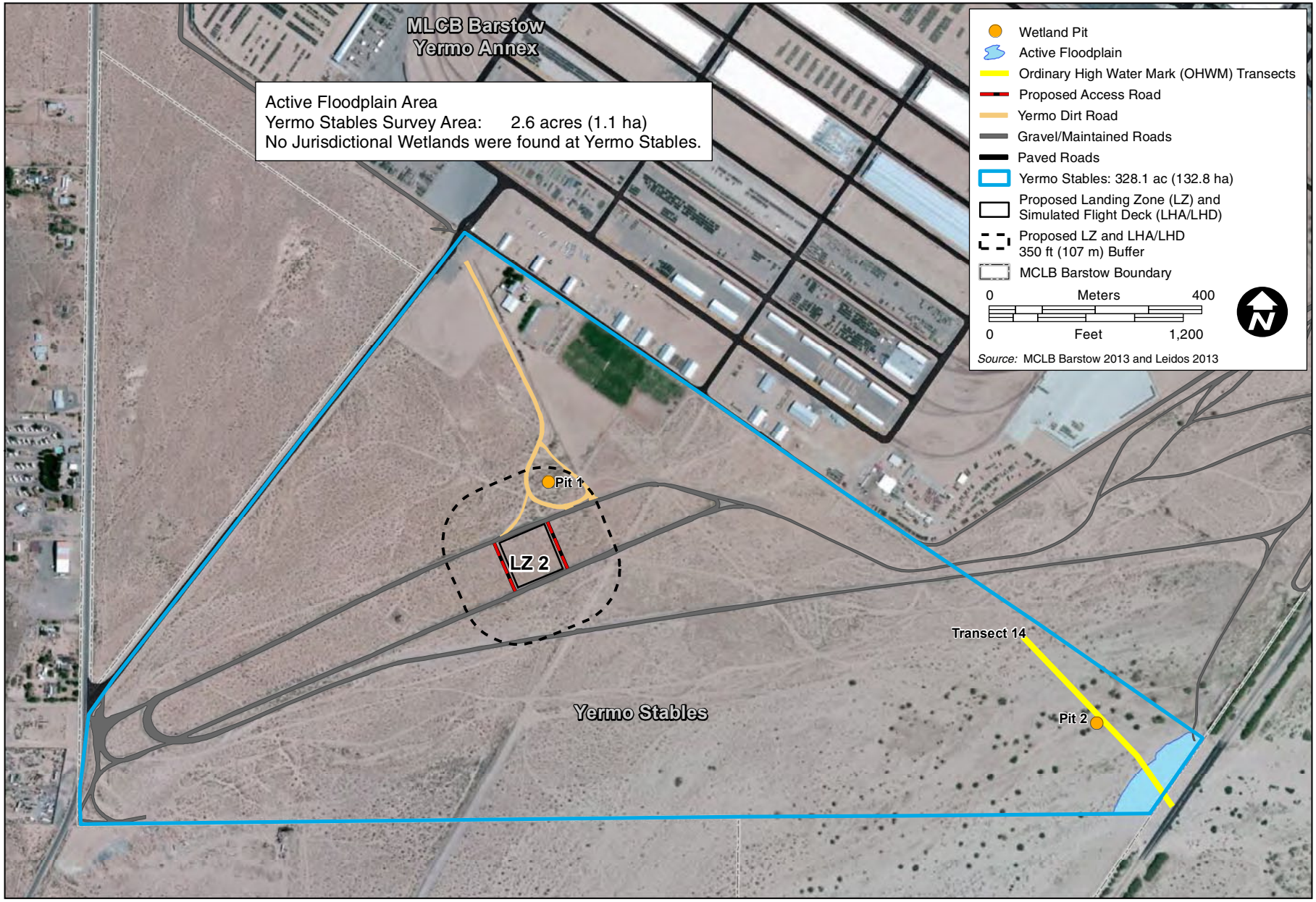
Survey Results - Range West
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE 6.1



Survey Results - Range East and KD Range Complex
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE 6.2



Survey Results - Yermo Stables
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE 6.3

Based on these transects and understanding of the site channel morphology, additional points marking the edge of the active flood plain (OHWM) were taken throughout the survey area. There was evidence of recent flow in all the channels in the survey area associated with the intense thunderstorm on 3 September 2013 that caused localized flooding around MCLB Barstow. The recent storm event was moderate (a 10 to 25 year storm event) and flow boundary evidence from the storm event was used to mark the OHWM in the field. Following the field survey, the cross-sections, GPS points, and photos from the field effort were used to digitize the boundaries of active floodplain. The latest aerial photograph available for the survey area was taken in May 2010. The most recent storm prior to May 2010 was on 21 January 2010, when over 1 inch (2.5 centimeters) of rainfall fell in a day (2 to 5 year storm event). Therefore, the active floodplain was distinguishable on the aerial photo. MCLB Barstow also provided 2-foot (30.5- centimeter) contours for the Range Complex.

In the field, abrupt banks generally marked the edge between the active floodplain and low terrace. These breaks in bank were evident as notches or sharp angles on the 2-foot (30.5- centimeter) contours. Through the combination of field data, aerial photography, and detailed contours, the boundaries of the active floodplain were delineated (Figures 6.1 through 6.3). Representative photographs of the survey area are included in Attachment D. Photographs 1 through 6 depict the active floodplain in the Range West survey area, Photographs 7 through 10 depict the Range Main Supply Route survey area, Photographs 11 through 18 depict the Range East and the KD Range Complex survey area, and Photographs 19 through 22 depict the Yermo Stables survey area.

According to the Cowardin System of classification, all of the drainages are Riverine (R), Intermittent (4), unconsolidated bottom (UB), and intermittently flooded (J); R4UBJ. Intermittent streams are those that contain water only part of the year and intermittently flooded indicates the substrate is usually exposed, but surface water is present for variable periods without detectable seasonal periodicity and may include extended periods of dryness (Cowardin et al 1979). According to the Arid West Classification System, most washes would be classified as Foothill, Soft Rock, Compound or Discontinuous Ephemeral Channels with Sand-dominated Active Channels (Lefebvre et al. 2013). None of the drainages within the survey areas support wetland or riparian vegetation.

All of the drainages mapped appear to have a surface water connection to the Mojave River, although many may connect only during extreme rain events.

6.2 Jurisdictional Wetlands

No USACE jurisdictional wetlands were found in the survey area. A potential wetland area was found within the Yermo Stables survey area (Pit 1 in Table 6.2 and Figure 6.3). This area supported saltcedar (*Tamarix ramosissima*, WIS FAC), and had a cracked soil surface; both positive indicators for wetland vegetation and hydrology. A wetland pit was dug near the saltcedar where there was evidence of water ponding (mudcracks) (refer to Attachment D Photographs 21 and 22). However, there were no positive indicators for hydric soils and the area did not meet the definition of USACE jurisdictional wetland (refer to Attachment C for a copy of the Pit 1 form).

An additional wetland area was investigated in the Yermo Stables survey area within the Mojave River floodplain in an area with shallow flow channels and soil surface cracks (a positive indicator of wetland hydrology) (Pit 2 in Table 6.2 and Figure 6.3). The pit was dug in a low spot adjacent to a large mound supporting desert willow and salt cedar (refer to Attachment D Photographs 23 and 24). The area was identified as Riverine in the NWI (USFWS 2013) and soils were Riverwash (NRCS 2013). Although the soil surface cracks are a positive indicator for wetland hydrology, the vegetation was dominated by upland species, and thus did not meet the criterion for wetland vegetation. In addition, there were no positive

indicators for hydric soils. Therefore, this area did not meet the definition of USACE jurisdictional wetland (refer to Attachment C for a copy of the Pit 2 form).

No other areas meeting the criteria for USACE jurisdictional wetlands were present in the survey area.

Table 6.2. Summary of Wetland Delineation Data for the Survey Area

Pit	*Wetland Indicator Parameters Present? (Yes/No)*			*Significant Nexus*	*USACE Jurisdictional Wetland (Yes/No)*	*Comments*
	Vegetation	*Soils*	*Hydrology*			
1	Yes	No	Yes	No	No	Saltcedar in man-made depression.
2	No	No	Yes	No	No	Shallow flow channel with cracked soil surface in lower floodplain of the Mojave River.

7 Summary

The determinations described in this report, including that the Mojave River does not appear to be a TNW are subject to verification by the USACE Los Angeles District. If the USACE determines that the Mojave River is a TNW or meets the (a)(3) criteria, then there would be a total of 90.0 acres (36.4 hectares) of active floodplain that could be USACE jurisdictional waters of the U.S. within the survey area, including 36.4 acres (14.7 hectares) in the Range West survey area, 30.7 acres (12.4 hectares) in the Range East and KD Range Complex survey area, 20.33 acres (8.2 hectares) in the Range Main Supply Route survey area, and 2.6 acres (1.1 hectares) in the Yermo Stables survey area. Two areas were investigated for potential jurisdictional wetlands in the Yermo Stables survey area; however, these sites did not meet the criteria for USACE jurisdictional wetlands. No other USACE jurisdictional wetlands were found in the survey area.

8 Discussion and Recommendations

Based on the available evidence and recent jurisdictional determinations by the USACE in the project vicinity, the lower Mojave River adjacent to and downstream of MCLB Barstow appears to function as an isolated, intrastate system that lacks the presence of a TNW. Also, the Mojave River does not appear to meet the criteria for (a)(3) waters as defined by 33 CFR 328.3, as it: i) does not have use for surface water recreation or other purposes by foreign or interstate travelers; ii) does not have harvesting activities of fish or shellfish that may be sold in interstate or foreign commerce; and iii) does not have surface water industrial usage by industries in interstate commerce. Therefore, this analysis concludes, subject to verification by the USACE Los Angeles District, that the desert washes within the project footprint are not (a)(3) waters and are not tributary to either a TNW or an a(3) water; and therefore, are non-jurisdictional.

In accordance with the USACE Jurisdictional Determination Form Instructional Guidebook (USEPA and USACE 2007b), it is recommended that MCLB Barstow submit an Approved Jurisdictional Determination request to the USACE Los Angeles District, which would then be forwarded to USACE Headquarters and USEPA. Should USACE determine that the Mojave River falls under its jurisdiction, any project related activities within areas ultimately determined to be jurisdictional will require regulatory coverage as prescribed by Sections 401 and 404 of the CWA, including submittal of a permit application to USACE and a CWA certification from the RWQCB. If the direct or indirect effects of the proposed action would result in a “minimal amount” of potential fill into jurisdictional wetlands or waters of the U.S., and potential loss of jurisdictional features is minimized, coverage under an existing USACE NWP could be possible. Otherwise an individual 404 permit will be required. Should the USACE determine the Mojave River does not fall under its jurisdiction, the project would still be required to comply with Section 401 of the CWA and submit a Water Quality Certification Application to the RWQCB.

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Attachment A

Mojave River Flow Characteristics

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FIGURE A-1: USGS 10262500 MOJAVE RIVER AT BARSTOW, CA

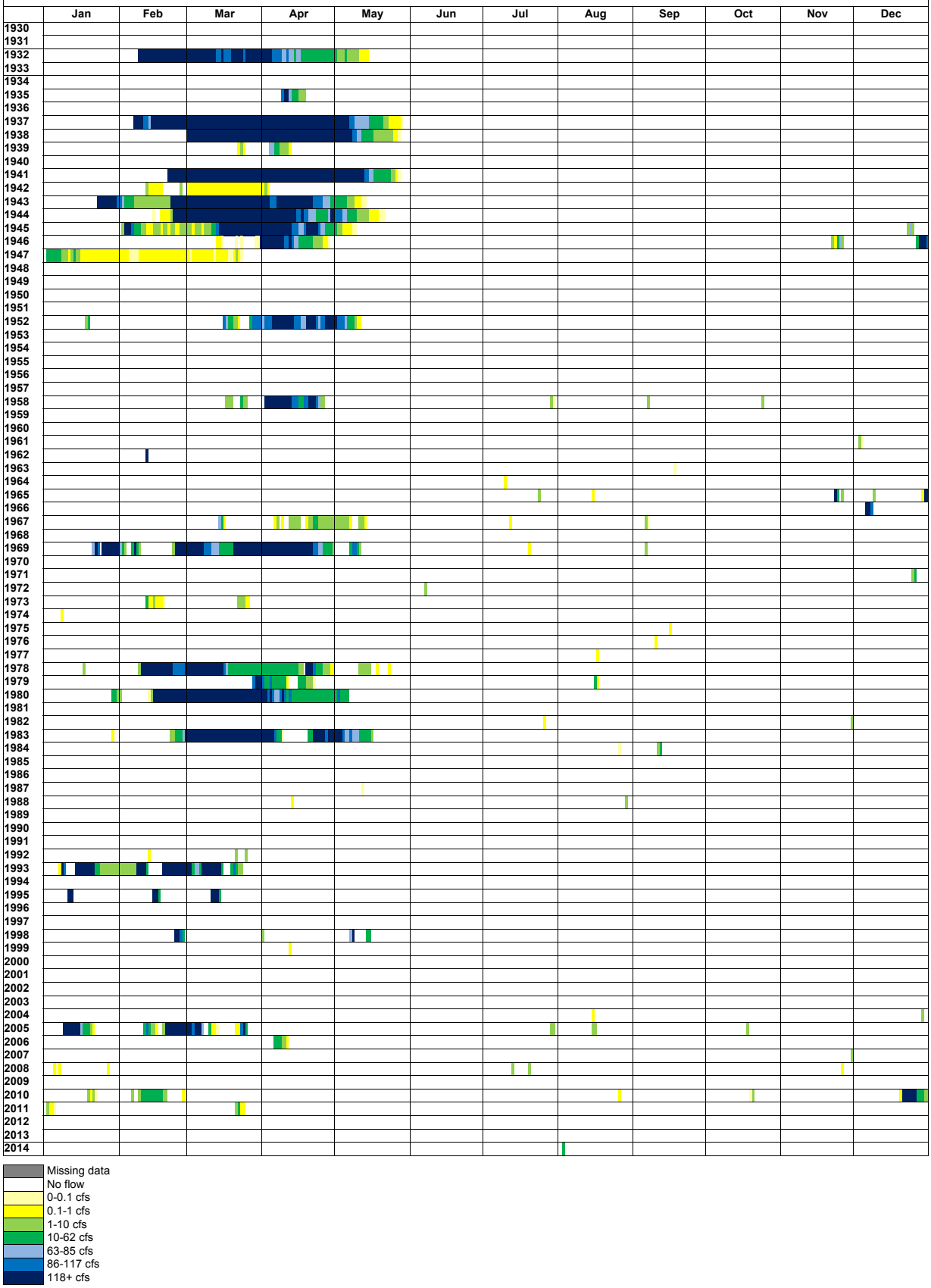

FIGURE A-2: USGS 10263000 MOJAVE RIVER AT AFTON, CA

FIGURE A-3: MOJAVE RIVER FLOW DURATION CURVES

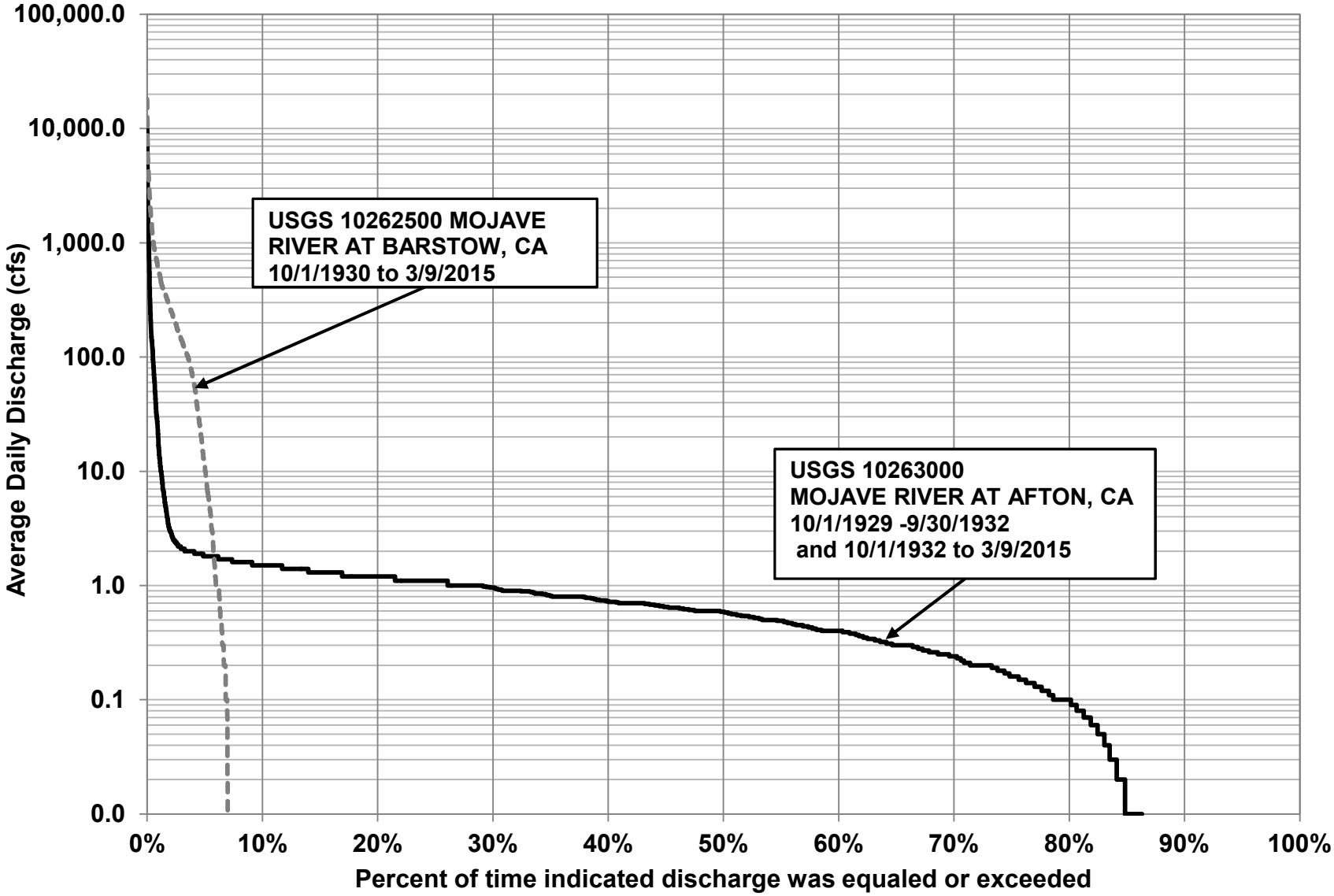

TABLE A-1: USGS 10262500 MOJAVE R A BARSTOW CA												
YEAR	Monthly mean in ft3/s (Calculation Period: 1971-10-01 -> 2014-11-30) Calculation period restricted by USGS staff due to special conditions at/near site											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1971										0	0	0.632
1972	0	0	0	0	0	0.08	0	0	0	0	0	0
1973	0	2.3	0.371	0	0	0	0	0	0	0	0	0
1974	0.007	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0.006	0	0	0
1976	0	0	0	0	0	0	0	0	0.017	0	0	0
1977	0	0	0	0	0	0	0	0.032	0	0	0	0
1978	0.297	302.4	500.8	47.3	0.567	0	0	0	0	0	0	0
1979	0	0	69.3	20.4	0	0	0	1.31	0	0	0	0
1980	2.24	1,589	683.1	60.6	8.45	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0.019	0	0	0	0.067	0
1983	0.015	46	1,264	139.9	71.5	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0.003	0.71	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0.007	0	0	0	0.129	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0.034	0.432	0	0	0	0	0	0	0	0	0
1993	419.8	1,640	95.9	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0
1995	57.4	33.9	92.6	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	174.5	0	0.2	13.1	0	0	0	0	0	0	0
1999	0	0	0	0.006	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0.004	0	0	0	0.065
2005	1,597	447.6	50.3	0	0	0	0.335	0.39	0	0.194	0	0
2006	0	0	0	2.87	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0.057	0
2008	0.035	0	0	0	0	0	0.077	0	0	0	0.007	0
2009	0	0	0	0	0	0	0	0	0	0	0	0
2010	0.137	6.56	0	0	0	0	0	0.011	0	0.11	0	378.8
2011	0.213	0	0.781	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0.677	0	0	0	
Mean of Monthly Discharge	48	99	64	6.3	2.2	0	0.01	0.06	0.02	0.01	0	8.8

TABLE A-2 : USGS 10263000 MOJAVE R A AFTON CA												
YEAR	Monthly mean in ft3/s (Calculation Period: 1971-10-01 -> 2014-11-30) Calculation period restricted by USGS staff due to special conditions at/near site											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1971										0.367	0.817	0.827
1972	0.775	0.96	0.697	0.394	0.164	0.048	0	4.57	0.201	0.455	0.616	0.791
1973	0.773	0.834	0.757	0.528	0.36	0.045	0	0	0	0.018	0.433	0.948
1974	1.15	1.01	1.17	0.822	0.449	0.104	1.06	0	0.052	0.149	0.222	0.35
1975	0.584	0.59	0.221	0.414	0.125	0	0	0	0	0	0.005	0.254
1976	0.34	0.708	0.482	0.23	0.131	0	0	0	2.8	0.235	0.613	0.776
1977	0.96	1.65	0.716	0.204	0.099	0.01	0	7.58	2	0.148	0.177	0.212
1978	0.56	375.9	414.6	1.25	1.02	0.796	0.659	0.559	0.718			
1980										1.57	2.29	2.28
1981	2.15	2.5	1.89	1.8	1.55	1.58	1.2	1.21	2.96	2.86	1.24	1.17
1982	1.24	1.56	1.8	1.52	1.22	0.809	0.597	2.37	1.03	1.16	1.39	1.34
1983	1.53	2.08	196.1	1.63	1.11	0.35	0.353	9.03	0.731	1.16	1.36	1.29
1984	1.62	1.4	1.35	0.919	0.52	0.402	0.708	18	1.01	0.716	1.27	1.77
1985	1.44	1.47	1.22	0.983	0.632	0.227	0.264	0.311	1.04	0.8	1.18	1.11
1986	1.16	1.33	1.12	0.72	0.338	0.169	0.501	0.241	0.488	0.832	1.04	1.19
1987	1.24	1.21	1.13	0.914	0.43	0.465	0.425	0.145	0.326	0.77	1.38	1.49
1988	1.27	1.21	1.2	1.14	0.345	0.455	0.155	1.49	4.3	0.45	0.717	1
1989	1	1	0.931	0.674	0.413	0.25	0.25	0.25	0.25	0.425	1.32	1.67
1990	0.845	0.72	1.2	1.48	0.562	0.348	0.242	0.114	0.127	0.364	0.619	0.627
1991	0.659	1.14	2.38	1.31	0.665	1.06	2.79	0.166	0.498	0.261	0.333	0.645
1992	0.876	1.46	4.08	2.25	0.249	0.06	0.051	0.035	0.084	2.97	0.352	1.52
1993	243.2	875.8	41.6	0.905	0.513	0.356	0.247	0.174	0.155	0.571	1.26	1.36
1994	1.03	0.976	0.846	0.471	0.398	0.073	0	0.022	1.04	1.39	0.869	1.04
1995	1.43	0.725	0.551	0.672	0.3	0.099	0.021	0.012	0.073	0.393	0.749	0.791
1996	0.849	0.875	0.969	0.571	0.172	0.051	2.89	0.084	2.06	0.502	0.778	1
1997	1.12	1.03	0.882	0.803	0.227	0.053	3.81	0.034	0.421	0.463	0.657	0.731
1998	0.872	12	0.895	0.522	0.322	0.135	0.068	0.193	5.46	0.283	0.475	0.663
1999	0.768	0.617	0.706	0.793	0.434	0.208	3.83	0.305	0.214	0.404	0.483	0.72
2000	0.784	0.703	0.618	0.429	0.2	0.056	0.018	0.145	0.12	0.323	0.505	0.586
2001	0.634	0.55	0.678	0.445	0.167	0.057	0.407	1.32	0.108	0.249	0.387	0.469
2002	0.638	0.681	0.71	0.53	0.272	0.01	0	0	0.034	0.271	0.509	0.599
2003	0.58	0.608	0.631	0.517	0.318	0.029	0	0	0.078	0.169	0.967	0.625
2004	0.742	1.4	1.76	0.558	0.237	0.033	0	0	0.051	0.252	0.565	0.652
2005	630.7	101.7	1.39	0.234	0.021	0.087	0.235	0.061	0	0.231	0.397	0.5
2006	0.554	0.617	0.435	0.28	0.085	0.009	0	0	0	0	0.18	0.51
2007	0.61	0.647	0.376	0.152	0.004	0	0.039	0	0	0.009	0.22	0.386
2008	0.445	0.433	0.391	0.227	0.036	0	0.588	0.003	0	0.001	0.2	0.351
2009	0.392	0.319	0.356	0.225	0.023	0	0	0	0	0	0.131	0.325
2010	0.883	0.969	0.387	0.254	0.045	0	0	0.197	0	0.061	0.144	100.7
2011	0.741	0.617	0.515	0.417	0.29	0.228	0.107	0.138	0.262	0.154	0.245	0.394
2012	0.479	0.434	0.297	0.199	0.069	0.008	2.57	0.058	0.055	0.008	0.008	0.009
2013	0.015	0.012	0.004	0	0	0	0	1.86	0	0	0.543	0
2014	0	0.004	0.129	0.057	0.015	0	0.031	13.6	8.77	0	0.005	
Mean of Monthly Discharge	22	34	17	0.69	0.35	0.21	0.59	1.6	0.92	0.51	0.66	3.3

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Attachment B

Plant List

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Plant Species Observed During Surveys						
Scientific Name[1]	*Common Name*	*Family*	*Plant Type*[2]	*Wetland Indicator Status*[3]	*Range Complex Survey Area*[4,5]	*Yermo Stables Survey Area*[5]
Adenophyllum cooperi	Cooper's dyssodia	Asteraceae	P	-	X	
Allionia incarnata var. *incarnata*	trailing windmills	Nyctaginaceae	A	-	X	
Amaranthus fimbriatus	fringed amaranth	Amaranthaceae	A	-	X	
Ambrosia dumosa	white bursage	Asteraceae	P	-	X	X
Atriplex polycarpa	allscale saltbush	Chenopodiaceae	P	FACU		X
Baileya multiradiata var. *multiradiata*	desert marigold	Asteraceae	P	-	X	
Bebbia juncea	sweetbush	Asteraceae	P	-	X	
Bouteloua aristidoides	needle grama	Poaceae	A	-	X	
Bouteloua barbata	six weeks grama	Poaceae	A	-	X	
Brassica tourneforti	Sahara mustard	Brassicaceae	A	-	X	X
Chamaesyce micromera	sandmat spurge	Euphorbiaceae	A	-	X	X
Chamaesyce setiloba	fringed spurge	Euphorbiaceae	A	-	X	X
Chilopsis linearis	Desert willow	Bignoniaceae	P	FACU		X
Cucurbita palmata	coyote gourd	Cucurbitaceae	P	-	X	X
Cylindropuntia echinocarpa	slender or golden cholla	Cactaceae	P	-	X	
Cylindropuntia ramosissima (= *Opuntia ramosissima*)	branched pencil cholla	Cactaceae	P	-	X	
Dalea mollissima	downy dalea	Fabaceae	P	-	X	
Echinocactus polycephalus var. *polycephalus*	cottontop cactus	Cactaceae	P	-	X	
Echinocereus engelmannii	Engelmann's hedgehog cactus	Cactaceae	P	-	X	
Encelia actoni	Acton encelia	Asteraceae	P	-	X	
Ephedra californica	desert tea	Ephedraceae	P	-	X	X
Ephedra nevadensis	Nevada ephedra	Euphedraceae	P	-	X	
Ericameria sp.	Goldenbush	Asteraceae	P	-		
Eriogonum deflexum	flat topped buckwheat	Polygonaceae	A	-	X	X
Eriogonum fasciculatum var. *polifolium*	California buckwheat	Polygonaceae	A	-	X	
Eriogonum inflatum	desert trumpet	Polygonaceae	P	-	X	
*Erodium cicutarium**	red stemmed filaree	Geranaceae	A	-	X	X
Funastrum hirtellum	climbing milkweed	Apocynaceae	P	-	X	
Hymenoclea salsola	cheesebush	Asteraceae	P	-	X	X
Krameria erecta	purple heather	Krameriaceae	P	-	X	
Larrea tridentata	creosote bush	Zygophyllaceae	P	-	X	X
Lepidospartum squamatum	scale broom	Asteraceae	P	FACU	X	
Lycium californicum	box thorn	Solanaceae	P	-	X	
Lycium pallidum var. *oligospermum*	rabbit-thorn	Solanaceae	P	-	X	X
Mammillaria sp.	fish-hook cactus	Cactaceae	P	-		
Mirabilis laevis	wishbone bush	Nyctaginaceae	P	-	X	
Opuntia basilaris	beavertail cactus	Cactaceae	P	-	X	
Palafoxia arida var. *arida*	desert needle	Asteraceae	A	-		X
Pectis papposa var. *papposa*	chinch weed	Asteraceae	A	-	X	X
Petalonyx thurberi subsp. *Thurberi*	sandpaper bush	Loasaceae	P	-	X	

Plant Species Observed During Surveys						
Scientific Name[1]	*Common Name*	*Family*	*Plant Type*[2]	*Wetland Indicator Status*[3]	*Range Complex Survey Area*[4,5]	*Yermo Stables Survey Area*[5]
Portulaca oleraceae	purslane	Portulacaceae	A	FAC		X
Psorothamnus arborescens	Mojave indigo bush	Fabaceae	P	FACU	X	
*Salsola tragus**	Russian thistle	Chenopodiaceae	A	FACU		X
Salvia carduacea	thistle sage	Lamiaceae	A	-	X	
Salvia columbariae	chia	Lamiaceae	A	-		
Schismus sp.*	Mediterranean grass	Poaceae	A	-	X	X
Scutellaria mexicana (=*Salazaria mexicana)*	Mexican bladdersage	Lamiaceae	P	-	X	
Senegalia greggii (= *Acacia greggii*)	catclaw	Fabaceae	P	FACU	X	
Senna armata	spiny senna	Fabaceae	P	-	X	
Sphaeralcea sp.	globe-mallow	Malvaceae	P	-	X	
Stephanomeria pauciflora	wire lettuce	Asteraceae	P	-	X	X
*Tamarix ramosissima**	saltcedar	Tamaariceae	P	FAC	X	X
Tidestromia oblongifolia	white leaved amaranth	Amaranthaceae	A	-	X	
Tiquilia plicata	fanleaf crinklemat	Boraginaceae	P	-	X	
Xylorhiza tortifolia	Mohave woodaster	Asteraceae	P	-	X	
Yucca schidigera	Mojave yucca	Agavaceae	P	-	X	

Notes:

1. Nomenclature follows Baldwin et. al. 2012. Old Latin name according to Hickman 1993 is indicated in this manner: (= old name), * = indicates non-native species.
2. Plant type A= annual, P= Perennial
3. Wetland Indicator Status (Lichvar 2013):
   OBL (Obligate Wetland) = Occur almost always (estimated probability >99%) under natural conditions in wetlands.
   FACW (Facultative Wetland) = usually occur in wetlands (estimated probability 67-99%), but occasionally found in non-wetlands.
   FAC (Facultative) = equally likely to occur in wetlands or non-wetlands.
   FACU (Facultative Upland) = usually occur in non-wetlands (estimated probability 67-99%), but occasionally found in wetlands.
   UPL (Obligate Upland) = Occur in wetlands in another region, but almost always occur in uplands in the region specified.
   - Not on WIS List.
4. The Range Complex survey area includes the Range West, Range East and KD Range Complex, and Range Main Supply Route survey areas.
5. "X" denotes species present on the site.

Attachment C

Wetland Delineation Forms

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Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: MCLB Barstow
Project Number: Training and Range EA
Stream: Tributary washes to Mojave River
Investigator(s): Lauren Brown, Joel Pegyer

Date: 10-2 to 10-3-13 **Time:** 8:30
Town: Barstow **State:** CA
Photo begin file#: **Photo end file#:**

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [X] / N [X] Is the site significantly disturbed? Portions are

Location Details: Range Complex

Projection: WGS 1984 **Datum:**
Coordinates: Geographic

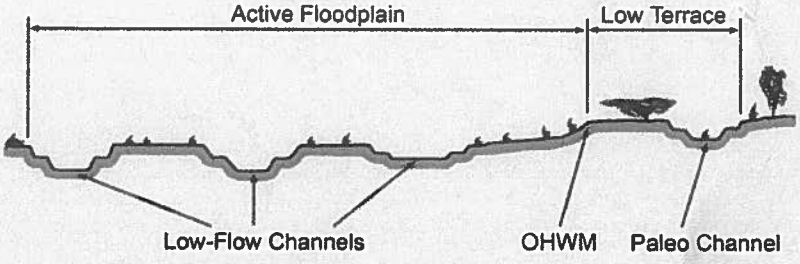
Potential anthropogenic influences on the channel system:
Parking lot, berms, and rifle range berms, roads

Brief site description:
Alluvial piedmont with numerous washes in creosote scrub soils very rocky. Recent storm in September is evident

Checklist of resources (if available):

- [X] Aerial photography
  Dates:
- [X] Topographic maps
- [X] Geologic maps
- [X] Vegetation maps
- [X] Soils maps
- [X] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



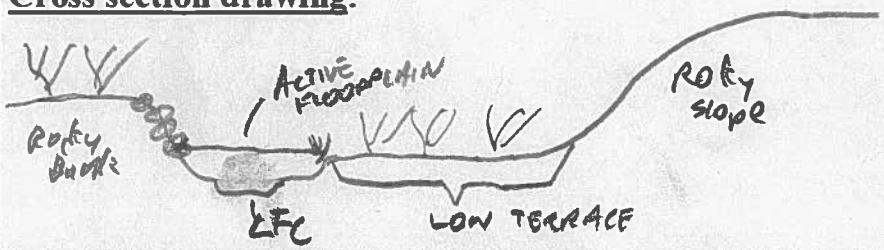
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [ ] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [ ] GPS
   - [ ] Other:

MCLBB TRAINING RANGE

Project ID: RANGE EA **Cross section ID:** Transect 1 **Date:** 2-09-13 **Time:** 930

Cross section drawing:



OHWM

GPS point: OHWM 1 (W + E)

Indicators:

- [x] Change in average sediment texture
- [ ] Change in vegetation species
- [x] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

Recent flow evident. Gutterizin and Debbia along edge

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: Low flow channel 1

Characteristics of the floodplain unit:

Average sediment texture: Gravelly coarse sand

Total veg cover: 0 % Tree: 0 % Shrub: 0 % Herb: 0 %

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [x] Ripples
- [ ] Drift and/or debris
- [x] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [ ] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Active flow channel, clear of vegetation

Project ID: RANGE EA **Cross section ID:** Transect 1 **Date:** 2 OCT 13 **Time:** 930

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: 1 ACTIVE FLOODPLAIN

Characteristics of the floodplain unit:
Average sediment texture: gravels + pebbles
Total veg cover: 15 % Tree: ____ % Shrub: 10 % Herb: 5 %
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☐ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:
Fines and drift and debris deposited on bench, Hymonoclea, Sebbia, gutterlz within and along margin of AF.

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: 1 low terrace

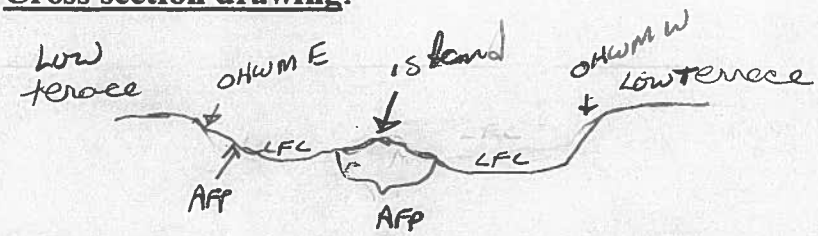
Characteristics of the floodplain unit:
Average sediment texture: pebbles
Total veg cover: 20 % Tree: ____ % Shrub: 10 % Herb: 10 %
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☒ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:
Larrea tridentata, yucca, low terrace evident from landform.

Project ID: RANGE EA **Cross section ID:** Transect 2 **Date:** 2-Oct-2013 **Time:** 11:37

Cross section drawing:



OHWM

GPS point: OHWM 2 East - West

Indicators:

- [x] Change in average sediment texture
- [x] Change in vegetation species
- [ ] Change in vegetation cover
- [x] Break in bank slope
- [x] Other: debris in shrubs
- [ ] Other: _____

Comments:

Lycium growing on edge of active channel
Acacia greggii, Hymenoclea tasola within active channel

Floodplain unit: [X] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: 2 Low flow channel

Characteristics of the floodplain unit:

Average sediment texture: fine sand + gravel

Total veg cover: 0 % Tree: 0 % Shrub: 0 % Herb: 0 %

Community successional stage:

- [X] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [X] Ripples
- [ ] Drift and/or debris
- [X] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [ ] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Clear flowlines from recent storm - sediment deposits also present around larger rocks

Project ID: RANGE EA **Cross section ID:** Transect 2 **Date:** 2-011-2013 **Time:** 1137

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: 2 active floodplain

Characteristics of the floodplain unit:
Average sediment texture: sand + cobbles
Total veg cover: 20 % Tree: ____ % Shrub: 19 % Herb: 1 %
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☒ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:
Acacia greggi, hymenoclea, in active floodplain
Lycium sp growing on edge
Drift deposits in shrubs, some shrubs uprooted

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: 2 low terrace

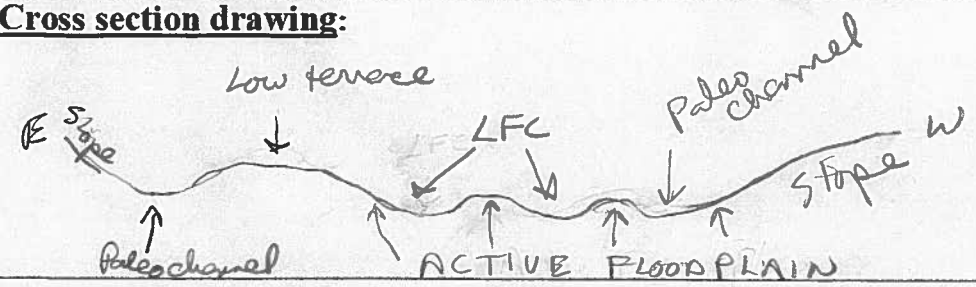
Characteristics of the floodplain unit:
Average sediment texture: pebbles + cobbles and larger
Total veg cover: 15 % Tree: ____ % Shrub: 12 % Herb: 3 %
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☒ Late (herbaceous, shrubs, mature trees)

Indicators: No indicators
- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☒ Surface relief – only
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:
Larrea tridentata, Ambrosia dumosa

Project ID: RANGE EA **Cross section ID:** Transect 3 **Date:** 2-Oct-13 **Time:** 1:39

Cross section drawing:



OHWM

GPS point: OHWM, E & W points on each channel,

Indicators:

- [x] Change in average sediment texture
- [x] Change in vegetation species
- [ ] Change in vegetation cover
- [x] Break in bank slope
- [x] Other: debris
- [ ] Other: _____

Comments:
Paleochannels may get flow in extreme events. Distinct cut bank downstream of transect in LFC

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: 3 LFC

Characteristics of the floodplain unit:
Average sediment texture: Sand + gravel, few larger rocks
Total veg cover: 0 % Tree: ____% Shrub: ____% Herb: ____%
Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [x] Drift and/or debris
- [x] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [ ] Surface relief
- [x] Other: sediment deposits
- [ ] Other: _____
- [ ] Other: _____

Comments:
cut bank downstream

Project ID: RANDEEA **Cross section ID:** Transect 3 **Date:** 2-09-13 **Time:** 1:39 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: 3 Active Floodplain

Characteristics of the floodplain unit:

Average sediment texture: pebbles, cobbles some gravel

Total veg cover: 30 % Tree: ____ % Shrub: 25 % Herb: 5 %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☑ Drift and/or debris
- ☐ Presence of bed and bank
- ☑ Benches
- ☐ Soil development
- ☑ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:

Senna, Lycium, Acacia greggii, Hymenoclea

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☑ Low Terrace

GPS point: ____

Characteristics of the floodplain unit:

Average sediment texture: Cobble, boulders, pebbles

Total veg cover: 20 % Tree: ____ % Shrub: 17 % Herb: 3 %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators: None

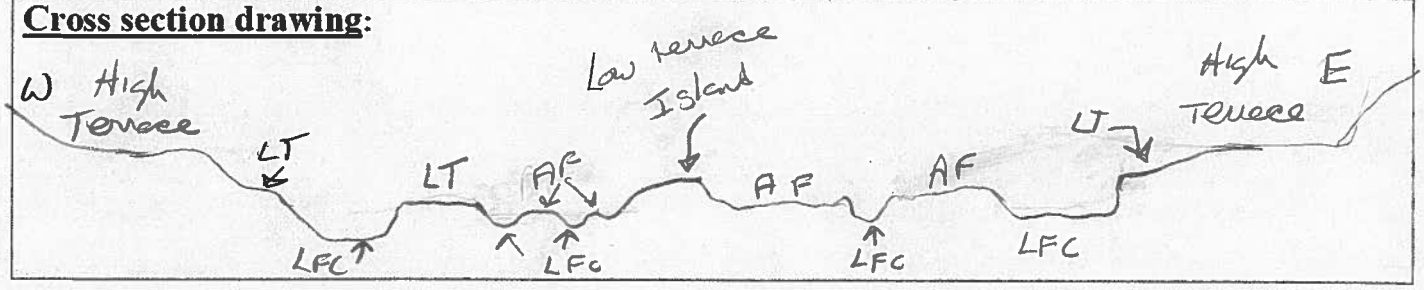
- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:

Larrea tridentata, Cacti (Cylindropuntia)
Ambrosia dumosa

Project ID: RANGEEA **Cross section ID:** Transect 4 **Date:** 2-Oct-1 **Time:** 3:34

Cross section drawing:



OHWM

GPS point: OWM 4 E + W Numerous Flow Channels

Indicators:

- [x] Change in average sediment texture
- [x] Change in vegetation species
- [ ] Change in vegetation cover
- [x] Break in bank slope
- [x] Other: sediment deposits
- [x] Other: drift deposits and uprooted shrubs

Comments:

Floodplain unit:

- [x] Low-Flow Channel
- [ ] Active Floodplain
- [ ] Low Terrace

GPS point: LFC 4

Characteristics of the floodplain unit:

Average sediment texture: sand, silt, gravel

Total veg cover: 0 % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [x] Mudcracks
- [x] Ripples
- [ ] Drift and/or debris
- [x] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [x] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Project ID: RANGE EA **Cross section ID:** Transect 4 **Date:** 2-09-13 **Time:** 3:34 PM

Floodplain unit: ☐ Low-Flow Channel ☑ Active Floodplain ☐ Low Terrace

GPS point: AF 4

Characteristics of the floodplain unit:
Average sediment texture: pebbles, cobbles, silt
Total veg cover: 15% % Tree: ____ % Shrub: 14 % Herb: 1 %
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☑ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☑ Mudcracks
- ☐ Ripples
- ☑ Drift and/or debris
- ☐ Presence of bed and bank
- ☑ Benches
- ☐ Soil development
- ☑ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:
Hymenoclea, Acacia greggii, Bebbia juncea

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☑ Low Terrace

GPS point: ____

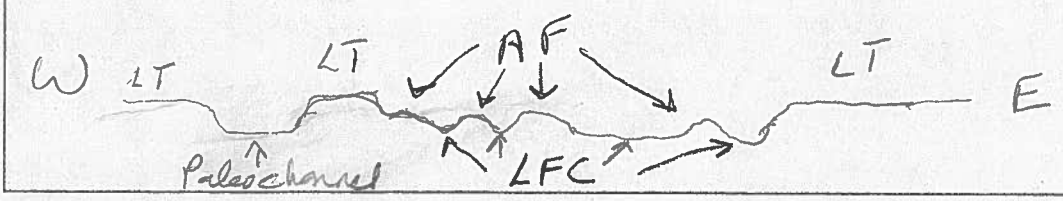
Characteristics of the floodplain unit:
Average sediment texture: cobbles + pebbles
Total veg cover: 15 % Tree: ____ % Shrub: 13 % Herb: 2 %
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☑ Late (herbaceous, shrubs, mature trees)

Indicators: None
- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:
Larrea tridenta, Yucca, Ambrosia dumosa

Project ID: RANGE EA **Cross section ID:** Transect 5 **Date:** 3-04-13 **Time:** 9:35

Cross section drawing:



OHWM

GPS point: OHWM - 5

Indicators:

- [x] Change in average sediment texture
- [x] Change in vegetation species
- [ ] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

Channel is on steeper slope to North, few fine sediments - coarse sand, gravels, pebbles and cobbles

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: LFC 5

Characteristics of the floodplain unit:

Average sediment texture: very coarse sand, granules, pebbles

Total veg cover: 0 % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- [ ] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [x] Ripples
- [ ] Drift and/or debris
- [x] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [x] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Project ID: RANGE EA **Cross section ID:** Transect 5 **Date:** 3-OCT-13 **Time:** 09:35 AM

Floodplain unit: ☐ Low-Flow Channel ☑ Active Floodplain ☐ Low Terrace

GPS point: AF 5

Characteristics of the floodplain unit:
Average sediment texture: granules, pebbles + some cobbles
Total veg cover: 15 % Tree: ____ % Shrub: 14 % Herb: 1 %
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☑ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☐ Mudcracks
- ☐ Ripples
- ☑ Drift and/or debris little
- ☐ Presence of bed and bank
- ☑ Benches
- ☐ Soil development
- ☑ Surface relief
- ☐ Other: uprooted shrubs (few)
- ☐ Other: ____
- ☐ Other: ____

Comments:
Lycium, Hymenoclea, Pectis, Acacia greggii

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☑ Low Terrace

GPS point: LT-5

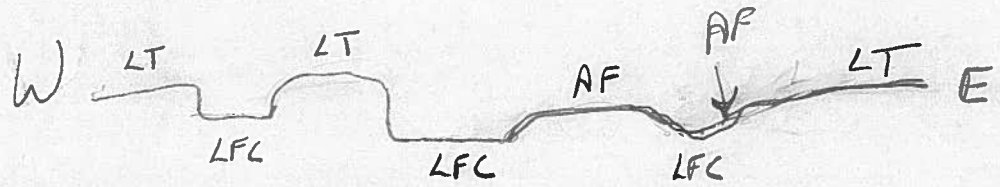
Characteristics of the floodplain unit:
Average sediment texture: pebbles + cobbles
Total veg cover: 25 % Tree: ____ % Shrub: 15 % Herb: 10 %
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☑ Late (herbaceous, shrubs, mature trees)

Indicators: None
- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:
larrea tridentata dominant, Ambrosia dumosa, Pectis (dom Herb), Euphorb (Chamaesyce)

Project ID: RANGE EA **Cross section ID:** Transect 6 **Date:** 3-Oct-13 **Time:** 10:35

Cross section drawing:



OHWM

GPS point: OHWM 6

Indicators:

- [x] Change in average sediment texture
- [x] Change in vegetation species
- [ ] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments: Steep banks up to 3' along drainage.

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: LFC 6

Characteristics of the floodplain unit:

Average sediment texture: fine sediment, coarse sand and granules

Total veg cover: 0 % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [x] Ripples
- [ ] Drift and/or debris
- [x] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [ ] Surface relief
- [x] Other: sediment deposits
- [x] Other: Shallow cut banks
- [ ] Other: _____

Comments:

Project ID: RANGE EA **Cross section ID:** Transect 6 **Date:** 3-Oct-13 **Time:** 1035

Floodplain unit: ☐ Low-Flow Channel ☑ Active Floodplain ☐ Low Terrace

GPS point: AF 6

Characteristics of the floodplain unit:
Average sediment texture: pebbles, cobbles some silt
Total veg cover: 10 % Tree: ____ % Shrub: 10 % Herb: 1 %
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☑ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☑ Mudcracks
- ☐ Ripples
- ☑ Drift and/or debris
- ☐ Presence of bed and bank
- ☑ Benches
- ☐ Soil development
- ☑ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:
Hymenoclea, Senna, a little bit of Lycium, encelia, sandpaper bush
small amount of Pectis

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☑ Low Terrace

GPS point: LT 6

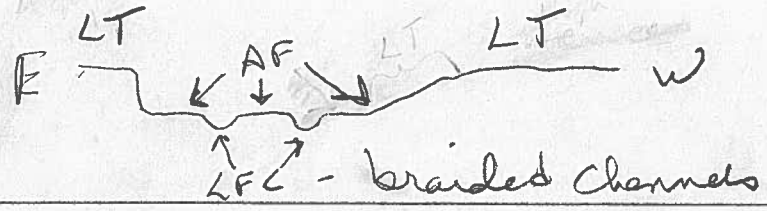
Characteristics of the floodplain unit:
Average sediment texture: pebbles, granules, cobbles
Total veg cover: 20% % Tree: ____ % Shrub: 15 % Herb: 5 %
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☑ Late (herbaceous, shrubs, mature trees)

Indicators: No indicators
- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:
larrea tridentata dominant, Ambrosia dumosa,
Yucca schidigeri, pencil cholla (few).
Chamaesyce and Pectis dominant

Project ID: RANGE EA **Cross section ID:** Transect 7 **Date:** 3-Oct-13 **Time:** 11:20

Cross section drawing:



OHWM

GPS point: OHWM

Indicators:

- [x] Change in average sediment texture
- [ ] Change in vegetation species
- [ ] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments: Alluvial piedmont

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: LFC 7

Characteristics of the floodplain unit:

Average sediment texture: coarse sand and granules

Total veg cover: 0 % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [x] Ripples
- [ ] Drift and/or debris
- [x] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [ ] Surface relief
- [ ] Other: iron and sediment deposits
- [ ] Other: _____
- [ ] Other: _____

Comments:

Project ID: RANGE EA **Cross section ID:** TRANSECT 7 **Date:** 3-OCT-13 **Time:** 1120

Floodplain unit: ☐ Low-Flow Channel ☑ Active Floodplain ☐ Low Terrace

GPS point: AF 7

Characteristics of the floodplain unit:
Average sediment texture: pebbles and granules
Total veg cover: 5 % Tree: ____ % Shrub: 5 % Herb: <1 %
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☑ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☐ Mudcracks
- ☐ Ripples
- ☑ Drift and/or debris
- ☐ Presence of bed and bank
- ☑ Benches
- ☐ Soil development
- ☑ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments: vegetation is along edge of channel, none in channel.
Lycium, Hymenoclea

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☑ Low Terrace

GPS point: LT 7

Characteristics of the floodplain unit:
Average sediment texture: pebbles, cobbles and granules
Total veg cover: ~~25~~ 15 % Tree: ____ % Shrub: 15 % Herb: 10 %
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☑ Late (herbaceous, shrubs, mature trees)

Indicators: None
- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments: larrea tridentata dom, Ambrosia dumosa, some Hymenoclea. Chamaesyce and Rectis
Low terrace very rarely flood.

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: MCLB Barstow
Date: 4-23-2014 **Time:** 730 - 1500
Project Number: Training and Range EA
Town: Barstow, CA **State:** CA
Stream: Tributaries to Mojave River
Photo begin file#: **Photo end file#:**
Investigator(s): Tom Schoenwetter, Joel Degner

Y ☐ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☐ Is the site significantly disturbed?

Location Details: Range complex
Projection: WGS 1984 **Datum:**
Coordinates: Geographic

Potential anthropogenic influences on the channel system:

Parking lots, berms, roads

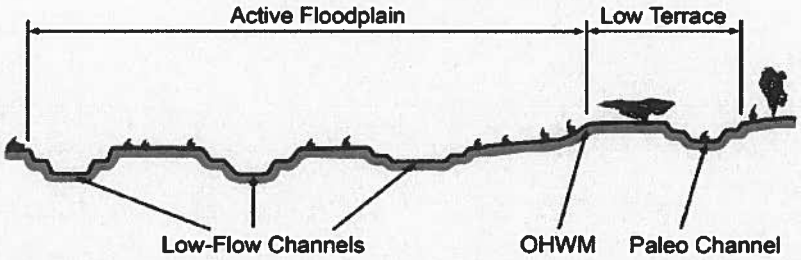
Brief site description:

Alluvial piedmont and alluvial fan, with numerous washes. Soils very rocky. No major storms recently (last major storm sep. 2013)

Checklist of resources (if available):

- ☒ Aerial photography
  Dates:
- ☒ Topographic maps
- ☒ Geologic maps
- ☒ Vegetation maps
- ☒ Soils maps
- ☒ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

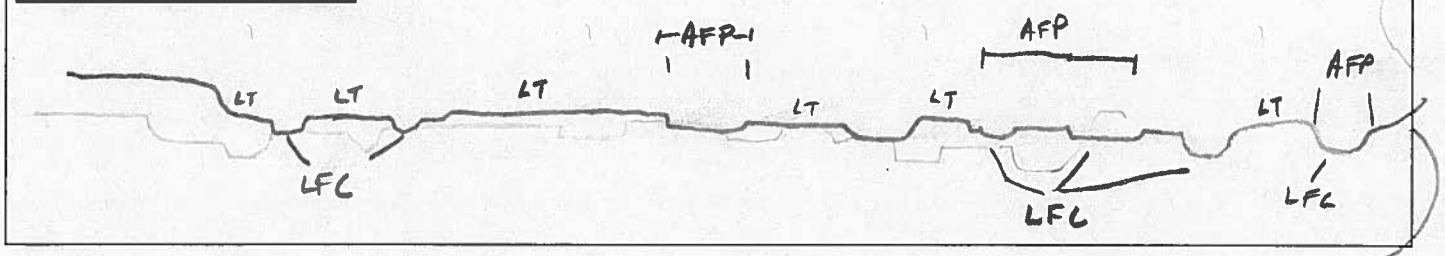


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

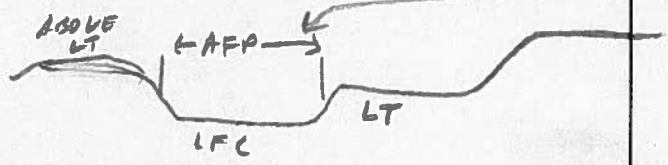
1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☐ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☐ GPS
   - ☐ Other:

Project ID: RANGE EA **Cross section ID:** TRANSECT 8 **Date:** 4-23-2014 **Time:** 730

Cross section drawing:



OHWM



GPS point: 8 OHWM

Indicators:

- [x] Change in average sediment texture
- [x] Change in vegetation species
- [ ] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

Numerous small channels affected by rifle range berm construction

Floodplain unit: [ ] Low-Flow Channel [ ] Active Floodplain [x] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Pebbles + gravel

Total veg cover: 60 % Tree: ____ % Shrub: 20 % Herb: 50 %

Community successional stage:

- [ ] NA
- [ ] Early (herbaceous & seedlings)
- [x] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [ ] Drift and/or debris
- [ ] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [x] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Larrea tridentata, Ambrosia dumosa, Ephedra sp, Ambrosia salsola, schismus sp. understory

Project ID: **Cross section ID:** Transect 8 **Date:** 4-23-14 **Time:** 730

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: 8 AFP

Characteristics of the floodplain unit:

Average sediment texture: Gravel

Total veg cover: 15 % Tree: — % Shrub: 15 % Herb: — %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☒ Ripples
- ☒ Drift and/or debris
- ☐ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Senna sp, Ambrosia salsola, Lycium sp., Ephedra sp., Psorothamnus sp.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: 8 LFC

Characteristics of the floodplain unit:

Average sediment texture: Sand

Total veg cover: — % Tree: — % Shrub: — % Herb: — %

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

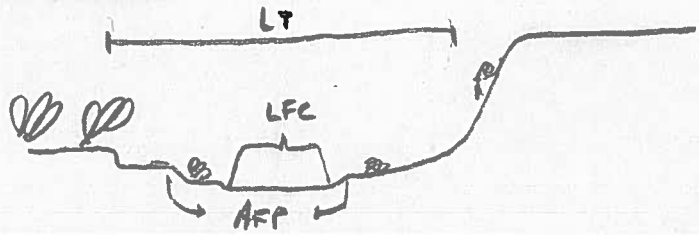
Indicators:

- ☐ Mudcracks
- ☒ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Project ID: RANGE EA **Cross section ID:** TRANSECT 9 **Date:** 4-23-2013 **Time:** 1050

Cross section drawing:



OHWM

GPS point: 9 OHWM E+W

Indicators:

- [x] Change in average sediment texture
- [x] Change in vegetation species
- [ ] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

Floodplain unit:

- [x] Low-Flow Channel
- [ ] Active Floodplain
- [ ] Low Terrace

GPS point: 9 LFC

Characteristics of the floodplain unit:

Average sediment texture: sandy gravel

Total veg cover: — % Tree: — % Shrub: — % Herb: — %

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [x] Ripples
- [ ] Drift and/or debris
- [ ] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [ ] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Project ID: RANGE EA **Cross section ID:** TRANSECT 9 **Date:** 4-23-2013 **Time:** 1050

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: 9 AFP

Characteristics of the floodplain unit:
Average sediment texture: Pebbles
Total veg cover: 30 % Tree: ____ % Shrub: 30 % Herb: ____ %
Community successional stage:
- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☒ Other: change in sediment
- ☐ Other: ____
- ☐ Other: ____

Comments:
Lycium pallida, Ephedra californica, Senna armata, ambrosia dumosa

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: 9 LT

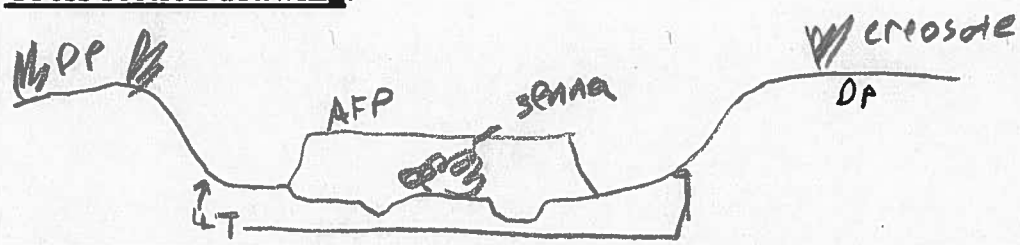
Characteristics of the floodplain unit:
Average sediment texture: Pebblest gravel
Total veg cover: 75 % Tree: ____ % Shrub: 15 % Herb: 60 %
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:
Larrea tridentata, Ambrosia dumosa, Schismus sp., Cylindropuntia sp.

Project ID: RANGE EA **Cross section ID:** TRANSECT 10 **Date:** 4-23-2013 **Time:** 350

Cross section drawing:



OHWM

GPS point: 10 OHWM E+W

Indicators:

- [x] Change in average sediment texture
- [x] Change in vegetation species
- [ ] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

Steep side banks confine channel

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: 10 LFC

Characteristics of the floodplain unit:

Average sediment texture: fine sand

Total veg cover: — % Tree: — % Shrub: — % Herb: — %

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [x] Ripples
- [ ] Drift and/or debris
- [x] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [ ] Surface relief
- [x] Other: Change in texture
- [ ] Other: _____
- [ ] Other: _____

Comments:

Broken into two channels

Project ID: RANGE EA **Cross section ID:** TRANSECT 10 **Date:** 4-23-2014 **Time:** 350

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: 10 AFP

Characteristics of the floodplain unit:
Average sediment texture: Pebble
Total veg cover: 25 % Tree: — % Shrub: 25 % Herb: — %
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:
Ambrosia salsola
Lycium andersonii
Ambrosia dumosa
Psorothamnus
Pencil cholla

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: 10 LT

Characteristics of the floodplain unit:
Average sediment texture: _____
Total veg cover: 35 % Tree: ____ % Shrub: 15 % Herb: 20 % – schismus
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☒ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:
Ambrosia dumosa
Larrea tridentata
Schismus sp.

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: MCLB Barstow
Date: 12/9 to 12/11/14/H **Time:**
Project Number: Training and Range EA
Town: Barstow **State:** CA
Stream: Tributaries to Mojave River and Mojave R. **Photo begin file#:** **Photo end file#:**
Investigator(s): Tara Schoenwetter, Joel Degner

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [X] / N [X] Is the site significantly disturbed? Portions are

Location Details: Range Complex (12-13), Yermo Stables (14)

Projection: WGS 1984 **Datum:**
Coordinates: Geographic

Potential anthropogenic influences on the channel system:

Roads, culverts, and bridge

Brief site description:

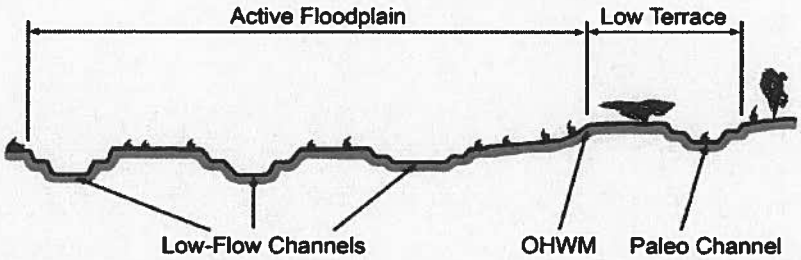
Alluvial fan washes on rocky desert soils. Mojave River floodplain with dune deposits above channel.

Checklist of resources (if available):

- [X] Aerial photography
  Dates:
- [X] Topographic maps
- [X] Geologic maps
- [X] Vegetation maps
- [X] Soils maps
- [X] Rainfall/precipitation maps
- [X] Existing delineation(s) for site
- [X] Global positioning system (GPS)
- [ ] Other studies

- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

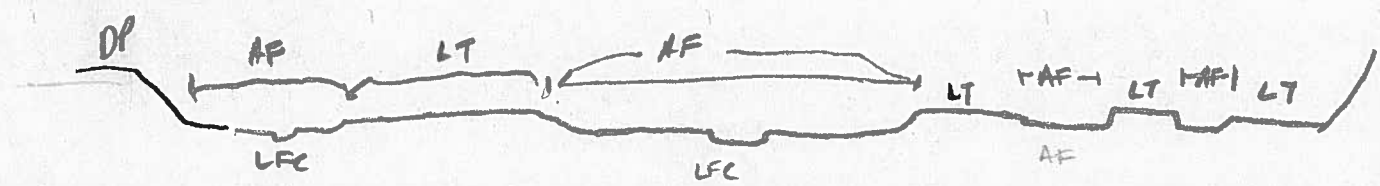


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [ ] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [ ] GPS
   - [ ] Other:

Project ID: RANDEEA **Cross section ID:** TRANSECT 11 **Date:** 12/9/14 **Time:** 1410

Cross section drawing:



OHWM

GPS point: 11 OHWM E+W

Indicators:

- [x] Change in average sediment texture
- [x] Change in vegetation species
- [x] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

OHWM MARKED BY BREAK IN SLOPE, TRANSITION FROM PEBBLES TO COBBLES AND ADDITION OF LYCIUM + CREOSOTE ALONG BANK

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: gravelly sand

Total veg cover: — % Tree: — % Shrub: — % Herb: — %

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [x] Ripples
- [x] Drift and/or debris
- [ ] Presence of bed and bank
- [ ] Benches
- [x] Soil development
- [ ] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Project ID: RANGE EA **Cross section ID:** TRANSECT 11 **Date:** 12/9/14 **Time:** 1410

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: 11 AF

Characteristics of the floodplain unit:

Average sediment texture: PEBBLES + GRAVEL

Total veg cover: 15 % Tree: ____ % Shrub: 15 % Herb: ____ %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:

HYMONOCLEA MAIN SHRUB WITH SOME ASCLOTHAMNUS, SENNA, BERBIA, AND ACACIA SP.

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: 11 LT

Characteristics of the floodplain unit:

Average sediment texture: COBBLES

Total veg cover: 25 % Tree: ____ % Shrub: 25 % Herb: 1 %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

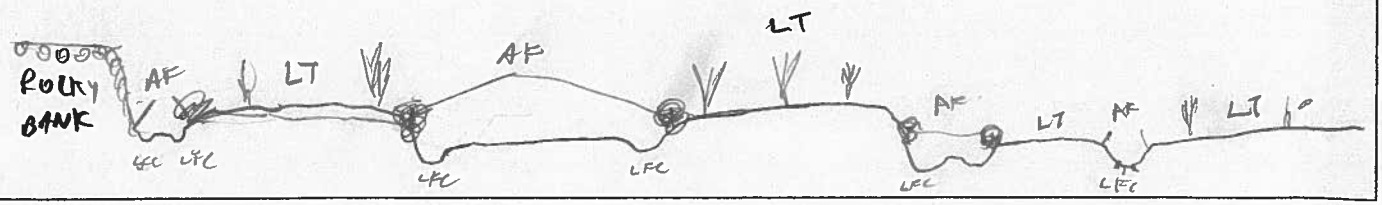
- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☒ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:

CREOSOTE ON TERRACE WITH LYCIUM ON TERRACE EDGE

Project ID: RANGE EA **Cross section ID:** TRANSECT 12 **Date:** 12/10/14 **Time:** 945

Cross section drawing:



OHWM

GPS point: 12 OHWM E+W

Indicators:

- [x] Change in average sediment texture
- [x] Change in vegetation species
- [ ] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

compound channel (4 threads)

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: 12 LFC

Characteristics of the floodplain unit:

Average sediment texture: sand

Total veg cover: 0 % Tree: 0 % Shrub: 0 % Herb: 0 %

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [x] Ripples
- [x] Drift and/or debris
- [ ] Presence of bed and bank
- [ ] Benches
- [x] Soil development
- [ ] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Project ID: RANGE EA **Cross section ID:** TRANSECT 12 **Date:** 12/10/14 **Time:** 0945

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: AFE, AFW

Characteristics of the floodplain unit:
Average sediment texture: Gravelly sand
Total veg cover: 10 % Tree: ____ % Shrub: 10 % Herb: ____ %
Community successional stage:
- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☒ Soil development
- ☐ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:
Hymonoclea salsola, Psorothamnus arborescens, Stephanomeria pauciflora?, Bebbia juncea, Senna armata

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: 12 LT

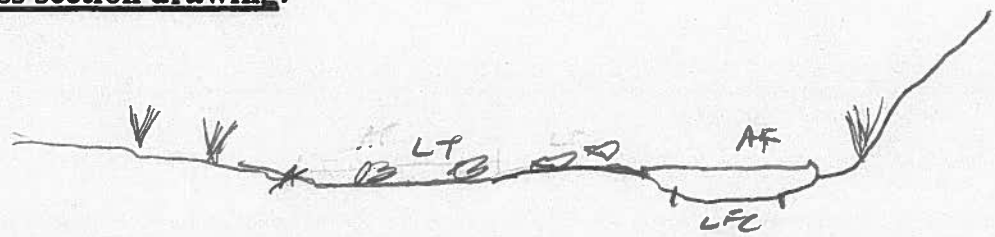
Characteristics of the floodplain unit:
Average sediment texture: cobbles / pebbles
Total veg cover: 20 % Tree: ____ % Shrub: 17 % Herb: 3 %
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☒ Presence of bed and bank
- ☒ Benches
- ☒ Soil development
- ☐ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:
Larrea tridentata, Hymonoclera salsola, Eriogonum inflatum, Yucca mohavensis, Cylindropuntia ramosissima, Psorothamnus arborescens, Senegalia greggii, Schismus sp., Pefalonyx thurberi,

Project ID: RANGE EA **Cross section ID:** TRANSECT 13 **Date:** 12/10/14 **Time:** 1150

Cross section drawing:



OHWM

GPS point: 13 AFE, AFW

Indicators:

- [x] Change in average sediment texture
- [x] Change in vegetation species
- [x] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

Channel has been disturbed, tire tracks in channel. Upstream some erosion deposits from road, downstream is the scar from the pipeline. Road graded regularly.

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: LFC

Characteristics of the floodplain unit:

Average sediment texture: course sand

Total veg cover: 0 % Tree: 0 % Shrub: 0 % Herb: 0 %

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [x] Ripples
- [x] Drift and/or debris
- [x] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [ ] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Tire tracks in channel

Project ID: RANGE EA **Cross section ID:** TRANSECT 13 **Date:** 12/10/14 **Time:** 1150

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: AFW, AFE

Characteristics of the floodplain unit:

Average sediment texture: Pebbles

Total veg cover: 15 % Tree: ____ % Shrub: 15 % Herb: ____ %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☒ Soil development
- ☐ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:

Hymenoclea salsola, Senna sp.
Boundary is somewhat ambiguous due to disturbance upstream.

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: LT

Characteristics of the floodplain unit:

Average sediment texture: Cobbles/pebbles

Total veg cover: 25 % Tree: ____ % Shrub: 20 % Herb: 5 %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

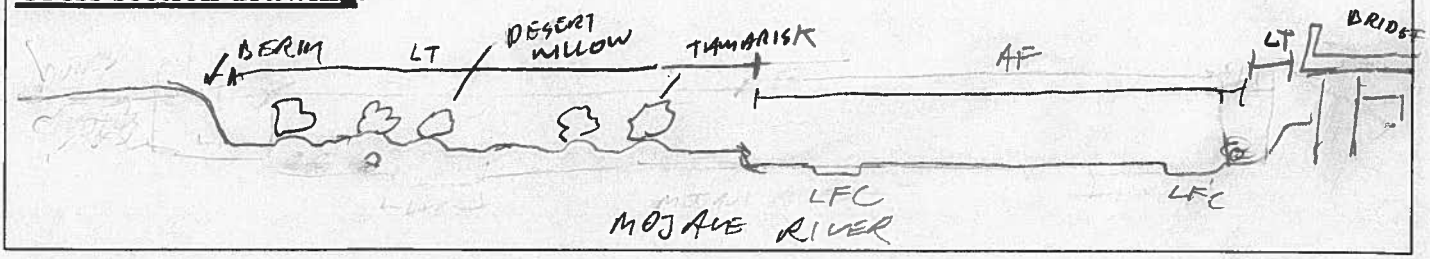
- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☒ Presence of bed and bank
- ☒ Benches
- ☒ Soil development
- ☐ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:

Larrea tridentata, Senna sp., Hymenoclea salsola, Ambrosia dumosa, Krameria sp., Schismus sp., Cryptantha sp. Camissonia sp., Pectis sp.

Project ID: RANGE EA **Cross section ID:** TRANSECT 14 **Date:** 12/1/14 **Time:** 0930

Cross section drawing:



OHWM

GPS point: AFE, AFW

Indicators:

- [x] Change in average sediment texture
- [x] Change in vegetation species
- [ ] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

The OHWM is clearly defined by mudcrack deposits and a break in bank slope due to recent flows. Off-road vehicle use prevalent along Mojave river bottom

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: LFC N, S

Characteristics of the floodplain unit:

Average sediment texture: Fine sand

Total veg cover: 0 % Tree: 0 % Shrub: 0 % Herb: 0 %

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [x] Ripples
- [ ] Drift and/or debris
- [x] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [ ] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Low flow channel is where the water has washed the mud away leaving fine sand.

Project ID: RANGEEA **Cross section ID:** TRANSECT 14 **Date:** 12/11/14 **Time:** 930

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: AFN, AFS

Characteristics of the floodplain unit:
Average sediment texture: SILT/CLAY
Total veg cover: 5 % Tree: ____ % Shrub: 4 % Herb: 1 %
Community successional stage:
- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☒ Mudcracks
- ☒ Ripples
- ☐ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:
Active floodplain is clearly marked by mudcrack deposits, species included Lepidospartum squamatum, Salsola tragis, Schismus sp., Poaceae species, Camisonia sp., Figuillia plicata

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: LT

Characteristics of the floodplain unit:
Average sediment texture: Fine sand lens of gravel and pebbles
Total veg cover: 20 % Tree: 5 % Shrub: 15 % Herb: 3 %
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☒ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☒ Mudcracks
- ☒ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☒ Soil development
- ☐ Surface relief
- ☐ Other: ____
- ☐ Other: ____
- ☐ Other: ____

Comments:
Evidence of fluvial deposits surrounding dune hummocks which form around desert willows and tamarisk. 3 different vegetation types, Tamarisk dominate close to active floodplain, then desert willow dominate, then saltbush and ephedra dominate. Herbaceous layer includes Schismus sp., Camissionia, Cryptantha, Cucurbita palmata

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: MCLB-Barstow City/County: San Bernardino Sampling Date: 4-Oct-13

Applicant/Owner: Dept of Defense State: CA Sampling Point: Pit 1

Investigator(s): L Brown, J. Agner Section, Township, Range: _____

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR): LRR D Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: (112) Cajon Sand 0-2% Slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation Y, Soil Y, or Hydrology _____ significantly disturbed? Yes Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	Is the Sampled Area within a Wetland? Yes _____ No ✓
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks: Area is disturbed with mounds and low soil spots. Tamarisk is a non-native, weedy species. No nexus to Mojave River (TNW).

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 0)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: 3m)			
1. Tamarix ramosissima	25%	Y	FAC
2. Atriplex polycarpa	2	N	FACU
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: 0)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	_____ = Total Cover		
Woody Vine Stratum (Plot size: 0)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

✓ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks: need to confirm Tamarisk species. – T. ramosissima – identified as synonym for T. chinensis in 2013 National Wetland Plant List (Lichvar 2013)

SOIL

Sampling Point: Pit 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-1	10YR 4/4	100%					silty clay.	
1-11	10YR 4/4						clayey silt	
11-12							pebbles, granules, coarse sand	
12-22	10YR 4/4						coarse sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (LRR C)
- ___ 2 cm Muck (A10) (LRR B)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No ✓

Remarks: 0-1 - layers of sediment.
0-11 layer - water absorbed fairly quickly.
No hydric soil indicators

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ✓ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (Riverine)
- ___ Sediment Deposits (B2) (Riverine)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ___ No ✓ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): ___

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Negative alpha, alpha test.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: MCLBB City/County: San Bernardino Sampling Date: 21-Apr 2015
Applicant/Owner: DoD State: CA Sampling Point: PIT 2
Investigator(s): L. Brown, T. Schoenwetter Section, Township, Range: _____
Landform (hillslope, terrace, etc.): terrace - low floodplain Local relief (concave, convex, none): none Slope (%): 0%
Subregion (LRR): LRR D Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: Riverwash NWI classification: Riverine

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? No Are "Normal Circumstances" present? Yes ✓ No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	Is the Sampled Area within a Wetland? Yes _____ No ✓
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks: Pit in side channel of Mojave River. Creates soil surface and flow lines

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: 3 m)			
1. Chilopsis linearis	90	Y	FACU
2.			
3.			
4.			
5.			
	90 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. Schismus	8	Y	N/A
2. Salsola tragus	2	Y	N/A
3.			
4.			
5.			
6.			
7.			
8.			
	10 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 90 % Cover of Biotic Crust 0

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	_____	x 1 = _____
FACW species	_____	x 2 = _____
FAC species	_____	x 3 = _____
FACU species	_____	x 4 = _____
UPL species	_____	x 5 = _____
Column Totals:	_____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: desert willow and tamarisk are on hummocks within the floodplain

SOIL

Sampling Point: 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-0.5	10YR 3/2	100					loam	
0.5-12	2.5Y 5/3	100%					coarse sand + finer sands	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (LRR C)
- ___ 2 cm Muck (A10) (LRR B)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No ✓

Remarks: Horizontal layers of soil materials - fine + coarser sand, indicative of deposition. Area floods periodically for short terms. Some layers very coarse sand, No redox features.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ✓ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (Riverine)
- ___ Sediment Deposits (B2) (Riverine)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ___ No ✓ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): ___

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil cracks are about 1/2" of sediment over sandy layers. These are in between hummocks that support desert willow and tamarisk

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Attachment D

Representative Photos

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Range West: Photograph 1 is the looking north from Transect 1 at the southern end of the western survey area and depicts the low flow channel and active floodplain.

Range West: Photograph 2 is looking east across the broad alluvial wash with braided channels just above the proposed LHA/LHD site.

Range West: Photograph 3 is looking west across Transect 2. This is the largest wash at the southern end of the western survey area and the photo depicts the low flow channel in the foreground (no vegetation), a raised island of active floodplain (with some acacia and cheesebush), followed by another low flow channel. The low terrace of the broad alluvial wash can be seen in the background above the steep rocky bank.

Range West: Photograph 4 shows the transition from the low flow channel to the low terrace with a clear change in sediments.

Range West: Photograph 5 is the drainage on the west side of Range West. The channel has created a steep cutbank in the south ridgeline.

Range West: Photograph 6 is looking west across Transect 4 in the northern section of the western survey area. The channel is very broad, with the low flow channel in the foreground transitioning to a cobble matrix and cheesebush (*Hymenoclea salsola*) on the active flood plain.

Range Main Supply Route: Photograph 7 is looking north downstream of the channel at Transect 12 on the western portion of the Range Main Supply Route.

Range Main Supply Route: Photograph 8 is looking west across Transect 11 in the middle section of the Range Main Supply Route. The channel is wide and transitions to a cobble bench along the active floodplain.

Range Main Supply Route: Photograph 9 is looking upstream (south) of the channel at Transect 13 on the Range Main Supply Route. The channel has been utilized by vehicles to connect to the utility corridor.

Range Main Supply Route: Photograph 10 is looking east where the major wash at the west end of the range crosses the existing utility ROW access route. Sediment flooded the road on 3 September 2013 and a small gully formed in the road bed causing vehicle traffic to avoid that section of the road bed.

Range East and KD Range Complex: Photograph 11 is looking north down a wash in Transect 5 near LZ 1. The proposed landing zone is on the low terrace left (west) of the channel.

Range East and KD Range Complex: Photograph 12 is looking west across Transect 6. This is the large wash downstream of the KD Rifle Range. A clear bank marks the edge of the active floodplain and the low terrace.

Range East and KD Range Complex: Photograph 13 is the channel upstream from Transect 6, where it crosses the access road to the KD Rifle Range. Floods have broken up much of the former hardened concrete crossing.

Range East and KD Range Complex: Photograph 14 is looking south from Transect 7. Most the channel is devoid of vegetation with cheesebush on the margins. The low terrace is dominated by creosote bush and larger cobbles.

Range East and KD Range Complex: Photograph 15 depicts the soil mudcracks (evidence of ponding) along the access road paralleling Interstate 40. Drainage from the range north across Interstate 40 to the Mojave River has been interrupted by roads and berms, such that water likely only reaches the Mojave River in major flood events.

Range East and KD Range Complex: Photograph 16 is looking south upstream at the well-defined channel at Transect 8 towards the KD Rifle Range targets.

Range East and KD Range Complex: Photograph 17 is looking upstream (south) at the single-thread channel at Transect 9 with *Ephedra california*, *Lycium pallidum*, and *Senna armata* growing on the banks of the channel.

Range East and KD Range Complex: Photograph 18 is looking north downstream at Transect 10 with *Senna armata* growing in the active floodplain.

Yermo Stables: Photograph 19 depicts the terrain at LZ 2. The topography is flat and no drainages have developed in the area.

Yermo Stables: Photograph 20 shows examples of several dirt piles which are located throughout the LZ 2 area. These man-made piles have created unnatural topography in portions of the survey area. The depressions pond water (evidenced by mudcracks) after storm events and allowed the establishment of a saltcedar.

Yermo Stables: Photograph 21 shows the location of Wetland Pit 1 near the saltcedar. This site had evidence of hydrology (mudcracks and depression) and wetland vegetation (saltcedar).

Yermo Stables: Photograph 22 shows the profile of Wetland Pit 1. The soils had no positive indicators for a hydric soil and the area did not meet the criteria for determination of USACE jurisdictional wetlands.

Yermo Stables: Photograph 21 shows mudcracks and Russian thistle (*Salsola tragus*) looking west upstream of the Mojave River active floodplain near Transect 14.

Yermo Stables: Photograph 22 shows the transition between the active floodplain (mudcracks and break in slope) and the low terrace of the Mojave River near Transect 14 looking east.

Yermo Stables: Photograph 23 shows coarse sand soils at Wetland Pit 2 on a side channel of the Mojave River.

Yermo Stables: Photograph 24 shows the stand of desert willow at Wetland Pit 2 adjacent to the Mojave River.

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Appendix D-4

Desert Tortoise Impact Calculations

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DRAFT

Table 1. Desert Tortoise (DT) Impacts due to Construction

Type	Acres	Acres per DT	DT Harassed by Translocation	DT Affected by Removal of Habitat
[1]	[2]	[3]	[4]	[4]
Existing Habitat Disturbed by Construction	96	38	2.5	-
Existing Habitat Permanently Removed by Construction	75	38	-	2.0
		Total	**2.5**	**2.0**

Assumptions

[1]: Type of construction activity

[2]: Area impacted by the activity

[3] = 977 acres/ 25.8 DT: The Range Complex is 977 acres. The Spring 2015 DT protocol surveys estimated a total number of 25.8 DT.

[4] = [2] / [3]: DT affected is calculated by dividing the acres of disturbed habitat by the acres per tortoise

[5] = [2] / [3]: DT affected is calculated by dividing the permanent impact area by the acres per tortoise

Table 2. Desert Tortoise (DT) Impacts due to On-road Vehicle Travel

Type	Annual Vehicle Miles Travelled on Range Complex	Average Vehicles per Convoy	Area Covered by Vehicles on Range Complex (acres)	Acres per DT	Vehicle DT Encounters per Year	Annual Harassment	Annual Kills
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Tactical Vehicle Usage on Roads	23,840	10	2,143	38	14	3.5	0.7
Range Maintenance Activities on Roads	2,776	2	1,121	38	7	1.9	0.4

Assumptions

[1]:Type of training activity.

[2]: Only the vehicle usage on the Range Complex would affect DT. The numbers of vehicle miles travelled are provided on the 'Vehicle Usage' tab.

[3]: Most training exercises would include vehicles moving in convoys. It is assumed that vehicles in convoys would have the same effect as one vehicle, with the lead vehicle encountering the DT.

[4] = [2] / [3] * 89/12*5280/43560: The vehicle miles travelled divided by the number of average vehicles in a convoy, multiplied by the average width of a vehicle (tactical = 89 inches, see 'Vehicle Usage' tab, maintenance = 80 inches [F150]) and converting to acres.

[5] = 977 acres/ 25.8 DT: The Range Complex is 977 acres. The Spring 2015 DT protocol surveys estimated a total number of 25.8 DT.

[6] = [5] / [4]*0.25: The total area annually covered by vehicle convoys divided by the acres/DT and multiplied by the percent of the time that DT are above ground. It is assumed DT would not have burrows in driving areas. The 25 percent is based on 1,538 radio telemetry guided locations of DT in the western Mojave Desert recorded in 1997 and 1998 by Ty Gardner. From March to September DT were found inside of their burrows, caliche cave, or rock shelters 55% of the time. During the colder half of the year it is assumed that DTs are in their burrows 100% of the time. With time in burrows estimated at 55% from March to September and 100% from October to February, the total time in burrows would be approximately 75% and above ground 25%.

[7] = [6] * 0.25: It is assumed that approximately 1/4 of the time a DT encounter would result in harassment of the DT.

[8] = [7]*0.05: It is assumed that 5 percent of DT encounters would result in crushing of the DT. This is based on a study of the ability of drivers to detect road hazards (Underwood et al. 2013) . The results ranged from 92 to 97 percent of the time the hazard was detected depending on the driver and the hazard type. Based on this study, it is estimated 5% of the time a driver might not detect a DT.

Table 3. Desert Tortoise (DT) Impacts due to Off-road Vehicle Dispersal

Type	Vehicles Dispersed Off Road Per Year	Area Covered by Dispersed Vehicles (acres)	Acres per DT	Above Ground DT Encounters	Below Ground DT Encounters	Burrows Destroyed	Annual Harassment	Annual Kills
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Tactical Vehicle Dispersal Off-roads	201	90.3	38	0.6	0.9	9.0	9.2	0.9

Assumptions

[1]:Type of training activity.

[2]:(Vehicles in Range Complex)*0.2: The total number of vehicles used on the Range Complex (see 'Vehicle Usage' tab) multiplied by 0.2 .It is estimated that 20 percent of vehicles used in training would disperse into different positions outside of the main bivouac areas.

[3] = [2] *5280* 89/12*/43560: The number vehicle multiplied by 0.5 miles travelled (there and back for dispersal) multiplied by the average width of a tactical vehicle (89 inches, see 'Vehicle Usage' tab above) and converting to acres.

[4] = 977 acres/ 25.8 DT: The Range Complex is 977 acres. The Spring 2015 DT protocol surveys estimated a total number of 25.8 DT.

[5] = [6] = [5] / [4]*0.25: The total area annual covered by vehicle divided by the acres/DT and multiplied by the percent of the time that DT are above ground. It is assumed DT would not have burrows in driving areas. The 25 percent is based on 1,538 radio telemetry guided locations of DT in the western Mojave Desert recorded in 1997 and 1998 by Ty Gardner. From March to September DT were found inside of their burrows, caliche cave, or rock shelters 55% of the time. During the colder half of the year it is assumed that DTs are in their burrows 100% of the time. With time in burrows estimated at 55% from March to September and 100% from October to February, the total time in burrows would be approximately 75% and above ground 25%.

[6] = [3]/[4]*0.75*0.5: DT encountered below ground is estimated by the area covered divided by the acres per DT, multiplied by 0.75 for time spent in burrow and also multiplied by 0.5 because it is estimated that at least half the area covered by dispersed vehicles will be along the active floodplain channels where no DT burrows are found.

[7] = [3]/(305/61)*0.5: The burrows destroyed is estimated by the area covered divided by the acres per burrow and multiplied by 0.5. The acres per burrow in the vehicle dispersal areas is calculated by the total area (305 acres) divided by the number of burrows located during the surveys (61) in that area. The total is multiplied by 0.5 because at least half of the miles will occur in the active floodplain channels where no burrows are found.

[8] = [5] / 0.25 + [7]: The annual harassments is estimated as the sum of 25 percent of the above ground DT encounters and the total numbers of burrows destroyed. Each time a burrow is destroyed it would likely cause harassment to the DT living in that area.

[9] = [5]*0.05+[6]: It is assumed that 5 percent of DT encounters above ground and 100% of the DT below ground would result in crushing of the DT. This is based on a study of the ability of drivers to detect road hazards (Underwood et al. 2013) . The results ranged from 92 to 97 percent of the time the hazard was detected depending on the driver and the hazard type. Based on this study, it is estimated 5% of the time a driver might not detect a DT.

Table 4. Desert Tortoise (DT) Impacts due to Tactical Landings by Aircraft

Type	Landings	Landings Within Range Complex	Acres per DT	DT Harassed by Approach/Takeoff Downwash Per Landing	DT Harassed in Focused Downwash Impact Area per Landing	DT Killed in Focused Downwash Impact Area per Landing	Annual Harassment	Annual Kills
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Tactical Landings (Stop and Go)	438	373	38	0.02	0.002	0.001	6.9	0.2

Assumptions

[1]:The only landings that would occur in unimproved zones would be Stop and Go Landings (aka Tactical Landings).

[2]: The total number of Stop and Go landings is provided in the 'Aircraft Range Ops - GME' tab and summarized in table above.

[3] = [2]* 0.85: Based on the 'Aircraft Range Ops - GME', 70% of the landings would occur near the LHA/LHD site and 15% would occur at LZ 1 for a total of 85% at the Range Complex

[4] = 977 acres/ 25.8 DT: The Range Complex is 977 acres. The Spring 2015 DT protocol surveys estimated a total number of 25.8 DT.

[5] = 2.5826 acres / [4] * 0.25 : Based on a approach/takeoff downwash footprint, approximately 2.5826 acres would be affected by downwash each landing. The area affected by downwash (2.5826 acres) is divided by [4] (the acres per DT) to estimate the DT affected per landing. When DT are in borrows, caliche cave, or rock shelters downwash impacts are expected to be minimal (except when directly under aircraft (see [6]0). Based on 1,538 radio telemetry guided locations of desert tortoise in the western Mojave Desert recorded in 1997 and 1998 from March to September DT were found inside of their burrows, caliche cave, or rock shelters 55% of the time, see 'Tortoise Data' tab. During the colder half of the year it is assumed that tortoises are in their burrows 100% of the time. With time in burrows estimated at 55% from March to September and 100% from October to February, the total time in burrows would be approximately 75% and above ground 25%.

[6] = 0.07805 acre / [4]*0.75: The area directly under the aircraft would experience substantially greater impacts due to focused downwash, engine exhaust heat, and landing gear. This is estimated to be a 40' x 85' rectangle covering 0.07805 acres. It is assumed that if the tortoise is in the burrow directly beneath an aircraft (75 % of time), they would be harassed but not likely killed.

[7] = 0.07805 acre / [4]*0.25: If the DT is above ground and an aircraft lands directly over it, it would likely be killed.

[8] = [2]*[5] + [2]*[6]: Annual harassment is the total landings multiplied by harassments in the approach/takeoff downwash zone and harassments in the focused downwash zone.

[9] = [2]*[7]: Annual kill is estimated by total landings multiplied by the DT killed in the direct downwash zone per landing.

Aircraft Type	Annual Tactical Landings (Stop and
H-1	40
MV-22	270
CH53	78
UH-72	0
UH-60	25
CH-47	25
Total	**438**

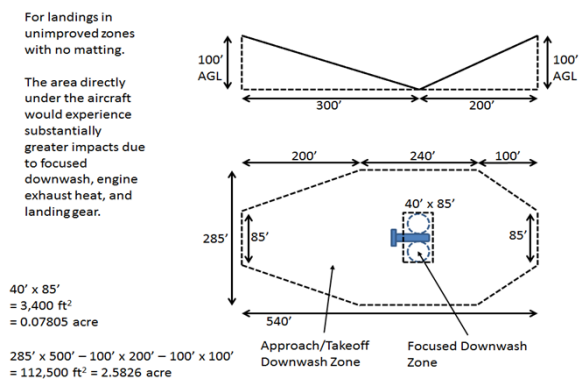

Table 5: Projected Desert Tortoise (DT) Impacts for 50 Years Distributed Across Range Complex

Year	Range East DT Impacts							Range West DT Impacts							Range Main Supply Route DT Impacts							Total DT Impacts		
	Estimated DT	Tactical Landings	Tactical Vehicles Off-road	Tactical Vehicles On-Road	Range Mant. On-road	Annual Kills	Percent Mortality	Estimated DT	Tactical Landings	Tactical Vehicles Off-road	Tactical Vehicles On-Road	Range Mant. On-road	Annual Kills	Percent Mortality	Estimated DT	Tactical Landings	Tactical Off-road	Tactical On-Road	Range on Road	Annual Kills	Percent Mortality	Total Estimated DT	Total Annual Kills	Percent Unnatural Mortality
		58%	40%	46%	46%				39%	41%	19%	19%				3%	19%	35%	35%					
Year 1	8.0	0.1	0.4	0.4	0.2	1.1	14%	7.6	0.1	0.4	0.1	0.1	0.7	10%	10.1	0.0	0.2	0.3	0.1	0.6	6%	25.8	2.5	9.5%
Year 2	7.0	0.1	0.4	0.3	0.2	0.9	14%	6.9	0.1	0.4	0.1	0.1	0.7	10%	9.5	0.0	0.2	0.3	0.1	0.7	7%	23.3	2.3	9.9%
Year 3	6.0	0.1	0.3	0.3	0.1	0.8	14%	6.2	0.1	0.3	0.1	0.1	0.6	10%	8.8	0.0	0.2	0.3	0.1	0.6	7%	21.0	2.1	9.8%
Year 4	5.2	0.1	0.3	0.2	0.1	0.7	14%	5.6	0.1	0.3	0.1	0.1	0.5	10%	8.2	0.0	0.2	0.3	0.1	0.6	7%	19.0	1.8	9.7%
Year 5	4.5	0.1	0.2	0.2	0.1	0.6	14%	5.1	0.1	0.3	0.1	0.1	0.5	10%	7.6	0.0	0.2	0.3	0.1	0.6	7%	17.1	1.7	9.6%
Year 6	3.9	0.1	0.2	0.2	0.1	0.5	14%	4.6	0.0	0.3	0.1	0.0	0.4	10%	7.0	0.0	0.2	0.2	0.1	0.5	7%	15.5	1.5	9.6%
Year 7	3.3	0.1	0.2	0.2	0.1	0.5	14%	4.2	0.0	0.2	0.1	0.0	0.4	10%	6.5	0.0	0.2	0.2	0.1	0.5	7%	14.0	1.3	9.5%
Year 8	2.9	0.0	0.1	0.1	0.1	0.4	14%	3.8	0.0	0.2	0.1	0.0	0.4	10%	6.0	0.0	0.1	0.2	0.1	0.4	7%	12.7	1.2	9.4%
Year 9	2.5	0.0	0.1	0.1	0.1	0.3	14%	3.4	0.0	0.2	0.1	0.0	0.3	10%	5.6	0.0	0.1	0.2	0.1	0.4	7%	11.5	1.1	9.4%
Year 10	2.2	0.0	0.1	0.1	0.1	0.3	14%	3.1	0.0	0.2	0.1	0.0	0.3	10%	5.2	0.0	0.1	0.2	0.1	0.4	7%	10.4	1.0	9.3%
Year 11	1.9	0.0	0.1	0.1	0.0	0.3	14%	2.8	0.0	0.2	0.1	0.0	0.3	10%	4.8	0.0	0.1	0.2	0.1	0.4	7%	9.4	0.9	9.2%
Year 12	1.6	0.0	0.1	0.1	0.0	0.2	14%	2.5	0.0	0.1	0.0	0.0	0.2	10%	4.5	0.0	0.1	0.2	0.1	0.3	7%	8.6	0.8	9.2%
Year 13	1.4	0.0	0.1	0.1	0.0	0.2	14%	2.3	0.0	0.1	0.0	0.0	0.2	10%	4.1	0.0	0.1	0.1	0.1	0.3	7%	7.8	0.7	9.1%
Year 14	1.2	0.0	0.1	0.1	0.0	0.2	14%	2.0	0.0	0.1	0.0	0.0	0.2	10%	3.8	0.0	0.1	0.1	0.1	0.3	7%	7.1	0.6	9.1%
Year 15	1.0	0.0	0.1	0.0	0.0	0.1	14%	1.8	0.0	0.1	0.0	0.0	0.2	10%	3.5	0.0	0.1	0.1	0.1	0.3	7%	6.4	0.6	9.0%
Year 16	0.9	0.0	0.0	0.0	0.0	0.1	14%	1.7	0.0	0.1	0.0	0.0	0.2	10%	3.3	0.0	0.1	0.1	0.0	0.2	7%	5.9	0.5	8.9%
Year 17	0.8	0.0	0.0	0.0	0.0	0.1	14%	1.5	0.0	0.1	0.0	0.0	0.1	10%	3.0	0.0	0.1	0.1	0.0	0.2	7%	5.3	0.5	8.9%
Year 18	0.7	0.0	0.0	0.0	0.0	0.1	14%	1.4	0.0	0.1	0.0	0.0	0.1	10%	2.8	0.0	0.1	0.1	0.0	0.2	7%	4.9	0.4	8.8%
Year 19	0.6	0.0	0.0	0.0	0.0	0.1	14%	1.2	0.0	0.1	0.0	0.0	0.1	10%	2.6	0.0	0.1	0.1	0.0	0.2	7%	4.4	0.4	8.8%
Year 20	0.5	0.0	0.0	0.0	0.0	0.1	14%	1.1	0.0	0.1	0.0	0.0	0.1	10%	2.4	0.0	0.1	0.1	0.0	0.2	7%	4.0	0.4	8.7%
Year 21	0.4	0.0	0.0	0.0	0.0	0.1	14%	1.0	0.0	0.1	0.0	0.0	0.1	10%	2.2	0.0	0.1	0.1	0.0	0.2	7%	3.7	0.3	8.7%
Year 22	0.4	0.0	0.0	0.0	0.0	0.1	14%	0.9	0.0	0.1	0.0	0.0	0.1	10%	2.1	0.0	0.0	0.1	0.0	0.2	7%	3.4	0.3	8.6%
Year 23	0.3	0.0	0.0	0.0	0.0	0.0	14%	0.8	0.0	0.0	0.0	0.0	0.1	10%	1.9	0.0	0.0	0.1	0.0	0.1	7%	3.1	0.3	8.6%
Year 24	0.3	0.0	0.0	0.0	0.0	0.0	14%	0.7	0.0	0.0	0.0	0.0	0.1	10%	1.8	0.0	0.0	0.1	0.0	0.1	7%	2.8	0.2	8.5%
Year 25	0.2	0.0	0.0	0.0	0.0	0.0	14%	0.7	0.0	0.0	0.0	0.0	0.1	10%	1.7	0.0	0.0	0.1	0.0	0.1	7%	2.6	0.2	8.5%
Year 26	0.2	0.0	0.0	0.0	0.0	0.0	14%	0.6	0.0	0.0	0.0	0.0	0.1	10%	1.5	0.0	0.0	0.1	0.0	0.1	7%	2.4	0.2	8.5%
Year 27	0.2	0.0	0.0	0.0	0.0	0.0	14%	0.5	0.0	0.0	0.0	0.0	0.1	10%	1.4	0.0	0.0	0.0	0.0	0.1	7%	2.2	0.2	8.4%
Year 28	0.2	0.0	0.0	0.0	0.0	0.0	14%	0.5	0.0	0.0	0.0	0.0	0.0	10%	1.3	0.0	0.0	0.0	0.0	0.1	7%	2.0	0.2	8.4%
Year 29	0.1	0.0	0.0	0.0	0.0	0.0	14%	0.4	0.0	0.0	0.0	0.0	0.0	10%	1.2	0.0	0.0	0.0	0.0	0.1	7%	1.8	0.2	8.3%
Year 30	0.1	0.0	0.0	0.0	0.0	0.0	14%	0.4	0.0	0.0	0.0	0.0	0.0	10%	1.1	0.0	0.0	0.0	0.0	0.1	7%	1.7	0.1	8.3%
Year 31	0.1	0.0	0.0	0.0	0.0	0.0	14%	0.4	0.0	0.0	0.0	0.0	0.0	10%	1.1	0.0	0.0	0.0	0.0	0.1	7%	1.5	0.1	8.3%
Year 32	0.1	0.0	0.0	0.0	0.0	0.0	14%	0.3	0.0	0.0	0.0	0.0	0.0	10%	1.0	0.0	0.0	0.0	0.0	0.1	7%	1.4	0.1	8.2%
Year 33	0.1	0.0	0.0	0.0	0.0	0.0	14%	0.3	0.0	0.0	0.0	0.0	0.0	10%	0.9	0.0	0.0	0.0	0.0	0.1	7%	1.3	0.1	8.2%
Year 34	0.1	0.0	0.0	0.0	0.0	0.0	14%	0.3	0.0	0.0	0.0	0.0	0.0	10%	0.8	0.0	0.0	0.0	0.0	0.1	7%	1.2	0.1	8.2%
Year 35	0.1	0.0	0.0	0.0	0.0	0.0	14%	0.2	0.0	0.0	0.0	0.0	0.0	10%	0.8	0.0	0.0	0.0	0.0	0.1	7%	1.1	0.1	8.2%
Year 36	0.0	0.0	0.0	0.0	0.0	0.0	14%	0.2	0.0	0.0	0.0	0.0	0.0	10%	0.7	0.0	0.0	0.0	0.0	0.1	7%	1.0	0.1	8.1%
Year 37	0.0	0.0	0.0	0.0	0.0	0.0	14%	0.2	0.0	0.0	0.0	0.0	0.0	10%	0.7	0.0	0.0	0.0	0.0	0.0	7%	0.9	0.1	8.1%
Year 38	0.0	0.0	0.0	0.0	0.0	0.0	14%	0.2	0.0	0.0	0.0	0.0	0.0	10%	0.6	0.0	0.0	0.0	0.0	0.0	7%	0.8	0.1	8.1%
Year 39	0.0	0.0	0.0	0.0	0.0	0.0	14%	0.2	0.0	0.0	0.0	0.0	0.0	10%	0.6	0.0	0.0	0.0	0.0	0.0	7%	0.8	0.1	8.0%
Year 40	0.0	0.0	0.0	0.0	0.0	0.0	14%	0.1	0.0	0.0	0.0	0.0	0.0	10%	0.5	0.0	0.0	0.0	0.0	0.0	7%	0.7	0.1	8.0%
Year 41	0.0	0.0	0.0	0.0	0.0	0.0	14%	0.1	0.0	0.0	0.0	0.0	0.0	10%	0.5	0.0	0.0	0.0	0.0	0.0	7%	0.6	0.1	8.0%
Year 42	0.0	0.0	0.0	0.0	0.0	0.0	14%	0.1	0.0	0.0	0.0	0.0	0.0	10%	0.5	0.0	0.0	0.0	0.0	0.0	7%	0.6	0.0	8.0%
Year 43	0.0	0.0	0.0	0.0	0.0	0.0	14%	0.1	0.0	0.0	0.0	0.0	0.0	10%	0.4	0.0	0.0	0.0	0.0	0.0	7%	0.5	0.0	8.0%
Year 44	0.0	0.0	0.0	0.0	0.0	0.0	14%	0.1	0.0	0.0	0.0	0.0	0.0	10%	0.4	0.0	0.0	0.0	0.0	0.0	7%	0.5	0.0	7.9%
Year 45	0.0	0.0	0.0	0.0	0.0	0.0	14%	0.1	0.0	0.0	0.0	0.0	0.0	10%	0.4	0.0	0.0	0.0	0.0	0.0	7%	0.5	0.0	7.9%
Year 46	0.0	0.0	0.0	0.0	0.0	0.0	14%	0.1	0.0	0.0	0.0	0.0	0.0	10%	0.3	0.0	0.0	0.0	0.0	0.0	7%	0.4	0.0	7.9%
Year 47	0.0	0.0	0.0	0.0	0.0	0.0	14%	0.1	0.0	0.0	0.0	0.0	0.0	10%	0.3	0.0	0.0	0.0	0.0	0.0	7%	0.4	0.0	7.9%
Year 48	0.0	0.0	0.0	0.0	0.0	0.0	14%	0.1	0.0	0.0	0.0	0.0	0.0	10%	0.3	0.0	0.0	0.0	0.0	0.0	7%	0.4	0.0	7.9%
Year 49	0.0	0.0	0.0	0.0	0.0	0.0	14%	0.1	0.0	0.0	0.0	0.0	0.0	10%	0.3	0.0	0.0	0.0	0.0	0.0	7%	0.3	0.0	7.8%
Year 50	0.0	0.0	0.0	0.0	0.0	0.0	14%	0.1	0.0	0.0	0.0	0.0	0.0	10%	0.2	0.0	0.0	0.0	0.0	0.0	7%	0.3	0.0	7.8%
																					Average Percent Unnatural Mortality			9%

Assumptions

1. The estimated impacts were distributed across the Range Complex training areas and based on the training intensity categories and suitable tactical landing areas within each training area.
2. This estimate does not account for migration, reproduction, or natural mortality and estimated DT. These estimates show an unnatural mortality rate and should not be used to predict actual populations.

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Appendix E

Technical Synthesis Report for Intensive Cultural Surveys

DRAFT

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DRAFT

Final Technical Synthesis Report Intensive Archaeological Survey for Barstow Training and Range Environmental Assessment Marine Corps Logistics Base Barstow San Bernardino County, California

Prepared for:

Marine Corps Logistics Base
Barstow, California

Prepared by:

leidos

November 2015

Final Technical Synthesis Report
Intensive Archaeological Surveys for
Barstow Training and Range Environmental Assessment,
Marine Corps Logistics Base Barstow,
San Bernardino County, California

Prepared for:

Marine Corps Logistics Base
Barstow, California

Under Contract to:

U.S. Department of the Navy
Naval Facilities Engineering Command Southwest
1220 Pacific Highway, Building 1 CIPT
San Diego, CA 92132-5190
Phone: (619) 532-3844
Point of Contact: Jesse Martinez

Prepared by:

leidos

5464 Carpinteria Avenue, Suite K
Carpinteria, CA 93013

November 2015

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National Archaeological Database Information

Project Manager:	Jessica Degner
Principal Archaeologist/ Primary Report Author:	Stephen Bryne, RPA
Consulting Firm:	Leidos 5464 Carpinteria Avenue, Suite K Carpinteria, CA 93013 805-566-6425
Report Title:	Final Technical Synthesis Report for Intensive Archaeological Surveys for Barstow Training and Range Environmental Assessment, Marine Corps Logistics Base Barstow, San Bernardino County, California
Submitted to:	United States Marine Corps
Contract:	N62473-08-D-8807, Delivery Order 0029 Naval Facilities Engineering Command, Southwest
USGS Quadrangle Maps:	Daggett, California, and Nebo, California
Dates of Survey:	13–15 February 2013; 21–24 October 2013; 5–15 January 2015
Acreage:	1,061.5 acres (429.6 hectares)
Keywords:	Archaeological site, archaeological survey, Barstow, can scatter, crypto-crystalline silicate, CA-SBR-73, CA-SBR-8319, Daggett, dog burial, fighting positions, historic refuse scatter, isolated artifact, jasper, lithic scatter, Marine Corps Logistics Base Barstow, Nebo Annex, petroglyph, Range Complex, Rattlesnake Rock, Rattlesnake Rock petroglyph site, rock art, rock ring, sleeping circle, Yermo Annex.

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Executive Summary

This report describes the location, field methods, and reporting protocols that were used by Leidos (formerly Science Applications International Corporation) archaeologists to conduct intensive archaeological surveys in support of the Barstow Training and Range Environmental Assessment, Marine Corps Logistics Base (MCLB) Barstow, California. The primary goal of the archaeological surveys was to identify, record, and inventory all prehistoric and historic archaeological resources in the survey area. This survey commenced at the request of Naval Facilities Engineering Command Southwest, on behalf of the United States Marine Corps.

The total area of the project footprint or Area of Potential Effects (APE) is 1,306 acres (528.5 hectares). Leidos personnel conducted archaeological surveys on approximately 1,061.5 acres (429.6 hectares) of land within the APE that had not been recently surveyed. Three archaeological surveys were conducted from 13–15 February 2013, 21–24 October 2013, and 5–15 January 2015. The survey area included the Range West training area, Range East and Known Distance Range Complex training area, Range Main Supply Route training area, and Yermo Stables training area. Previously recorded archaeological sites within the survey area were revisited to ensure site conditions had not changed since they were recorded.

The fieldwork component of the investigation consisted of a Class III intensive field survey of the previously unsurveyed portion of the APE. The field crew walked in parallel transects spaced at no more than 82-foot (25-meter) intervals, and mapped and recorded both archaeological sites and isolated finds.

Leidos personnel recorded 26 newly identified archaeological sites and 116 newly identified isolated artifacts during the archaeological surveys. The newly identified sites consist of prehistoric lithic scatters, historic refuse scatters, historic can scatters, a historic refuse scatter and campsite, a historic camp, and a rock ring of undetermined era. In addition, 17 previously recorded archaeological sites are located within the APE. These sites include prehistoric lithic scatters, a rock ring, sleeping circles, and a petroglyph site (CA-SBR-73).

Based on survey observations, one of the newly identified archaeological sites (temporary number MCLB-SITE-7, a rock ring) is recommended as potentially eligible for inclusion in the National Register of Historic Places (National Register). Of the 17 previously recorded sites that occur within the APE, three prehistoric sites including CA-SBR-73 (Rattlesnake Rock Petroglyph), CA-SBR-8319 (Sleeping Circles), and CA-SBR-11840 (Prehistoric Rock Ring) are potentially eligible for inclusion in the National Register. It is recommended that Native American consultation regarding the four sites listed above be initiated, and that impacts to these sites be avoided or mitigated as necessary.

It is recommended that avoidance and/or mitigation measures include clearly defined limits on construction, ground training, aircraft operations, and range maintenance and sustainment activities and operator education to ensure no effects to potentially eligible archaeological resources within the APE. If potentially eligible sites cannot be avoided, then the next step would be to determine the effects of the proposed undertaking on the identified sites and, if the effects are adverse, to determine what measures could be implemented to mitigate the adverse effects. Note that, in addition to the identified archaeological sites, there may be other sensitive cultural resources identified through future Native American consultation, and these resources, if any, should be taken into consideration when developing final avoidance and/or mitigation measures.

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Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
APE	Area of Potential Effects
B.P.	before present
CCS	crypto-crystalline silicate
CFR	*Code of Federal Regulations*
DoD	Department of Defense
DPR	California Department of Parks and Recreation
EA	Environmental Assessment
FARP	forward arming and refueling point
GIS	Geographic Information Systems
GPS	Global Positioning System
I MEF	First Marine Expeditionary Force
KD	Known Distance
LHA	Landing Helicopter Assault
LHA/LHD	Simulated Flight Deck
LHD	Landing Helicopter Deck
LZ	Landing Zone
MAGTF	Marine Air-Ground Task Force
MCLB	Marine Corps Logistics Base
NAHC	Native American Heritage Commission
NAVFAC	Naval Facilities Engineering Command
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act of 1966
NRHP	National Register of Historic Places
RPA	Register of Professional Archaeologists
SHPO	State Historic Preservation Officer
U.S.	United States
U.S. Navy	United States Department of the Navy
USGS	United States Geological Survey
USMC	United States Marine Corps

1 Introduction

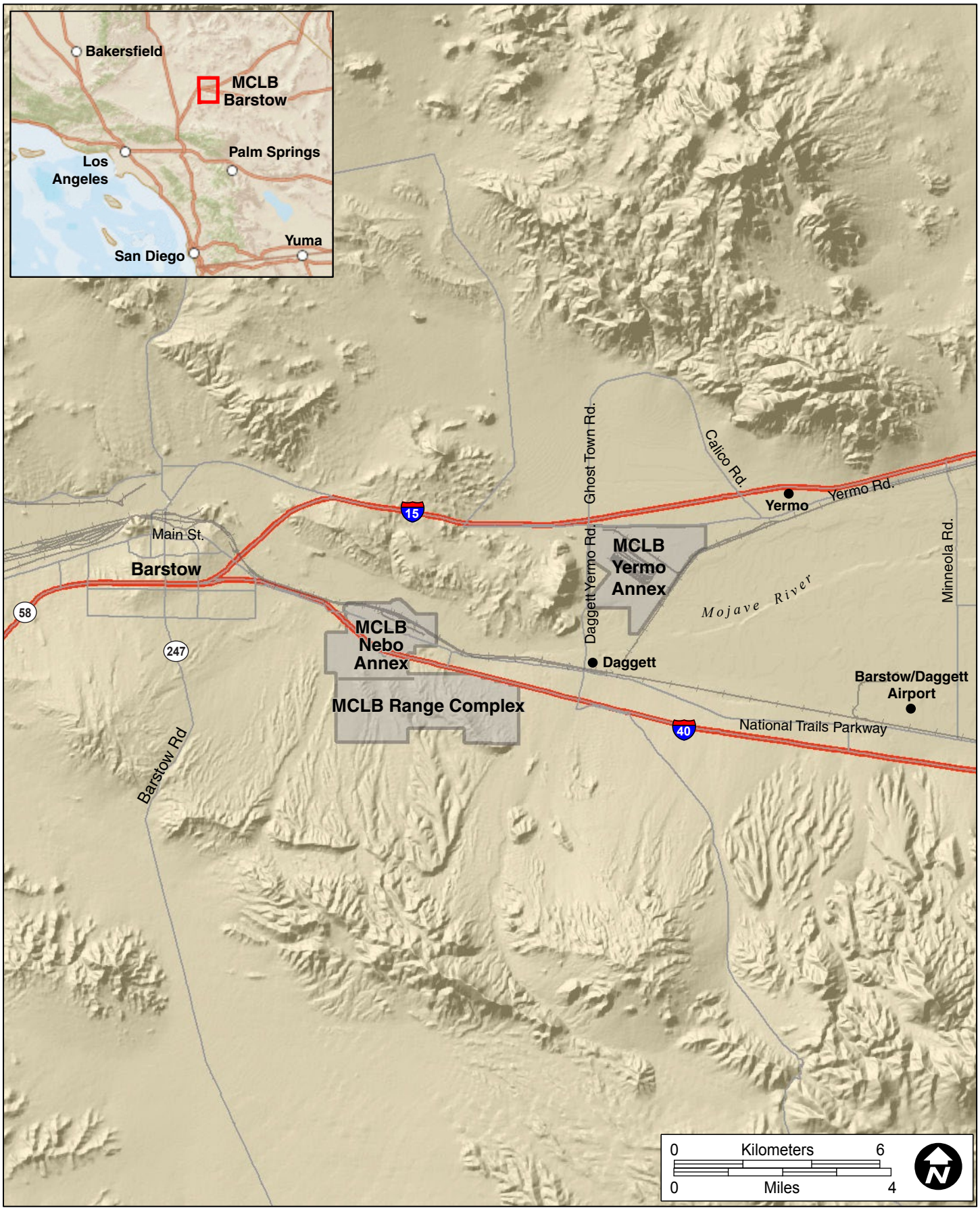
This report describes the location, field methods, and reporting protocols that were used by Leidos archaeologists to conduct intensive archaeological surveys in support of the Barstow Training and Range Environmental Assessment (EA), Marine Corps Logistics Base (MCLB) Barstow, California (hereinafter "proposed action") (Figure 1). The objectives of this report are to provide compliance with the National Historic Preservation Act (NHPA) of 1966, as amended, as well as the National Environmental Policy Act (NEPA) of 1969. The primary goal of the archaeological surveys was to identify, record, and inventory all prehistoric and historic archaeological resources through a full-coverage survey of the project footprint (Figure 2). This survey commenced at the request of Naval Facilities Engineering Command (NAVFAC) Southwest, on behalf of the United States Marine Corps (USMC).

The USMC is proposing to enhance and update operational capabilities of existing training ranges and areas, including establishing general aviation maneuver areas and designating rotary wing/tilt-rotor Landing Zones (LZs) and a Simulated Flight Deck (Landing Helicopter Assault [LHA] or Landing Helicopter Dock [LHD]) site to accommodate components of regional Marine Air-Ground Task Force (MAGTF) training activities. Depending on the specific mission, ground training could range from a single company commander conducting maneuvers with three infantry platoons to battalion or larger headquarters/command post training (300 personnel), with integrated air and logistics support. In addition to the designated LZs and LHA/LHD site, all the training ranges would support general aviation maneuver areas. Aircraft would be allowed to land anywhere within the general aviation areas. Proposed improvements to existing access routes/trails and construction of new access roads to the LZs and LHA/LHD site would be required to support tactical aviation and ground training activities.

The total area of the project footprint or Area of Potential Effects (APE) is 1,306 acres (528.5 hectares). Leidos personnel conducted archaeological surveys on approximately 1,061.5 acres (429.6 hectares) of land within the APE that had not been recently surveyed. Three archaeological surveys were conducted from 13–15 February 2013, 21–24 October 2013, and 5–15 January 2015. The survey area included the Range West training area, Range East and Known Distance (KD) Range Complex training area, Range Main Supply Route training area, and Yermo Stables training area (Figures 3-5). Previously recorded archaeological sites within the survey area were revisited to ensure site conditions had not changed since they were recorded.

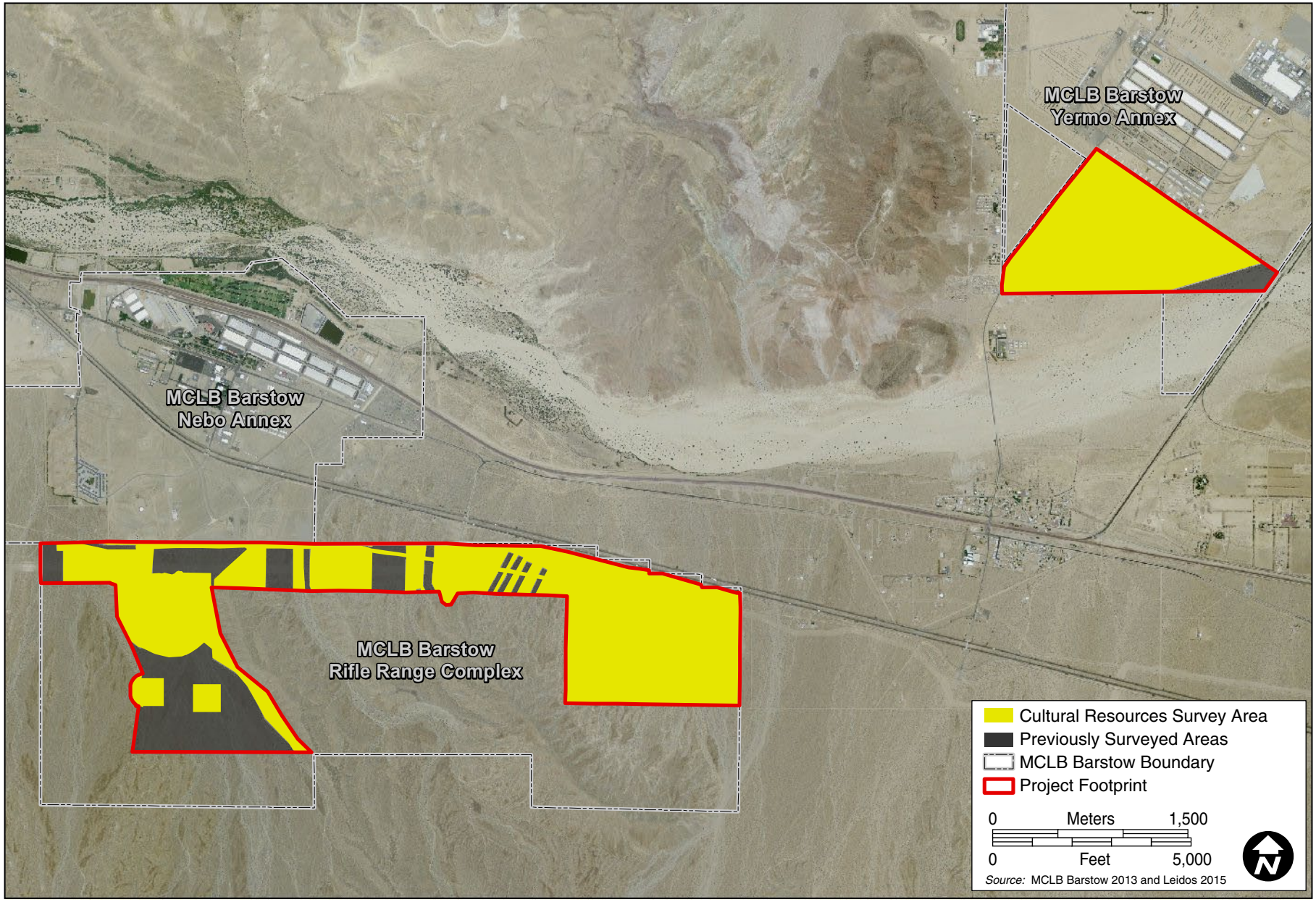
The surveys consisted of a team of archaeologists walking in parallel transects spaced at 82-foot (25-meter) intervals over the survey area. When artifacts or sites were identified, pin flags were placed at artifact locations and a site boundary was established. A Trimble® Global Positioning System (GPS) unit with sub-meter accuracy was used to plot the locations of sites and isolates. Prehistoric sites were defined as three or more artifacts in a 269 square foot (25 square meter) area. Historic sites consisted of six or more artifacts, greater than 50 years in age, in a 269 square foot (25 square meter) area. Less than six historic artifacts in a 25 square meter area were designated as historic isolates. Due to the desert conditions, ground surface visibility was very good, averaging 90 percent.

A total of 26 newly recorded archaeological sites and 116 locations of isolated artifacts were identified during the three archaeological survey efforts (refer to Confidential Appendix B, Figures B-1 through B-3). In addition, 17 previously recorded archaeological sites are located in the APE (refer to Confidential Appendix B, Figures B-1 through B-3).



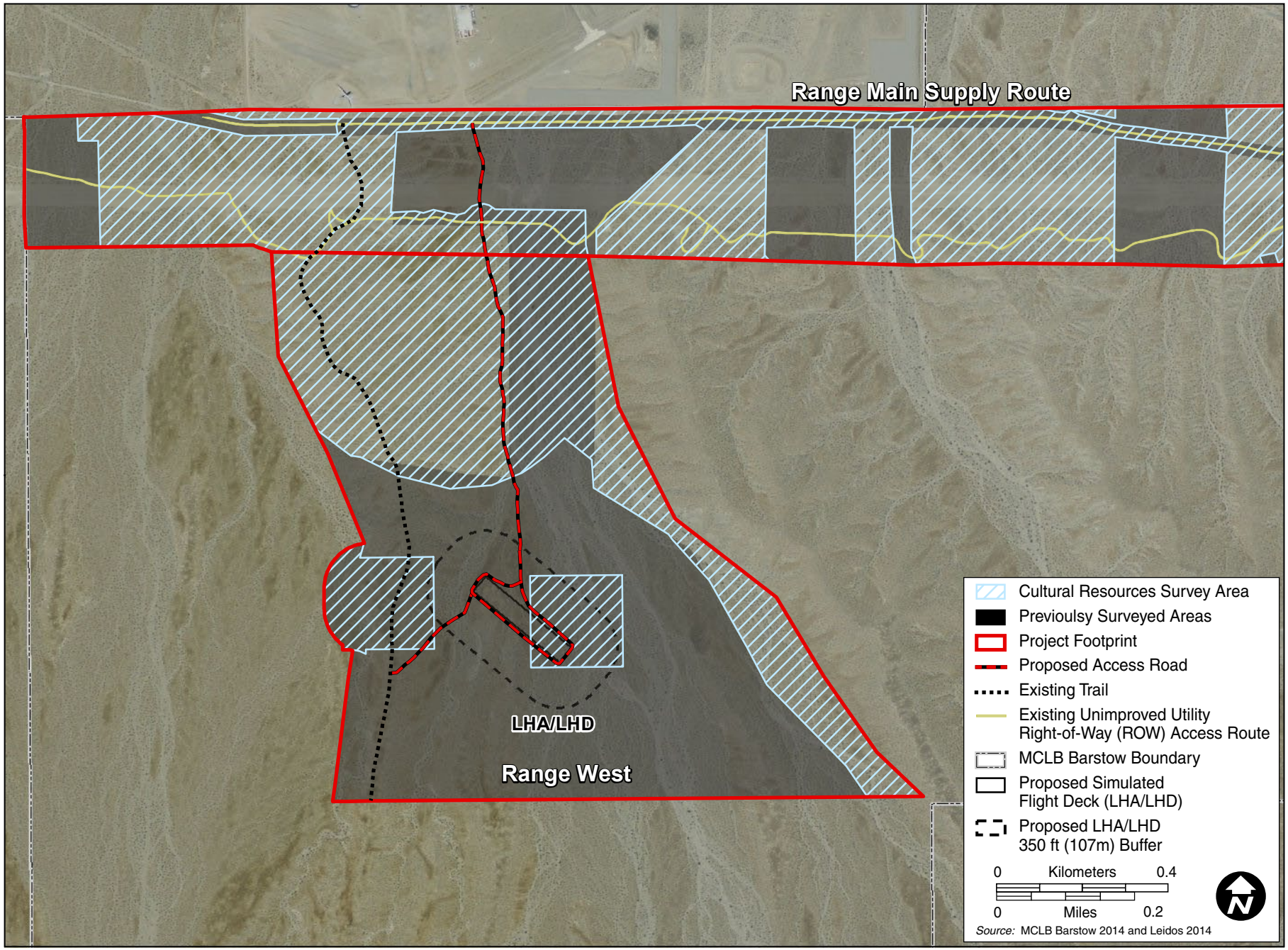
Location of Marine Corps Logistics Base Barstow
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE 1



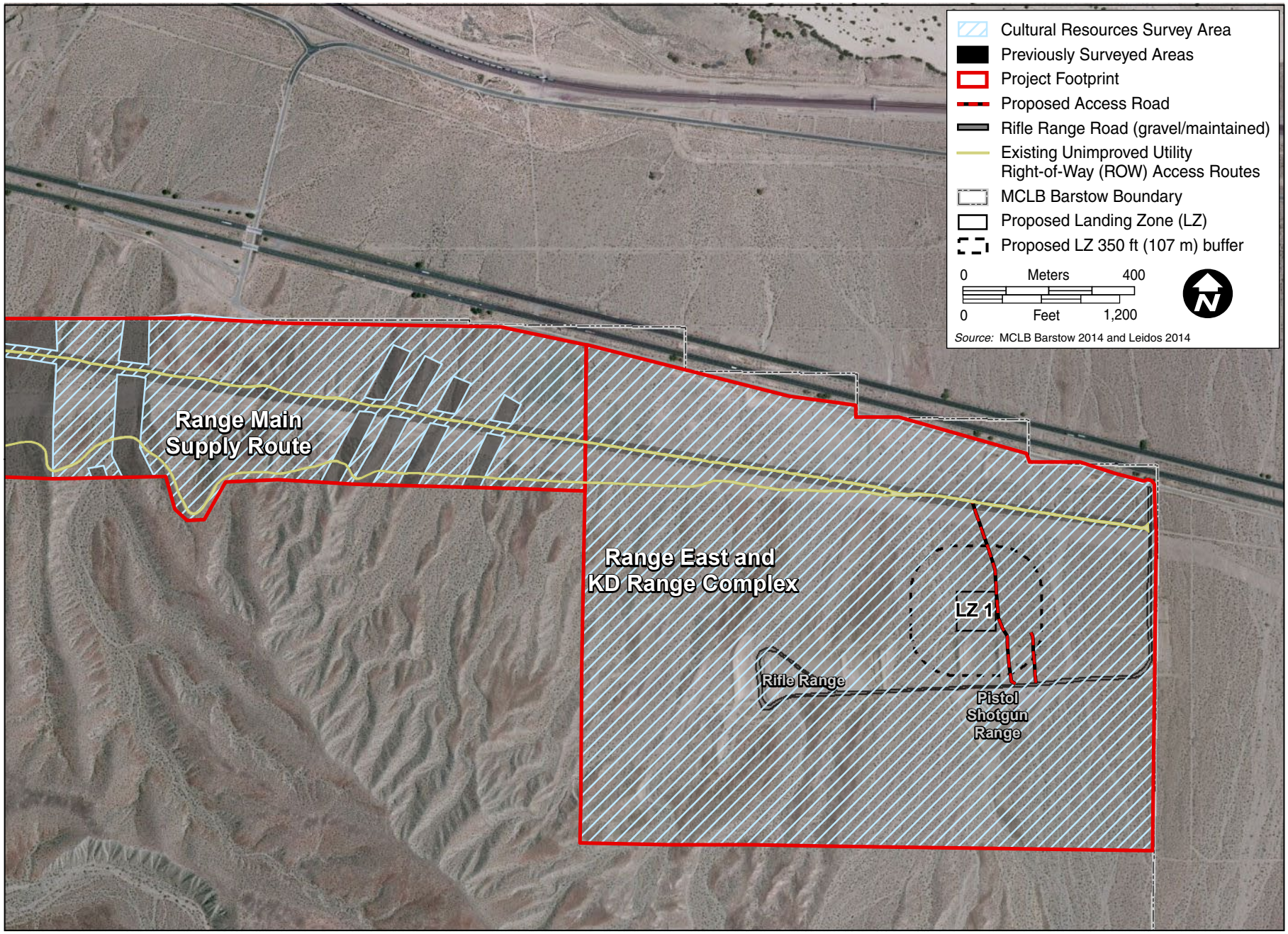
Archaeological Survey Area
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
2



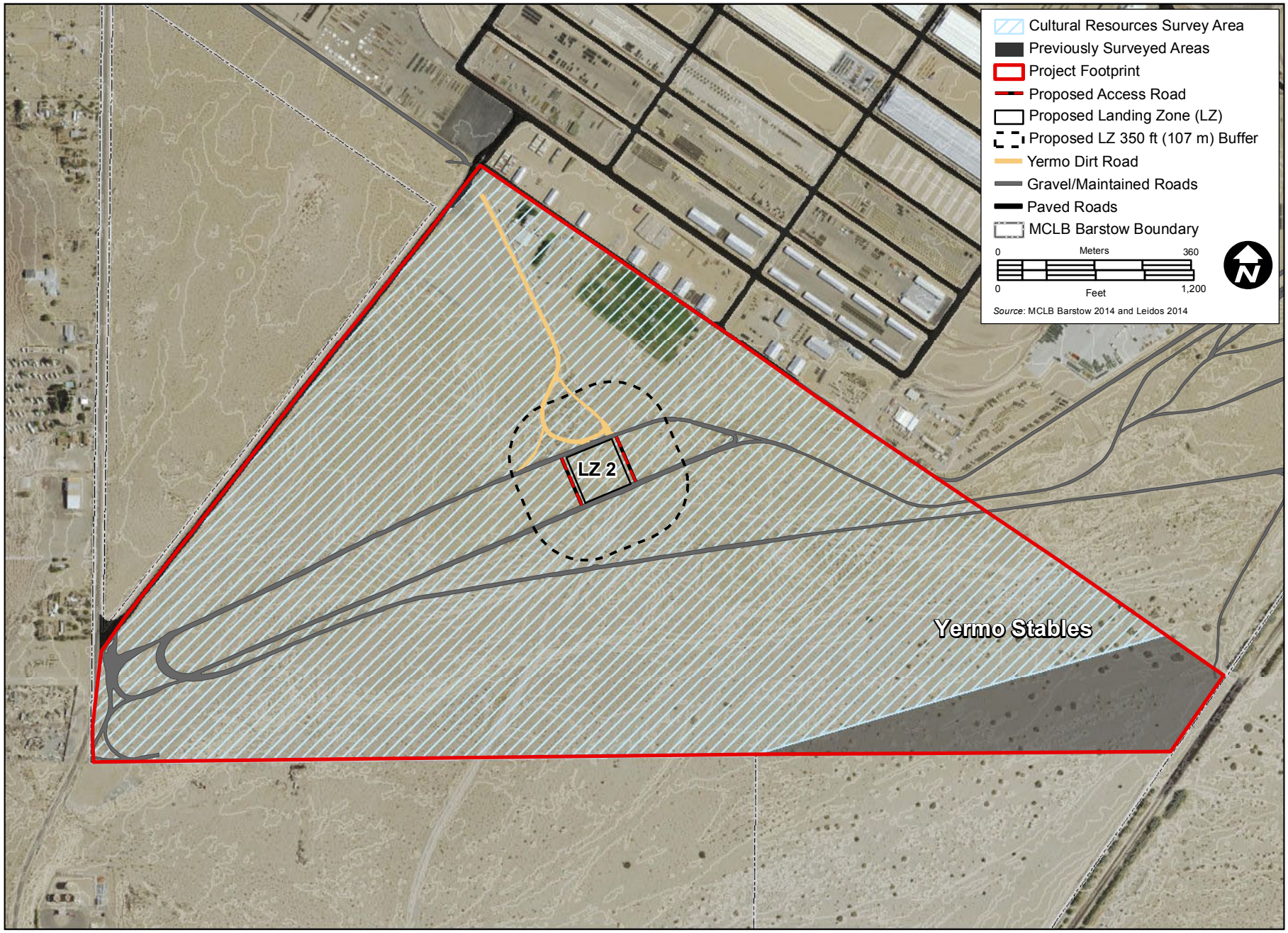
Range West Survey Area
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE 3



Range East and KD Range Complex Survey Area
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE 4



Yermo Stables Survey Area
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
5

1.1 Undertaking Information

The USMC proposes to update operational capabilities of existing training areas and ranges on MCLB Barstow to support combat readiness of USMC operating forces, including tenant, unit, and MAGTF-level training, in support of the First Marine Expeditionary Force (I MEF). The proposed action would include: (1) construction and operation of a Simulated Flight Deck (LHA/LHD) and superstructure (e.g., temporary modular structure), new access road to the LHA/LHD site, and establishment of a vehicle loading and refueling area near the West Gate in the Range West training area; (2) establishment of a LZ and access roads, new firing lines (700, 800, and 900 yards) at the KD Rifle Range, modernization/upgrades to the KD Rifle Range and 100-yard shotgun range, establishment of three designated bivouac areas, a forward arming and refueling point (FARP) site, and vehicle loading and refueling area, construction of a new teargas facility, and upgrades and/or replacement of existing KD Range Complex support facilities within the Range East and KD Range Complex training area; and (3) establishment of a new LZ and access roads and installation of permanent fencing at the Yermo Stables training area. Training operations would be consistent with existing unrestricted (Class G) airspace conditions and no new military requirement for restricted airspace would be required.

The purpose of the proposed action is to enhance and update operational capabilities at MCLB Barstow, thereby improving training and readiness opportunities and maximizing range use and throughput. The proposed action is needed because MCLB Barstow's existing industrial facilities and supporting infrastructure, open training lands, and live-fire ranges do not adequately support the ability for multiple units to conduct simultaneous training, and they do not provide the flexibility to meet evolving USMC operational requirements. Furthermore, the proposed action is needed to ensure range maintenance and sustainment of MCLB Barstow's training ranges. The proposed action would update and enhance MCLB Barstow's existing training and readiness capability and capacity in accordance with the Commandant of the Marine Corps (CMC's) mandates in the *Marine Corps Vision and Strategy 2025* and *Expeditionary Force 21* to support local and regional operational training requirements. Through a process of modernization, training facilities would be upgraded and training lands and live-fire ranges better utilized, maintained, and managed to support maximum throughput by increasing the capability of MCLB Barstow to support greater training opportunities. Enhancing training opportunities, areas, and ranges at MCLB Barstow to provide components of integrated regional I MEF training is consistent with historical and continuing activities at MCLB Barstow, and further is critical to the quality, quantity, and variety of training for USMC units to maintain operational readiness.

1.2 Definition of the Area of Potential Effects

The APE of an undertaking is defined in 36 *Code of Federal Regulations* (*CFR*) 800.16(d) as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist." For the proposed undertaking, the APE consists of the project footprint that includes all areas potentially disturbed during construction (i.e., establishing designated LZs, LHA/LHD site, and access routes, KD Range Complex upgrades, new support facilities, and utility infrastructure modifications), ground and aviation training, and range maintenance and sustainment activities.

The total area of the project footprint, or APE, is approximately 1,306 acres (528.5 hectares). Leidos personnel conducted archaeological surveys on approximately 1,061.5 acres (429.6 hectares) of land within the APE that had not been recently surveyed.

1.3 Native American Consultation

Native American consultation requires a "government-to-government relationship" between sovereign Indian tribal governments and the government of the United States (U.S.). Therefore, consultation is the responsibility of the federal lead agency, and, as such, is not addressed in this report.

A Sacred Lands File and Native American Contacts list was requested for this project from the State of California Native American Heritage Commission (NAHC) on 19 February 2013. A response from the NAHC was received on 21 February 2013 (Appendix A). The NAHC stated that a search of their Sacred Lands File failed to indicate the presence of Native American cultural resources in the APE. However, the Native American Heritage Commission noted that the absence of specific site information in the Sacred Lands File does not indicate the absence of cultural resources in any APE. The NAHC suggested that "other sources of cultural resources should also be contacted for information regarding known and recorded sites." They indicate that, "a Native American tribe or individual may be the only source of the presence of traditional cultural places." The commission included a list of Native American tribes, individuals/organizations who may have knowledge of cultural resources in the APE.

2 Environmental Setting

2.1 Geography

MCLB Barstow is located in western San Bernardino County, California, approximately 3.5 miles (6 kilometers) east of the city of Barstow, in the Mojave Desert. The Mojave Desert is a large, alluvial-filled basin situated between the Garlock Fault on the north and the San Andreas Fault on the south. It is bounded by the Transverse Ranges to the southwest, the Tehachapi Mountains and the southern Sierra Nevada Range to the northwest, and the Colorado River to the east (Schoenherr 1992:411). The Mojave Desert includes a number of mountain ranges, including the Calico Mountains, which is dominated by Calico Mountain. MCLB Barstow encompasses 5,400 acres (2,185 hectares) and is separated into three parcels: Nebo Annex, Range Complex, and Yermo Annex. The project footprint is located on the Range Complex and the Yermo Annex.

2.1.1 Climate

The Mojave is the northernmost "hot" desert in North America, occurring between the cold-steppe of the Great Basin and the subtropical Sonoran Desert. MCLB Barstow experiences an arid desert climate characterized by hot, dry summers, warm springs and autumns, and mild winters. The area has mean summer temperatures of 77 to 102 degrees Fahrenheit (°F) (25 to 39 degrees Celsius [°C]). Temperatures fluctuate throughout a 24-hour period with high temperatures during the day and cool temperatures at night, and daytime and nighttime temperatures varying as much as 77°F (25° C) (Beck and Haase 1974). Winter temperatures can be cold, and may drop below freezing. Precipitation occurs mostly in the winter; however, summer thunderstorms occur frequently in July, August, and September.

2.1.2 Geology and Soils

The Calico Mountains, located north of the APE, are composed primarily of late Cenozoic-era rocks, overlain and underlain by multi-colored, extrusive igneous rocks. The Calico Mountains derive their name from the term miners applied to the multicolored rock formations, which range from yellow-white to red (Hart 1987:73). Middle Miocene calcareous clays of the Barstow Formation also exist in the area. The highly dissected alluvial fans surrounding the APE are late Pleistocene Epoch in origin and have the appearance of very low, undulating hills (Strudwick 1999b:3).

Throughout the region, crypto-crystalline silicate (CCS), basalt, rhyolite, and felsite outcrops, as well as secondary cobble deposits, occur (Strudwick 1999b:3). These were used by the prehistoric inhabitants of the region as sources of tools (Basgall and Hall 1993; Hall 1993).

The APE is located in the west-northwest portion of the Lake Manix Basin. Perennial freshwater covered an area of 139 square miles (360 square kilometers) and existed between approximately 500,000 to 19,000 years before present (B.P.) (Strudwick 1999b:3).

Sand and gravelly sand textured soils are found on low river terraces and recent alluvial fans on the Range Complex. These include the Cajon sand, Cajon gravelly sand, and Arizo sand soil units. These young soils on the alluvial fans consist of a mixture of sands, gravelly sands, and loamy sands that formed in Holocene alluvium, derived primarily from granitic parent material. They are very deep, somewhat excessively drained to excessively drained, and are characterized by low available water capacity, rapid permeability, and slow runoff. Soils on old alluvial fans and terraces formed in alluvium are derived from mixed sources. On MCLB Barstow these soil types include Nebona-Cuddback and Typic Haplagrids-Yermo complexes. The soils of these complexes are generally older and more developed. They may support desert pavement of varnished gravel and cobbles on their surfaces. Varnished desert pavement has developed on the stable terraces of Pleistocene nonmarine deposits (Natural Resources Conservation Service 2013).

2.1.3 Vegetation

Vegetation in the survey area consists of widely spaced shrubs typical of the western Mojave. Vegetation in the Range East and KD Range Complex and Range West survey areas is dominated by creosote bush (*Larrea tridentata*) and white bursage scrub (*Ambrosia dumosa*); less common are cheesebush scrub (*Hymenoclea salsola*) and developed areas (Leidos 2015). The Yermo Stables survey area consists of allscale scrub (*Atriplex polycarpa*) with some developed areas.

Range West, which includes the LHA/LHD site, has a rocky substrate, with steeper slopes on the western and eastern ends that terminate into a large basin with various washes. The terrain is undulating with desert pavement on the flat areas and ridges. Desert pavement consists of gravel or larger stones that remain after wind has blown upper layers of silt and sand away. The soil surface becomes armored with pebbles left behind and cemented with calcium carbonate residual from water evaporation. Shrubs are sparsely distributed with creosote bush and white bursage as the dominant species; less common are purple heather (*Krameria erecta*), Engelmann's hedgehog cacti (*Echinocereus engelmannii*), branched pencil cholla (*Cylindropuntia ramosissima*), and sweetbush (*Bebbia juncea*). Cheesebush, box thorn (*Lycium* spp.), spiny senna (*Senna armata*), Mojave indigo bush (*Psorothamnus arborescens*), and catclaw (*Senegalia greggii*) are mainly restricted to the desert washes. Native summer annual species frequent in the understory include sandmat spurge (*Chamaesyce micromera*) and chinch weed (*Pectis papposa* var. *papposa*); less common are fringed spurge (*Chamaesyce setiloba*), fringed amaranth (*Amaranthus fimbriatus*), and six weeks grama (*Bouteloua* spp.).

Range East and KD Range Complex, which includes LZ 1, has a similar distribution and composition of plant species to Range West. The KD Range Complex also has developed areas (e.g., KD Rifle Range, KD Pistol Range, and 100-yard shotgun range) and cheesebush scrub is present in the previously disturbed areas adjacent to the KD Range Complex. The terrain is generally flat with exception to the man-made berms in the KD Rifle Range, KD Pistol Range, and 100-yard shotgun range. Throughout the survey area there are numerous shallow sandy, cobble washes that slope to the north.

The Range Main Supply Route is disturbed creosote bush – white bursage scrub habitat. The two existing unimproved, four-wheel drive utility right-of-way access routes within this training area are dirt with

vegetation along the border and sometimes growing in the road. There are several buried gas pipelines on the edges of the existing access routes. In some areas, the buried pipelines have created berms that have changed the natural drainage patterns. The terrain is undulating and the substrate is sandy with rocks and cobbles throughout the training area. Various areas have eroded after the recent rain events and parts of the access routes have washed away exposing many pipelines. Shrubs are sparsely distributed with creosote bush and white bursage dominant.

The Yermo Stables survey area includes LZ 2, the Yermo Dirt Road, proposed access roads, the existing gravel test track, and portions of the Mojave River flood plain. The northern portion of the site is flat and the southern portion of the site has numerous undulating sandy mounds and includes the floodplain of the Mojave River. Allscale is the dominant shrub throughout the site and creosote bush is occasional. Sparsely disturbed shrubs include box thorn, California ephedra (*Ephedra* spp.), cheesebush, and climbing milkweed (*Funastrum hirtellum*). The floodplain adjacent to the low-flow channel of the Mojave River also had large hummocks supporting desert willow (*Chilopsis linearis*) and salt cedar (*Tamarix ramosissima*) interspersed with flat areas that had indications of flooding closer to the river (i.e., cracked soil surfaces or small, shallow flow channels).

2.1.4 Fauna

Fauna typically found in the APE include black-tailed jackrabbit (*Lepus californicus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), desert kit fox (*Vulpes macrotis*), badger (*Taxidea taxus*), desert woodrat (*Neotoma lepida*), pocket mouse (*Perognathus* spp.), and California desert tortoise (*Gopherus agassizii*), as well as various lizards, snakes, and raptorial birds. Other fauna likely present in the region include mule deer (*Odocoileus hemionus*), iguanids (e.g., chuckwalla [*Sauromathus obesus*]), desert banded gecko (*Coleynyx variegatus*), kangaroo rat (*Dipodomys* spp.), and Mojave ground squirrel (*Spermophilus mohavensis*).

3 Regional Cultural Setting

The following section provides a general outline of the prehistoric and historic cultural history of the APE. This overview is intended to provide a framework for understanding and interpreting the results of the archaeological surveys.

3.1 Prehistory

The most prominent chronological framework for the Mojave Desert is that proposed by Warren (1980) and Bettinger and Taylor (1974) (Table 1). Warren's (1984) terminology provides the general framework in the following discussion.

Table 1. Prominent Chronological Sequences for the Mojave Desert

Warren (1984)	Bettinger and Taylor (1974)
Lake Mojave (12,000–7000 B.P.)	Mojave (?–6000 B.P.)
Pinto (7000–4000 B.P.)	Little Lake (6000–3200 B.P.)
Gypsum (4000–1500 B.P)	Newberry (3200–1400 B.P.)
Saratoga Springs (1500–800 B.P.)	Haiwee (1400–700 B.P.)
Protohistoric (800 B.P. – Historic)	Marana (700 B.P. – Historic)
Note: B.P. = before present.	

3.1.1 Lake Mojave

The earliest accepted period of human occupation in the Mojave Desert is tentatively dated from about 12,000 to 7000 B.P. (Warren 1984). In southern California, this period has also been termed San Dieguito or Playa (Rogers 1939). The Lake Mojave cultural complex was originally distinguished at a series of sites along the shorelines of ancient Lake Mojave, which encompassed modern Soda Lake and Silver Lake (Byrd and Pallette 1994). Absolute dates on stratified occupation horizons from this time period are rare, and the onset and termination of this period are uncertain.

Overall, sites of this time period are relatively infrequent and they may represent only brief occupations. They are characterized by a well-developed lithic industry with long-stemmed points (typically termed Silver Lake and Mojave points), large bifaces, crescents in simple lunate and more eccentric forms, large flake and core scrapers, choppers, scraper-planes, and hammerstones. Microcrystalline raw material is common, although other raw materials were also utilized (Byrd and Pallette 1994). Milling stones were considered either rare or absent during this period until recent fieldwork at the National Training Center Fort Irwin, which recovered ground stone in association with early assemblages.

3.1.2 Pinto

This period is defined largely on the presence of slightly shouldered, stemmed points with indented bases that are often lumped under the term Pinto (Warren 1984). Associated with these points are leaf-shaped bifaces and various unifacial tools, including thick scrapers and core-cobble tools. Pinto period sites are relatively few in number and are typically surface manifestations or lack well-developed middens (Warren 1984:413; Byrd and Pallette 1994). However, these sites occur widely over the Mojave Desert. Percussion flaking of fine-grained igneous material dominates the lithic assemblage of this period. Ground stone implements include large, slightly modified milling slabs; small, thin, extensively used milling slabs; and both shaped and unshaped handstones.

This time period is associated with the Altithermal, a climatic regimen characterized by gradual global warming and local lake desiccation, with shorter periods of increased precipitation (or pluvials). The settlement pattern is interpreted as highly mobile with most sites considered to be temporary, seasonal camps (Byrd and Pallette 1994:20). Pinto culture sites have been found on high terraces near former shorelines of sinks and along extinct rivers (Warren 1984).

3.1.3 Gypsum

The Gypsum period is marked by intensified occupation of the Mojave Desert along with new technological developments, a broadening subsistence base, and the development of new socioeconomic ties with the California coast and the Southwest (Byrd and Pallette 1994:20). The hunting of large mammals (artiodactyls) appears to have been a significant part of the Gypsum subsistence pattern, although smaller faunal remains are also represented. Medium to large stemmed and notched points characterize the early part of the Gypsum period, indicating the continued use of the dart and atlatl (spear thrower). These projectile points include Gypsum Cave, Humboldt Concave Base, Elko Eared, and Elko Corner-notched styles. Bifacially retouched cores, pressure flaking, and the use of microcrystalline material are widespread. Milling bases and manos are common during the Gypsum period, indicating the increased reliance on hard seeds. The appearance of mortars and pestles has been interpreted as indicating the onset of mesquite bean exploitation (Warren 1984:420).

The Gypsum settlement pattern includes large, intensively occupied sites located on the valley floors. Rogers (1939:61) suggested that these sites may represent permanent habitation sites, or at least areas that were repeatedly reoccupied over many years. The Gypsum period also saw the broader use of the

landscape with canyon and upland areas being exploited. Late in the period, the occurrence of pit houses in the eastern Mojave Desert and the introduction of ceramics, along with shell beads and ornaments, suggest greater connection with the Southwest and California coast by Gypsum period peoples.

3.1.4 Saratoga Springs

The Saratoga Springs period is characterized by cultural divergence and increased regional variance within the Mojave Desert (Byrd and Pallette 1994:22). External influence and probably occupation by the Anasazi from the Virgin area and Patayan from the Colorado River has been hypothesized. Metates, manos, mortars, pestles, ceramics, and a variety of ornamental and ritual objects represent the cultural inventory. Smaller Rose Spring and Cottonwood Triangular projectile points were used with the bow and arrow. Reliance on the exploitation of plants and small animals increased during this period. Tools became more specialized and were manufactured from a narrow range of locally available lithic resources (McGuire and Hall 1988:323).

The presence of large village sites, such as the Bickel site in the western Mojave, Saratoga Spring in Death Valley, and Oro Grande on the Mojave River, are first documented during this period (Byrd and Pallette 1994:22). The settlement pattern appears to shift from circulating to radiating in these areas, with temporary camps and processing stations situated around major habitation locations (McGuire and Hall 1988:320).

3.1.5 Protohistoric

Variation in the spatial distribution of ceramic types is the primary archaeological evidence used to distinguish spheres of influence within the Mojave Desert during the Late Prehistoric or Protohistoric period. Patayan influence appears early and continuously during the Protohistoric, while Anasazi occupation was more restricted and short-lived (Byrd and Pallette 1994:22). Paiute Owens Valley brownware ceramics are most common north of the Mojave River, while Colorado buffwares are most common south of the Mojave River (Byrd and Pallette 1994:22). Shell beads found in the Mojave Desert are evidence of trade with the southern California coast, and a trade route along the Mojave River Valley was well established.

3.2 Ethnography

The APE is within the ethnographic Serrano (or Vanyume) territory. Very little is known of the Vanyume, a sparse population living along the Mojave River (Bean and Smith 1978:570). It is unknown whether they spoke a dialect of Serrano or a separate Takic language (Bean and Smith 1978:570). Politically, they appear separate from the Serrano proper.

The Serrano were hunter-gatherers and occasional fishermen (Bean and Smith 1978:571). The women were responsible for most of the gathering, while hunting and fishing were done by males. In the desert, vegetal staples included honey mesquite and piñon nuts, yucca roots, mesquite, and cactus fruits. These were supplemented with other roots, bulbs, shoots, and seeds, particularly chia (*Salvia columbariae*). Desert groups traveled annually to the foothills to collect nuts of various kinds and to trade desert fruits and seeds for products not available in the desert (Bean and Smith 1978:571).

Principal game animals were deer, mountain sheep, antelope, rabbits and other small rodents, and birds including quail. Bows and arrows were used for larger game and throwing sticks, traps, snares, and deadfalls were used for smaller game and birds. Communal deer and rabbit hunts were held, along with communal acorn, nut, and mesquite gathering expeditions. Food processing utensils included flint knives,

stone or bone scrapers, pottery trays and bowls, baskets, horn and bone spoons and stirrers, and mortars and metates (Bean and Smith 1978:571).

Most Serranos lived in small villages adjacent to water sources. Individual family dwellings were usually circular, domed structures built of willow frames and covered with tule thatching (Bean and Smith 1978:571). Routine household activities usually occurred in the open or beneath a *ramada*. The *ramada* is a wall-less structure with a roof of thatched willow poles supported by four or more posts placed vertically in the ground. In addition, most Serrano villages featured a large ceremonial house as well as granaries and sweat lodges.

3.3 History

The first Europeans arrived in the region in 1772, when Pedro Fages, commander of the Spanish forces in California, entered the area.

In the 1860s, a drought in parts of California caused cattlemen to move to the Mojave River Valley in order to feed their herds. To protect travelers and the ranchers from Indian attack, the U.S. Army established Camp Cady on the Mojave River, about 15 miles (24 kilometers) downstream from Daggett. This site was chosen for its abundant water supply (United States Department of Agriculture 1986). The encampment was named for Major Albemarle Cady, 6th Infantry, then in command of Fort Yuma. For three months the Dragoons quartered themselves in temporary shelters of brush and mud or dugouts similar to those used later by the region's miners. The makeshift quarters were finally replaced by permanent structures built by the U.S. Army: Camp Cady, a 300-square-yard (251-square-meter) parade ground, with buildings arranged along three of its sides. The buildings were constructed of adobe, floored and shingle roofed, plastered outside, and plastered and whitewashed inside. The officers' quarters was the only structure with ceilings. Camp Cady served as the base for a whole series of camps, redoubts, and forts along the Old Government Road to Fort Mojave and the Salt Lake Road, with campaigns waged against the Paiutes and Shoshones. Camp Cady was abandoned on 24 April 1871 (Hart 2013).

Gold, silver, and borax mines in the Mojave Desert and gold mining in the San Bernardino Mountains stimulated travel and settlement in the area from the middle to the end of the 19th century.

In 1882, the Southern Pacific Railroad started a line from the town of Mojave east to the Colorado River (United States Department of Agriculture 1986:2). In 1885, the Santa Fe Railroad built a rail line north from San Diego through Cajon Pass and along the Mojave River. It joined the Atlantic and Pacific Railroad at a point 9 miles (14.5 kilometers) west of Daggett. The completion of this line stimulated activity in the Mojave Valley and influenced the establishment of Barstow, Victorville, and other settlements along the line (United States Department of Agriculture 1986:2).

Waterman Junction was an intersection on the Santa Fe line. Originally, this location had been called Fishpond, but it was renamed Waterman Junction in honor of the governor of California, who owned a nearby silver mine (Hart 1987:35). It was renamed Barstow in 1886 after William Barstow Strong, president of the Santa Fe Railroad at the time (Leadabrand 1966:106).

The first traces of silver in the Calico Hills (an area at the western edge of the Calico Mountains) were supposed to have been discovered by a man named Lee in 1875 (Leadabrand 1966:106). In 1880, a man named Porter, who operated a mill near Barstow, relocated some silver claims to the area (Leadabrand 1966:106). In 1881, Lowrey Silver made some discoveries on Calico Mountain and on 6 April 1881, S. C. Warden, Hues Thomas, John C. King, and others (possibly Frank Mecham and "Doc" Yaeger) founded the Silver King mine and the camp of Calico was established (Leadabrand 1966:106). The Silver King would go on to earn the title "the biggest and richest mine in California" (Leadabrand 1966:106).

The California Division of Mines estimated that between $13 million and $20 million of silver was mined in Calico (Leadabrand 1966:109).

In 1882, a station on the railroad was located and named Calico, even though it was 7 miles (11 kilometers) away. This station was renamed Daggett in 1883 (Leadabrand 1966:107). Daggett became an important transportation and supply center for the mines. In 1905, the San Pedro, Los Angeles, and Salt Lake Railroad was constructed from Riverside to Daggett and then to Salt Lake City. This line was later purchased by the Union Pacific Railroad, and Yermo became a division point (United States Department of Agriculture 1986:2).

In 1883, borax was discovered east of Calico along a ravine that earned the name Mule Canyon after the 20-mule teams that would haul the borax to the railroad siding 12 miles (19 kilometers) away at Daggett (Leadabrand 1966:107). Also, in 1883, a large fire swept through Calico destroying most of the buildings, but by 1884, the town had rebuilt and the community reached its peak population of 2,500 (Leadabrand 1966:107).

By the spring of 1882, there were 100 people living along Main Street in Calico. In 1888, a narrow-gauge railroad was built from a mill near Daggett past the site of Calico into the hills to the Waterloo Mine. Calico was served by the railroad (Leadabrand 1966:107).

In 1892, the price of silver dropped and the railroad suspended operations. It operated again around 1899, but by 1903 the tracks had been removed. After 1903, only sporadic mining continued in the Calico area. Walter Knott, of Knott's Berry Farm fame, acquired the original property of the townsite at Calico from the Zenda Mining Company in 1951. Because of his strong family ties to the place, he began to restore Calico to its original frontier character (Leadabrand 1966:109). At present, Calico is a ghost town and a tourist attraction.

3.3.1 Military History

MCLB Barstow was constructed as a United States Department of the Navy (U.S. Navy) Depot in 1942 (Willey et al. 2005:11). The USMC inherited the base when it was turned over by the U.S. Navy in 1942 (Bricker 2012). The land had been purchased from its original owner, a sheepherder's wife, with the stipulation of having perpetual care given to her husband's gravesite on base (Bricker 2012).

Barstow's geographic location at the junction of two transcontinental railroads and three interstate highways, as well as available land for expansion, made the base the key USMC logistics center for West Coast operations (William Manley Consulting 1999:8). During the Cold War era, MCLB Barstow supplied, stored, maintained, and repaired equipment and vehicles for the USMC and other Department of Defense (DoD) organizations in the western U.S. and the Pacific (William Manley Consulting 1999:28). During the Vietnam War, MCLB Barstow supplied more than 70 percent of the supplies shipped to the Marines in Vietnam (William Manley Consulting 1999:28).

Most of the buildings and structures on MCLB Barstow were constructed between 1946 and 1989 for the base mission of procuring, maintaining, repairing, storing, and distributing supplies in support of the USMC and other DoD installations west of the Mississippi and around the Pacific (William Manley Consulting 1999). MCLB Barstow contains the largest, single-story building in the USMC. This structure, Production Plant Barstow, Marine Maintenance Command (formerly known as Maintenance Center Barstow), is 440,000 square feet (40,877 square meters) (Bricker 2012). It has more than 300 product lines dedicated to repairing and overhauling ground equipment used by the USMC (Bricker 2012). On 28 December 2012, MCLB Barstow marked its 70th anniversary (Bricker 2012).

4 Previous Archaeological Research

4.1 Records and Literature Search Methods

A records and literature search was conducted at the San Bernardino Archaeological Information Center of the California Historical Resources Information System at the San Bernardino County Museum on 17 September 2013. This records search included a review of all available maps, reports, and site forms within a 1-mile (1.6-kilometer) radius of the APE.

4.2 Results of the Records Search

4.2.1 Previous Archaeological Investigations

Based on the records search information, 33 archaeological investigations have been conducted within 1 mile (1.6 kilometers) of the APE (Table 2).

Table 2. Previous Cultural Resources Investigations within 1-Mile (1.6 Kilometers) of the APE

Author(s) and Year	Report Title
Berryman and Bull (2003)	Final Cultural Resources Survey of 250 Acres on the Western Edge and Proposed Fence Line for the Rifle Range and Reevaluation of a Portion of CA-SBR-8318, Marine Corps Logistics Base, Barstow.
Berryman and Cheever (2003)	Final Archaeological Survey Report for the Western Portion of the Rifle Range, Marine Corps Logistics Base Barstow, California.
Blair et al. (2001)	Reevaluated Cultural Resources Sites for the Proposed 2003 Kern River Expansion Project California. Addendum I To: 2001 Cultural Resource Class I and Class III Investigations for the Proposed 2003 Kern River Expansion Project – California.
Clay and Hause (1990)	Draft Report: An Archaeological Inventory of Two Proposed PG&E Pipeline Corridor Segments: Newberry Springs to Hinkley 29.6 Mi by 200 Ft (717.6 AC), San Bernardino County, California, and Arvin to Kern River 25.2 Mi by 200 Ft (610.9 AC), Kern County, California.
Compass Rose Archaeological, Inc. (2000)	Letter Report on Results of a Phase I Archaeological Survey for Southern California Edison Project.
Daniels et al. (2011)	Final: A Station-wide Cultural Resources Survey at MCLB Barstow, San Bernardino County, California.
Glover (1991)	A Cultural Resources Inventory of Selected Route Re-Alignments for the Mohave Pipeline in California and Arizona.
Hearn and Simpson (1976)	Archaeological-Historical Resources Assessment of Proposed Chino Maintenance Yard Construction.
Heidelberg (2009)	Archaeological Survey Report for Southern California Edison's Service Pole Replacements on the Mule Canyon 12-kV Transmission Line in Yermo, San Bernardino County, California.
Lerch (1990)	Cultural Resources Assessment of the Texaco Cool Water Coal/Sludge Gasification Plant and Alternate Slag Disposal Areas, Daggett, San Bernardino County, California.
Lerch (1994)	Class III Cultural Resources Inventory of the Mojave River Pipeline Project, Phelan to Minneola, San Bernardino County, California. Report prepared for Mojave Water Agency, Apple Valley, CA, and Farmers Home Administration Rural Development Administration, Moreno Valley, CA.
Lerch (2002)	Preliminary Report of Data Recovery on a Portion of the Daggett Ditch, CA-SBR-7883H, Mojave River Pipeline Project, Reach 3D/E, San Bernardino County.
Macko (1992)	Final Report on the Results of a Class III Cultural Resource Survey of the 220-Acre New Owl Rock Products Land Exchange near Barstow, San Bernardino County, California.
McGuire (1990)	A Cultural Resources Inventory and Limited Evaluation of the Proposed Mojave Pipeline Corridor in California and Arizona.

Table 2. Previous Cultural Resources Investigations within 1-Mile (1.6 Kilometers) of the APE

Author(s) and Year	Report Title
McKenna (2005)	Results of a Class III Archaeological Survey for the Proposed Materials Testing Locations at the Service Rock Products/Bureau of Land Management Exchange Project Area near Barstow, San Bernardino County, California.
New Mexico State University (1989)	Cultural Resources for the All American Pipeline Project: Santa Barbara, California, to McCamey, Texas, and Additional Areas to the East along the Central Pipeline Route in Texas. Report submitted by All American Pipeline Company to the Bureau of Land Management California Desert District.
Peak & Associates (1988)	Cultural Resource Survey and Clearance for Re-Routed Portions of the Proposed American Telephone and Telegraph Las Vegas to San Bernardino Fiberoptics Communication Route.
Schmidt and Romani (2002)	Negative Archaeological Survey Report: Southern California Edison Burlington Northern Santa Fe Railroad Line Extension Project.
Simpson (n.d.)	Cultural Resources Assessment, Daggett Community Services District, Water System Improvements, North Reservoir and Well System.
Smith (1980)	Archaeological Studies Daggett Hill Project, Mitigation for Construction of Water Reservoir on Southeast Portion of the Extension of Elephant Mountain.
Southern California Edison Company (1972)	Coolwater-Kramer 220-kV Transmission Line Environmental Report.
Strudwick (1999a)	Cultural Resource Inventory of Three Test Borings Adjacent to the Nebo Annex Marine Corps Logistics Base, Barstow, California.
Strudwick (1999b)	Cultural Resource Inventory of Four Test Borings Adjacent to the Yermo Annex Marine Corps Logistics Base, Barstow, California.
Sutton (1980a)	Memorandum to Geologist, Barstow from Archaeologist, Barstow re: Cultural Resource Assessment #CA-060-MPO-7, Nebo Area.
Sutton (1980b)	Archaeological Investigations at SBr-4037 and SBr-4055, Barstow, California.
SWCA Environmental Consultants (2006)	Cultural Resources Monitoring for the Mojave River Pipeline Project Reaches 4A and 4B, San Bernardino County, California.
Weil et al. (1984)	Cultural Resources Records Search, Records Check and Sample Field Survey for the California Portion of the Celeron/All American Pipeline Project.
Wesson et al. (2004)	Final Reach 4A Addendum Class III Cultural Resources Inventory of the Mojave River Pipeline Project, Phelan to Minneola, San Bernardino County, California.
Willey et al. (2005)	**Survey Report for a Portion of the Rifle Range at Marine Corps Logistics Base, Barstow, California.**
William Manley Consulting (1996)	**Cultural Resources Inventory Survey, Marine Corps Logistics Base Barstow, California.**
William Manley Consulting (1999)	**Cold War Era Historic Resources Eligibility Survey, Marine Corps Logistics Base, Barstow, California.**
Wise and Way (2004)	Final Cultural Resource Survey of One Work Station on the Mule Canyon 33-kV Circuit, Southern California Edison Deteriorated Pole Replacement Program, Marine Corps Supply Center, Naval Reserve, Yermo, San Bernardino County, California.
Wohlgemuth and Glover (1991)	A Cultural Resources Inventory of Three Corridor Expansion Tracts in San Bernardino County, California.
Note: **Bolded** text indicates the study covered a portion of the APE. APE = Area of Potential Effects.	

Of the previous studies listed in Table 2, six studies occurred in the APE. These studies are described below.

- An archaeological survey of MCLB Barstow was completed by William Manley Consulting in 1996 (William Manley Consulting 1996). This study resulted in the recording of three archaeological sites and three lithic isolates on MCLB Barstow.

- An eligibility survey of Cold War-era historic resources on MCLB Barstow was conducted by William Manley Consulting in 1999 (William Manley Consulting 1999). This study included buildings and structures only.
- In 2004, Lorraine M. Willey, Rebecca Apple, and Tanya Wahoff of EDAW, Inc. conducted an archaeological survey of 250 acres (101 hectares) of the Range Complex (Willey et al. 2005). This study resulted in the recordation of 18 sites and 7 isolated finds.
- A study conducted by RECON surveyed 250 acres (101 hectares) on the western edge and proposed fence line of the Range Complex (Berryman and Bull 2003). This study resulted in the recordation of 8 discrete artifact clusters, 1 possible historic trail, and 12 prehistoric isolates.
- James Daniels, Sarah Bowsher, and Mark Becker of ASM Affiliates, Inc. (Daniels et al. 2011) surveyed 426 acres (172 hectares) in the Range Complex and Yermo Annex. The Range Complex survey identified three prehistoric sites, one site with prehistoric and historic components, and two prehistoric isolates. Surveys of two small parcels in the Yermo Annex identified three historic isolates. Two historic period wells were also documented during the investigation.
- A study conducted by Heidelberg (2009) surveyed Southern California Edison's service pole replacements for the Mule Canyon 12-kilovolt transmission line. This study, which crossed the Yermo Annex, did not identify any archaeological resources in the APE.

4.2.2 Previously Recorded Archaeological Sites

Sixty-four previously recorded archaeological or historical sites occur within a 1-mile (1.6-kilometer) radius of the APE (Table 3). Of these cultural resources, 17 are located within the APE (refer to **bolded rows** in Table 3). The previously recorded archaeological sites located within the APE are further described below and are shown in Confidential Appendix B, Figures B-1 through B-3.

Table 3. Previously Recorded Archaeological Sites within 1 Mile (1.6 Kilometers) of the APE

Site Number/ Trinomial	Primary Number	Site Description
CA-SBR-73	36-000073	Rattlesnake Rock Petroglyph site.
CA-SBR-1067	36-001967	A lithic scatter containing secondary flakes, a possible scraper, and one hammerstone.
CA-SBR-2901H	36-002901	Historic trail.
CA-SBR-4411H	36-004411	Mormon Trail.
CA-SBR-5289	36-005289	A lithic scatter of tools and flakes.
CA-SBR-6693H	36-006693	A portion of the Burlington Northern Santa Fe Railway.
CA-SBR-6731	36-006731	A lithic scatter containing one core and three decortication flakes.
CA-SBR-6757/4037H/4055	36-006757	Cobble test/quarry area.
CA-SBR-6764H	36-006764	Multiple building foundations and associated refuse scatters.
CA-SBR-7868	36-007868	Camp with midden deposit, fire-affected rock, milling, and debitage.
CA-SBR-7869H	36-007869	Rock-lined clearing with bottles and glass.
CA-SBR-7873H	36-007873	Refuse dumps and dirt air strip.
CA-SBR-7875H	36-007875	Remains of several houses and associated refuse dumps.
CA-SBR-7883H	36-007883	Daggett Ditch/Canal.
CA-SBR-8317	36-008317	A lithic scatter of chert flakes and cores.
CA-SBR-8319	36-008319	Three sleeping circles.
CA-SBR-10566	36-010566	A lithic scatter including a cluster of chert/chalcedony debitage, one core fragment, one hammerstone, and one scraper.

Table 3. Previously Recorded Archaeological Sites within 1 Mile (1.6 Kilometers) of the APE

Site Number/ Trinomial	Primary Number	Site Description
CA-SBR-10663	36-010663	A low-density lithic scatter.
CA-SBR-10664	36-010664	A lithic scatter containing two cores, one bifacially worked flake, and five to eight chert/silicate flakes.
CA-SBR-10665	36-010665	A lithic scatter of two cores and 15 to 20 chert/silicate flakes and cores.
CA-SBR-10666	36-010666	Lithic scatter - surface scatter of two cores and 8 to 10 chert/silicate flakes.
CA-SBR-10667	36-010667	A lithic scatter of 2 cores and 5 to10 red chert/silicate flakes.
CA-SBR-10668	36-010668	A sparse lithic scatter containing 2 cores and 5 to 10 chert/silicate flakes.
CA-SBR-10669	36-010669	A small lithic scatter containing 2 cores and 10 to 15 chert/silicate flakes.
CA-SBR-10670	36-010670	A sparse lithic scatter containing one core and five to eight chert/silicate primary flakes.
CA-SBR-10671	36-010671	A sparse lithic scatter or chipping station containing 4 cores and 30 to 35 chert/silicate flakes.
CA-SBR-10672	36-010672	A sparse lithic scatter containing 3 to 5 cores and 50 to 60 chert/silicate flakes.
CA-SBR-10673H	36-010673	Possible historic trail.
CA-SBR-10674	36-010674	A small lithic scatter or chipping station containing 8 to 10 primary cores and 100 to 125 flakes of chert/silicates.
CA-SBR-10675	36-010675	A sparse lithic scatter containing 1 core, 1 retouched/unifacially worked flake, and 5 to 10 chert/silicate flakes.
CA-SBR-10676	36-010676	A sparse lithic scatter or chipping stations containing three areas of concentrated chipping containing 5 to 6 cores and 50 to 75 flakes of chert/silicates, and 1 metavolcanic cobble used as an anvil.
CA-SBR-10677	36-010677	A widely dispersed lithic scatter containing 4 to 5 cores, and 70 to 85 chert/silicate flakes.
CA-SBR-10678	36-010678	A sparse lithic scatter containing 5 to 10 primary chert/silicate flakes.
CA-SBR-10679	36-010679	A sparse lithic scatter containing one core and four to five chert/silicate flakes.
CA-SBR-10680	36-010680	A sparse lithic scatter containing 1 core and 10 to 15 chert/silicate flakes.
CA-SBR-11294	36-011294	A low-density lithic scatter containing 3 cores, and 30 chert flakes. Site is within the updated boundary of CA-SBR-8318.
CA-SBR-11295	36-011295	A low-density lithic scatter containing 20 chert flakes, and natural chert cobbles. Site is within updated boundary of CA-SBR-8318.
CA-SBR-11296H	36-011296	Possible historic trail.
CA-SBR-11297	36-011297	A low-density lithic scatter containing 2 cores, and 10 chert/silicate flakes.
CA-SBR-11298	36-011298	A low-density lithic scatter containing 2 cores, 25 chert/silicate flakes, and two smaller chipping stations.
CA-SBR-11299	36-011299	A lithic scatter and 15 primary reduction CCS flaking stations.
CA-SBR-11300	36-011300	A low-density lithic scatter containing 3 small chipping stations, including 7 cores and 45 chert flakes; 2 cores and 15 flakes; and 3 cores and 20 flakes.
CA-SBR-11301	36-011301	A large lithic scatter and 12 primary reduction CCS flaking stations.
CA-SBR-11302	36-011302	A low-density lithic scatter containing 25 chert flakes and natural chert cobbles. Site is within the updated boundary of CA-SBR-8318.
CA-SBR-11836	36-011836	A large lithic scatter and 28 primary reduction CCS flaking stations.
CA-SBR-11837	36-011837	A lithic scatter comprised of two primary reduction CCS flaking stations.

Table 3. Previously Recorded Archaeological Sites within 1 Mile (1.6 Kilometers) of the APE

Site Number/ Trinomial	Primary Number	Site Description
CA-SBR-11838	36-011838	A lithic scatter comprised of 12 primary reduction CCS flaking stations along with 5 debitage and nine cores.
CA-SBR-11839	36-011839	A lithic scatter comprised of four CCS flaking stations along with two flakes, four cores, and one unifacial tool.
CA-SBR-11840	36-011840	A rock ring composed of approximately 35 embedded small- to medium-sized rocks.
CA-SBR-11841	36-011841	A lithic scatter comprised of three primary reduction CCS flaking stations along with one flake.
CA-SBR-11842	36-011842	A lithic scatter comprised of 19 primary reduction CCS flaking stations along with 19 flakes and one biface preform.
CA-SBR-11843	36-011843	A lithic scatter comprised of five primary reduction CCS flaking stations along with four cores and four flakes.
CA-SBR-11844	36-011844	A lithic scatter comprised of two primary reduction CCS flaking stations.
CA-SBR-11845	36-011845	A lithic scatter comprised of 14 primary reduction CCS flaking stations and a low-density lithic scatter of 8 flakes and 1 core.
CA-SBR-11846	36-011846	A lithic scatter comprised of one primary reduction CCS flaking station consisting of five pieces of debitage and one core.
CA-SBR-11847	36-011847	A lithic scatter comprised of one primary reduction CCS flaking station consisting of six pieces of mottled CCS debitage.
CA-SBR-11848	36-011848	A lithic scatter comprised of 1 primary reduction CCS flaking station consisting of 15 pieces of debitage.
CA-SBR-11849	36-011849	A lithic scatter comprised of 1 primary reduction CCS flaking station consisting of 12 pieces of mottled brown CCS debitage.
CA-SBR-11850	36-011850	A lithic scatter comprised of one primary reduction CCS flaking station consisting of two flakes and eight pieces of mottled CCS debitage.
CA-SBR-13861H	36-013861	Two historic refuse deposits, two historic structures, one burned ancillary structure, and one possible well site.
CA-SBR-14833	36-014833	A lithic scatter comprised of 15 pieces of rhyolite including 12 pieces of shatter, 2 interior flakes, and 1 primary flake.
CA-SBR-14834	36-014834	A lithic scatter comprised of 11 pieces of debitage (possible rhyolite), 1 CCS shatter, and 1 assayed chalcedony cobble.
CA-SBR-14835	36-023502	A lithic scatter and possible chert quarry containing several large pieces of brown and white CCS material and two flakes.
CA-SBR-14836/H	36-023503	A lithic scatter, a quarry, and a historic hearth. The historic component consists of a small rock ring with a historic can nearby. The prehistoric component contains two loci of debitage. Locus A is 28 orange volcanic flakes, 10 jasper flakes, and 1 CCS cobble. Locus B contains 14 large assayed CCS cobbles.
Note: Rows in bolded text are within the APE; APE = Area of Potential Effects; CCS = crypto-crystalline silicate.		

4.2.2.1 CA-SBR-73

This site is located in the central portion of the Yermo Stables training area. The site was documented in the late 1800s (Crossman 1890; Mallery 1889; Steward 1929). The first formal site recordation was made by G. A. Smith (1939) with numerous updates submitted since that time. The site consists of numerous petroglyphs on a rocky outcrop. Over the years the site has been vandalized and historic graffiti dating from the late 1800s onward has been added (Murray et al. 2011).

Sonin (1995:140) describes the site as containing Great Basin curvilinear abstract petroglyphs on the top, south, and east sides of an isolated porphyritic rock outcrop. It appears that many of the glyphs occur on boulders that have broken off of the main outcrop and rolled downhill (Sonin 1995:140).

Early reports listed stone tools and an *Olivella* bead as present around the rock. However, excavation of 45 shovel test pits around the rock in 1996 produced no prehistoric artifacts (William Manley Consulting 1996; Manley and Hector 1996). Manley and Hector (1996) reported that the site was "seriously disturbed by the carving of initials and dates, and particularly by the blasting away of portions of the rock." The site was situated inside a "tracked vehicle test track" and considerable heavy vehicle traffic occurs just outside the fence (Manley and Hector 1996).

In 2000, a draft National Register of Historic Places (NRHP or National Register) nomination form was prepared for CA-SBR-73. The nomination form describes the site in detail and includes descriptions, photographs, and drawings of each rock art panel, and any vandalism present. The site was recommended as eligible for listing in the NRHP under Criterion C (embodying the distinctive characteristics of a type, period, or method of construction, or representing the work of a master, or possessing high artistic values). The USMC installed a protective, chain-link fence around the site.

In 2015, a purple dwarf olive (*Olivella biplicata*) spire-lopped shell bead was observed approximately 6.5 feet (2 meters) north of the fenceline that surrounds the site. According to Bennyhoff and Hughes (1987:120), this bead is a Class A: Spire-Lopped and is type A1 Simple Spire-Lopped type. This bead appears to be a Large Spire-Lopped type.

4.2.2.2 CA-SBR-11299

This site is located near the southern boundary of the Range West training area. This site was first recorded by Berryman and Bull (2003). The site was re-recorded by Willey et al. (2005) as a part of their re-survey of the northern section of CA-SBR-8318.

This site is situated on a low terrace within a large north-trending wash (Wahoff and Fitzsimons 2004a). The site measures 1,082 feet (330 meters) northwest-southeast by 279 feet (85 meters) northeast-southwest (Wahoff and Fitzsimons 2004a). This site is a lithic scatter comprised of 15 flaking stations; all are primary reduction of CCS material (Wahoff and Fitzsimons 2004a). The flaking stations range in size from 3 feet (1 meter) in diameter to 6.5 feet (2 meters) by 13 feet (4 meter) in size. The flaking stations contained three to 60 or more flakes or lithic debitage. Eight additional pieces of debitage and one core were also observed (Wahoff and Fitzsimons 2004a).

4.2.2.3 CA-SBR-11301

This site is located near the southern boundary of the Range West training area. This site was first recorded by Berryman and Bull (2003). The site was re-recorded by Willey et al. (2005) as a part of their re-survey of the northern section of CA-SBR-8318.

This site is located on two ridgelines and a low terrace within a large, north-trending seasonal wash (Wahoff and Fitzsimons 2004b). The site measures approximately 1,115 feet (340 meters) north–south by 492 feet (150 meters) east–west. The site is described as a large lithic scatter comprised of 12 flaking stations and a low-density lithic scatter (Wahoff and Fitzsimons 2004b). The flaking stations are primary reduction of CCS material (Wahoff and Fitzsimons 2004b).

4.2.2.4 CA-SBR-11837

This site is located near the western boundary of the Range West training area. Originally recorded as part of CA-SBR-8318, CA-SBR-11837 measures 148 feet (45 meters) north–south by 26 feet (8 meters) east–west (Willey et al. 2005). The site is situated on a terrace covered with moderate to well-developed desert pavement (Wahoff and Fitzsimons 2004c). The site is a lithic scatter comprised of two flaking stations, both containing primary reduction flakes of locally available CCS material (Wahoff and Fitzsimons 2004c).

4.2.2.5 CA-SBR-11838

This site is located near the western boundary of the Range West training area. This site is a lithic scatter comprised of 12 flaking stations, 5 debitage, and 9 cores (Wahoff and Fitzsimons 2004d). All of the primary reduction flakes are CCS material. The site measures 1,197 feet (365 meters) north–south by 230 feet (70 meters) east–west and is situated on a ridge top and a terrace on the west-facing slope of the ridgeline (Wahoff and Fitzsimons 2004d).

4.2.2.6 CA-SBR-11840

This site is located near the western boundary of the Range West training area. This site consists of a rock ring measuring 9 feet (2.75 meters) north–south by 7.2 feet (2.2 meters) east–west (Wahoff and Fitzsimons 2004e). The ring is composed of approximately 35 embedded small- to medium-sized boulders of volcanic material (Wahoff and Fitzsimons 2004e). The site is situated on a desert pavement-covered ridgeline (Wahoff and Fitzsimons 2004e). No artifacts were observed in association with the rock ring (Wahoff and Fitzsimons 2004e).

4.2.2.7 CA-SBR-11841

This site is located in the southwestern portion of the Range West training area. This site is a lithic scatter comprised of three flaking stations and one flake; all are primary reduction of CCS material (Wahoff and Fitzsimons 2004f). The site measures 82 feet (25 meters) northeast-southwest by 43 feet (13 meters) northwest-southeast and is situated on a terrace at the base of the east-facing slope of a large ridgeline (Wahoff and Fitzsimons 2004f).

4.2.2.8 CA-SBR-11842

This site is located in the center of the Range West training area. This site is a lithic scatter comprised of 19 flaking stations, about 19 flakes, and a biface preform. The 19 flaking stations contain from 3 to 17 or more flakes. All of the artifacts are primary reduction of CCS material (Wahoff and Fitzsimons 2004g).

The site measures 787 feet (240 meters) north–south by 492 feet (150 meters) east–west and is situated on a series of low terraces within a large, north-trending wash (Wahoff and Fitzsimons 2004g).

4.2.2.9 CA-SBR-11843

This site is located in the eastern half of the Range West training area. This site is a lithic scatter comprised of five flaking stations, four cores, and four flakes (Wahoff and Fitzsimons 2004h). All of the debitage are primary reduction flakes of CCS material. The site measures 459 feet (140 meters) northwest-southeast by 98 feet (30 meters) northeast-southwest and is situated on a series of low terraces within a large, north-trending wash (Wahoff and Fitzsimons 2004h).

4.2.2.10 CA-SBR-11844

This site is located in the eastern half of the Range West training area. This site is a lithic scatter comprised of two flaking stations (Wahoff and Fitzsimons 2004i). All artifacts are primary reduction of CCS materials. The site measures 98 feet (30 meters) northeast-southwest by 33 feet (10 meters) northwest-southeast and is situated on a low terrace within a large, north-trending seasonal wash (Wahoff and Fitzsimons 2004i).

4.2.2.11 CA-SBR-11845

This site is located near the eastern boundary of the Range West training area. This site is a lithic scatter comprised of 14 flaking stations and a low-density lithic scatter of eight flakes and one core (Wahoff and Fitzsimons 2004j). The lithics are primary reduction of CCS material. The site measures 1,017 feet (310 meters) northwest-southeast by 131 feet (40 meters) northeast-southwest and is situated on a series of low terraces within a large, north-trending seasonal wash (Wahoff and Fitzsimons 2004j).

4.2.2.12 CA-SBR-11846

This site is located in the center of the Range West training area. This site consists of a single flaking station located on a graveled/pavement-covered terrace (Wahoff and Fitzsimons 2004k). The flaking station is composed of five pieces of CCS debitage and one core. The site measures 3.3 feet (1 meter) by 3.3 feet (1 meter).

4.2.2.13 CA-SBR-11847

This site is located near the western boundary of the Range West training area. This site consists of a flaking station of six mottled CCS pieces of debitage (Wahoff and Fitzsimons 2004l). The debitage is all primary reduction. The site is situated on a low terrace adjacent to a large, north-trending seasonal wash (Wahoff and Fitzsimons 2004l). The site measures 1.6 feet (0.5 meter) by 1.6 feet (0.5 meter).

4.2.2.14 CA-SBR-11850

This site is located in the southwest portion of the Range West training area. This site consists of one flaking station and two flakes situated on a large terrace at the base of an east-facing slope (Wahoff and Fitzsimons 2004m). The flaking station is composed of eight mottled CCS pieces of debitage. The site measures 131 feet (40 meters) northwest-southeast by 33 feet (10 meters) northeast-southwest (Wahoff and Fitzsimons 2004m).

4.2.2.15 CA-SBR-14835

This site is located near the northeast corner of the Range West training area. This site is a possible quarry site for chert (Daniels 2011a). The artifacts identified include more than 10 large CCS rocks with evidence of testing and 2 interior flakes (Daniels 2011a). The dimensions of the site are 59 feet (18 meters) long by 36 feet (11 meters) wide. The site is located on the eastern edge of a large, north-to-south trending wash (Daniels 2011a).

4.2.2.16 CA-SBR-14836/H

This site is located near the northeast corner of the Range West training area. This site is a multicomponent site on the east bank of a large, dry, seasonal wash (Daniels 2011b). The prehistoric component includes two loci. Locus A consists of a small (33 feet [10 meters] by 16 feet [5 meters]) concentration of debitage including 28 orange volcanic flakes, 10 jasper flakes, and 1 unmodified cobble. Locus B is a larger (72 feet [22 meters] by 36 feet [11 meters]) concentration of CCS rocks including 14 large, assayed cobbles (i.e., rocks whose interiors have been exposed by the removal of one or a few flakes, to test the material quality) and numerous small pieces of shatter. The historic component consists of a small rock ring or fire hearth and a historic can with a friction lid (Daniels 2011b).

4.2.3 Previously Recorded Isolated Artifacts

In addition to the previously recorded archaeological sites, 24 previously recorded isolated artifacts occur within a 1-mile (1.6-kilometer) radius of the APE. Four of the previously recorded isolated artifacts are located within the APE. The isolated artifacts are listed in Table 4 and are shown in Confidential Appendix B, Figures B-1 and B-2.

Table 4. Previously Recorded Isolated Artifacts within 1 Mile (1.6 Kilometers) of the APE

Primary Number	Isolate Description
36-020356	One CCS angular waste flake.
36-020358	One CCS core.
36-020359	One CCS flake.
36-020360	Two CCS flakes.
36-020361	One CCS flake.
36-020362	One CCS flake.
36-021601	One CCS core.
36-023506	One jasper interior flake.
36-023507	One CCS flake tool.
36-061564	1932 California license plate.
36-061565	One edge-modified basalt cobble.
36-061576	One jasper flake.
36-061577	Two white chert flakes and several pieces of debitage.
36-061578	Several brown chert (or jasper) flakes and pieces of debitage.
36-061579	Several red chert flakes and pieces of debitage.
36-064594	One chert/silicate core.
36-064597	One chert/silicate core and one flake.
36-064599	One chert/silicate core.

Table 4. Previously Recorded Isolated Artifacts within 1 Mile (1.6 Kilometers) of the APE

Primary Number	Isolate Description
36-064600	Two chert/silicate flakes.
36-064601	One core and two flakes.
36-064602	One chert/silicate flake.
36-064603	One chert/silicate flake.
36-064605	One chert/silicate flake and one core.
36-064606	Two chert/silicate flakes.
Notes: Rows in **bolded** text are within the APE. APE = Area of Potential Effects; CCS = crypto-crystalline silicate.	

5 Field Methods

Leidos personnel performed intensive archaeological surveys on approximately 1,061.5 acres (429.6 hectares) of land within the APE that had not been recently surveyed (Figures 2-5). The archaeological field crew included Stephen Bryne, Register of Professional Archaeologists (RPA); Trisha Drennan, RPA; Christopher Duran, RPA; Cathy Halley, and Sydni Kitchel.

The survey area boundaries were delineated by use of non-differential Global Positioning System (GPS) equipment, built environment/hardscape landmarks, and topographic landmarks with the assistance of aerial photographs and United States Geological Survey (USGS) maps. Once a survey area was located, the crew assembled along one boundary and walked parallel transects spaced at no more than 82-foot (25-meter) intervals. Additionally, a concentrated effort was made to examine subsurface exposures such as animal burrows, eroded areas, and road cuts for indications of buried cultural deposits.

Sites were defined as three or more prehistoric artifacts and six or more historic artifacts in a 269-square-foot (25-square-meter) area. Less than three prehistoric artifacts and less than six historic artifacts were recorded as isolated artifacts. Leidos personnel revisited all the previously recorded archaeological sites within the APE to ensure site conditions have not changed since they were recorded. Field data were collected using the hand-held Trimble GPS GeoXH 2008 (with sub-one meter accuracy) for recording point, line, and polygon information. All recorded sites and isolates were mapped with the same hand-held Trimble GPS GeoXH 2008.

All archaeological sites identified as a result of the surveys were recorded on current California Department of Parks and Recreation (DPR) forms and will be submitted to the San Bernardino Archaeological Information Center of the California Historical Resources Information System for permanent state trinomials.

Only visible surface artifacts and artifact identifications were made. No artifacts were collected. All artifacts and features were identified in the field as to general classification (e.g., flake, bottle) and basic raw material type. Descriptions provided indicate the level of detail that could be obtained from an artifact. For example, when a metal can could be identified as a sanitary (food) can that specification was made; if not it was identified as a metal can. In addition, evidence of usage or use wear (i.e., battering, striations) was noted. Measurements of some artifacts were taken when possible. Isolated artifacts were photographed. Representative digital photographs were also taken of all archaeological sites and isolated artifacts.

6 Results of the Field Survey

Surface visibility within the APE averaged approximately 90 percent, with little or no vegetation obscuring the ground surface. The landforms present in this area, including alluvial terraces and desert pavement, are depositional environments and the dominant geomorphic processes are alluvial. However, in areas featuring desert pavement, the ground surface appears to be very stable, and it appears to have been largely undisturbed for hundreds if not thousands of years. In the Range Complex, soils are composed of well-developed desert pavement. In the Yermo Stables survey area, soils are alluvium, most likely deposited during flood events of the Mojave River.

Modern refuse or debris was found scattered throughout the survey area and included aluminum cans, glass soft drink and beer bottles, lumber, car parts, wire, machine bolts and nuts, spray paint cans, metal paint cans, batteries, shotgun shells, and brass shell casings.

Newly recorded sites and isolates were assigned temporary numbers beginning with MCLB-SITE or MCLB-ISO and sequential numbers. (Note to reviewers: Temporary numbers will be replaced with Primary numbers and/or trinomials assigned by the Information Center.)

Figures showing the locations of previously and newly identified sites and isolates are included in Confidential Appendix B. DPR forms 523 (site forms) for the newly identified sites are included in Appendices C (sites) and D (isolates).

6.1 Newly Recorded Sites

A total of 26 newly recorded archaeological sites and 116 isolated artifacts were identified in the APE. Descriptions of the newly recorded sites are provided below and summarized in Table 5. Representative photographs of the newly recorded sites are shown in Figures 6-8.

Table 5. Newly Recorded Archaeological Sites in the APE

Site Number	Site Description
MCLB-SITE-1	Historic refuse scatter
MCLB-SITE-2	Historic can scatter
MCLB-SITE-3	Historic refuse scatter
MCLB-SITE-4	Historic refuse scatter
MCLB-SITE-5	Historic can scatter
MCLB-SITE-6	Historic camp
MCLB-SITE-7	Rock ring
MCLB-SITE-8	Prehistoric lithic scatter
MCLB-SITE-9	Prehistoric lithic scatter
MCLB-SITE-10	Historic can scatter
MCLB-SITE-11	Historic refuse scatter
MCLB-SITE-12	Historic camp
MCLB-SITE-13	Prehistoric lithic scatter
MCLB-SITE-14	Historic refuse scatter
MCLB-SITE-15	Historic can scatter
MCLB-SITE-16	Historic refuse scatter
MCLB-SITE-17	Historic refuse scatter
MCLB-SITE-18	Prehistoric lithic scatter
MCLB-SITE-19	Prehistoric lithic scatter
MCLB-SITE-20	Historic can scatter

Table 5. Newly Recorded Archaeological Sites in the APE (Continued)

Site Number	Site Description
MCLB-SITE-21	Historic refuse scatter
MCLB-SITE-22	Historic refuse scatter
MCLB-SITE-23	Historic refuse scatter
MCLB-SITE-24	Historic can scatter
MCLB-SITE-25	Prehistoric lithic scatter
MCLB-SITE-26	Historic refuse scatter
APE = Area of Potential Effects; MCLB = Marine Corps Logistics Base.	

6.1.1 MCLB-SITE-1

MCLB-SITE-1 is a historic refuse scatter in the Range East and KD Range Complex. The site is located mostly north of the existing unimproved, utility right-of-way access route; however, a small portion of the site extends south of the access route. A utility corridor, which contains power lines and a high-pressure gas line, is just south of the access route.

The site most likely represents a deposit of domestic refuse that was dumped at this location, rather than the remains of a camp or dwelling, since there are no structural remains present. All of the artifacts are located on the ground surface, and there is no evidence of a subsurface deposit. Vegetation in the area includes creosote bush and white bursage.

The dimensions of the site are 92 feet (28 meters) north–south by 148 feet (45 meters) east–west, and the site area is 9,601 square feet (892 square meters). This site contains a scatter of historic refuse, including hole-in-top cans, metal sanitary cans, a porcelain metal bowl, a turquoise Fiesta ware plate fragment, a Mason jar screw-top lid, and amber, green, and clear soft drink bottles (Figure 6). A head gasket from a 6-cylinder automobile or truck engine is also present. Metal sanitary cans include a canned meat or fish can with a twist key, stamped on the base "ESTABIA, …USTRIA," 4-ounce juice cans, and food cans. Soft drink bottles include Donald Duck Soda, Seven-Up, and Nesbitt's of California. The Donald Duck Soda is labeled "Donald Duck Beverage, Bottled under Authority General Beverages Incorporated." A Seven-Up bottle is labeled "7 UP, NO DEPOSIT, 12 FL. OZ., 7 UP YOU LIKE IT—IT LIKES YOU." The base of this bottle is embossed "5051 NOT TO BE REFILLED, 99, H [double diamond symbol] 15A."

Hole-in-top cans, especially for condensed milk, were manufactured from ca. 1810 into the mid- to late-1900s (Nevada Archaeological Site Stewardship Program 2007; IMACS User Guide 2001). Fiesta ware, produced by the Homer Laughlin China Company of Newell, West Virginia, was manufactured from the 1930s to the 1970s (Smithsonian Legacies 2013). Donald Duck soft drinks were produced by General Beverages, Inc. of Chattanooga, Tennessee (Donald Duck Soda 2013). The Donald Duck fruit-flavored sodas were introduced in the 1940s (Donald Duck Soda 2013). The brand was discontinued in the late 1950s (Donald Duck Soda 2013).

Charles Grigg developed a soft drink with the name of Bib-Label Lithiated Lemon-Lime Soda in the 1930s (Seven-Up Timeline and History 2013). In 1936, Grigg changed the name of the company from The Howdy Company to The Seven-Up Company. The soda's name was changed to 7UP or Seven-Up. The product's slogan was "You Like It, It Likes You." The Seven-Up Company went through three front-label changes between 1936 and about 1968 (Lockhart 2005:21). The final style, from 1953 to ca. 1968, had several minor changes, but the label dropped the figure of a lady in a swim suit. The Seven-Up bottle from this site appears to be the third or final style, dating from 1953 to ca. 1968.

MCLB-SITE-1, facing south.

MCLB-SITE-5, facing northwest.

MCLB-SITE-6, Locus A.

MCLB-SITE-6, Locus B.

MCLB-SITE-6, Locus C, facing southeast.

MCLB-SITE-6, Locus E (Fire Ring).

Representative Site Photographs
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
6

MCLB-SITE-7, Rock ring, facing east.

MCLB-SITE-7, Rock ring, facing south.

MCLB-SITE-11, facing north.

MCLB-SITE-12, Locus A, facing southwest.

MCLB-SITE-12, Locus B, facing south.

MCLB-SITE-12, Locus C, facing northeast.

Representative Site Photographs Barstow Training and Range MCLB Barstow, San Bernardino County, California	FIGURE 7

MCLB-SITE-12, Locus H, portable slab metate, close-up.

MCLB-SITE-15, facing north.

MCLB-SITE-25, facing southwest.

Recent dog burials, facing southwest.

Dog burial excavation.

Representative Site Photographs
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
8

Nesbitt's soft drinks were produced by the Nesbitt Fruit Products Company of Los Angeles, California. Nesbitt's began bottling Nesbitt's soft drinks in 1938 or 1939; in addition to orange, other flavors included Crème Soda, Grape, Strawberry, Root Beer, and Lemon-Lime. Nesbitt's was sold to Clorox in 1972 (Nesbitt's Orange Facts 2013).

No features or standing structures of any type are present. Since no structural remains are present, the site likely represents a deposit of domestic refuse that was dumped at this location, rather than the remains of a camp or dwelling. Based on the artifacts present, this site appears to date from about 1940 to 1953, particularly due the third style of Seven-Up bottle present at the site.

6.1.2 MCLB-SITE-2

This site consists of a historic can scatter in the Range East and KD Range Complex. The dimensions of the site are 49 feet (15 meters) north–south by 33 feet (10 meters) east–west, and the site area is 1,109 square feet (103 square meters). This site likely represents refuse discarded from a vehicle or vehicles traveling on the existing unimproved, utility access route just south of the site. There is no evidence of a historic occupation (e.g., building materials or architectural features). All of the cans are located on the ground surface, and there is no evidence of a subsurface deposit. Vegetation in the site area includes creosote bush and white bursage.

The site contains a scatter of five metal cans. One small metal can is embossed on its base "ESTAB 199" and "AT 220," which was manufactured between 1907 and the 1950s. This can was opened on its side with a twist-key. It may have been a potted meat or SPAM can. The key method of opening cans was developed by Edwin Norton of Chicago in 1885 (Nevada Archaeological Site Stewardship Program 2007). This method rolled a scored strip from the can, so that the top or bottom could be removed as a single unit. This opening method was used through the 1950s.

No features or standing structures of any type are present. Based on the artifacts present, this site likely dates from approximately 1907 through the 1950s.

6.1.3 MCLB-SITE-3

This site consists of a historic refuse scatter in the Range Main Supply Route. The site extends north and south of the existing unimproved, utility access route. The dimensions of the site are 141 feet (43 meters) north–south by 400 feet (122 meters) east–west, and the site area is 32,550 square feet (3,024 square meters). This site likely represents refuse discarded from a vehicle or vehicles traveling on the utility access route, which transects through the site from east to west. There is no evidence of a historic occupation. All of the artifacts are located on the ground surface, and there is no evidence of a subsurface deposit. Vegetation in the site area includes creosote bush and white bursage.

This site contains a scatter of historic refuse, including metal cans, glass bottles, Mason jars, a pharmaceutical bottle, a white-enameled metal basin, and a wooden crate. The pharmaceutical bottle is not diagnostic—it is a clear glass bottle fragment (portion of body and neck) with a screw-top, black plastic lid or closure. The base is missing and no embossing was present on the bottle fragment. One clear glass soft drink bottle is embossed on its shoulder "No Deposit No Return." Other glass soda or soft drink bottles include Bireley's, Pepsi-Cola, Coca-Cola, Nehi, and Seven-Up. All of the metal cans are 12-ounce steel cans with church-key-type openings. Most, or all, the cans have been shot with firearms or used for target practice.

Bireley's Orange was manufactured by Frank W. Bireley of Palo Alto, California, beginning in the 1920s. It was a pasteurized fruit drink made from blended fruit juice, and it was not carbonated. Bireley's orange

soda dates from ca. late 1940s through the 1960s (USA Soda 2013). Cans with church-key-type openings first appeared in 1935 and were common until 1960 (Rock 1987:112).

No features or standing structures of any type are present. Based on the artifacts present, this site appears to date to the late 1940s until 1960.

6.1.4 MCLB-SITE-4

This site consists of a historic refuse scatter in the Range Main Supply Route. The dimensions of the site are 69 feet (21 meters) north–south by 105 feet (32 meters) east–west and the site area is 3,143 square feet (292 square meters). This site likely represents refuse discarded from a vehicle or vehicles traveling on the existing unimproved, utility access route just south of the site. There is no evidence of a historic occupation. All of the artifacts are located on the ground surface, and there is no evidence of a subsurface deposit. Vegetation in the site area includes creosote bush and white bursage.

Household refuse on the site includes clear glass drinking glasses or tumblers, metal food cans, a wire-metal dish drainer, shoes, plastic toys, washing machine parts, wooden furniture pieces, plastic jars, ceramic flower pot fragments, and a Pond's Cold Cream jar. A milk glass canning jar lid (in three fragments) likely dates from ca. 1890s to the 1960s. A clear glass has an image of Bamm-Bamm Rubble of The Flintstones cartoon feature. The Flintstones appeared on television from 1960 through 1966 (The Flintstones 2015).

A plastic, Dolly Parton doll that is based on country music star Dolly Parton was present at the site. The Dolly Parton doll dates to ca. 1970. A Care Bear plastic eraser toy was also present. The Care Bear eraser likely dates to the 1980s. Metal cans include tuna fish cans opened with a rotary-type can opener. One clear glass pharmaceutical bottle has a screw-top closure. Broken glass includes clear, amber, yellow, and green colors.

No features or standing structures of any type are present. Based on the artifacts present, the site likely dates to the 1960s through the 1980s.

6.1.5 MCLB-SITE-5

This site consists of a historic can scatter in the Range Main Supply Route. The dimensions of the site are 56 feet (17 meters) north–south by 26 feet (8 meters) east–west, and the site area is 1,108 square feet (103 square meters). The site is situated in a dry desert wash and another dry desert wash is located about 33 feet (10 meters) west of the site (Figure 6). This site likely represents refuse discarded from a vehicle or vehicles traveling on the existing unimproved, utility access route just south of the site. There is no evidence of any structural remains or a historic occupation. The artifacts are located on the ground surface and there is no evidence of a subsurface deposit.

The site contains three metal cans. Two cans have church-key-type openings and one is a smaller, sanitary-type food can. All three cans have been used for target practice or shot with a shotgun. Cans with church-key-type openings first appeared in 1935 and were common until 1960 (Rock 1987:112).

No features or standing structures of any type are present. Based on the artifacts present, this site likely dates between 1935 and 1960.

6.1.6 MCLB-SITE-6

This site is a historic camp in the Range Main Supply Route and Range West. The dimensions of the site are 272 feet (83 meters) north–south by 88 feet (27 meters) east–west, and the site area is 16,824 square feet (1,563 square meters). The site is located on a desert terrace just east of the base of a ridge to the west. Vegetation in the site area includes creosote bush, white bursage, catclaw, ephedra, and Mojave yucca (*Yucca schidigera*).

There are five loci (Loci A through E) in the site area (Figure 6). Locus A is a can scatter with 12 metal sanitary food cans, 1 amber glass jug, 3 steel tobacco cans, clear and cobalt blue glass fragments, 1 aluminum pan from a mess kit, 1 clear glass bottle, and 1 small metal can or flask. Locus B is a rock pile approximately 3 feet (1 meter) high by 11 feet (3.5 meters) long by 10.5 feet (3.2 meters) wide. Locus C is a refuse scatter with turquoise Fiesta ceramics, bottle glass, chicken wire, metal pipes, hole-in-top cans, a metal baby bedspring, dimensional lumber, and clear, cobalt, amber, and light green bottle glass fragments. Locus D contains a fire ring with nine metal cans with church-key-type openings; the cans are scattered throughout the locus. The Locus D fire ring is composed of 16 rocks in a circle with charcoal and wire nails in the center. The Locus D fire ring is surrounded by rock ring for sitting. Locus E is a fire ring composed of 13 rocks and containing charcoal and one wire nail.

Hole-in-top cans, especially for condensed milk, were manufactured from ca. 1810 into the mid- to late-1900s (Nevada Archaeological Site Stewardship Program 2007; IMACS User Guide 2001). Cans with church-key-type openings first appeared in 1935 and were common until 1960 (Rock 1987:112). Fiesta ceramics were produced by the Homer Laughlin China Company of Newell, West Virginia (Smithsonian Legacies 2013). These ceramics were manufactured from the 1930s to the 1970s. Fiesta ceramic dinnerware was introduced in 1936. Fiesta wares were known for their bright colors, modern design, and affordability.

No standing structures of any type are present. Based on the artifacts present, this site likely dates between to the 1940s or 1950s.

6.1.7 MCLB-SITE-7

This site is a rock ring located west of the existing trail along the ridgeline on the western boundary of Range West. The site is located at the northern terminus of a ridgetop with a sweeping view of the surrounding terrain. The site is approximately 33 feet (10 meters) west of the existing trail, which runs roughly north–south along this ridgetop. The dimensions of the rock ring are 14 feet (4.2 meters) long by 10.5 feet (3.2 meters) wide. This rock ring is loosely constructed; approximately 50 rocks are arranged in a rough oval shape (Figure 7).

The rocks do not appear to be deeply embedded into the ground. Since no diagnostic artifacts are present, it is unclear whether this site represents a prehistoric or a historic site.

6.1.8 MCLB-SITE-8

This site is a prehistoric lithic scatter in Range West. The dimensions of the site are 43 feet (13 meters) north–south by 29 feet (9 meters) east–west, and the site area is 893 square feet (83 square meters). This site is located on a terrace at the base of a hill to the east, and the site overlooks a dry desert wash to the west. The ground surface is desert pavement. Sparse vegetation in the site area includes creosote bush, white bursage, spiny senna, desert trumpet (*Eriogonum inflatum*), and Mojave yucca.

This site contains one *in situ*, small CCS boulder with approximately 20 flakes and shatter in the immediate vicinity of the boulder and 25 flakes in the surrounding area. All of the flaked material is CCS. Primary reduction, or assaying, of this material appears to have been the reason for this site's occurrence. No diagnostic artifacts are present. All of the artifacts are located on the ground surface. This site appears to be limited to a surface expression, and a subsurface component does not appear likely.

6.1.9 MCLB-SITE-9

This site is a prehistoric lithic scatter in Range West. The dimensions of the site are 26 feet (8 meters) north–south by 29 feet (9 meters) east–west, and the site area is 667 square feet (62 square meters). This site is at the terminus of a finger ridge. The ground surface is desert pavement. Sparse vegetation in the site area includes creosote bush, white bursage, spiny senna, desert trumpet, and Mojave yucca.

This site contains approximately 25 flakes and shatter. All of the lithic material is CCS. This appears to be a site where primary lithic reduction occurred. Primary reduction, or assaying, of this material appears to have been the reason for this site's occurrence. No diagnostic artifacts are present. This site appears to be limited to a surface expression, and a subsurface component does not appear likely. All of the artifacts are located on the ground surface.

6.1.10 MCLB-SITE-10

This site is located near the eastern boundary of the Range East and KD Range Complex. The site consists of a historic can scatter and a brass shell casing. The dimensions of the site are 26 feet (8 meters) north–south by 16 feet (5 meters) east–west, and the site area is 344 square feet (32 square meters). This site likely represents refuse discarded from a vehicle or vehicles traveling on the Rifle Range Road approximately 33 feet (10 meters) west of the site.

There is no evidence of a historic occupation. All of the artifacts are located on the ground surface, and there is no evidence of a subsurface deposit. Vegetation in the site area includes creosote bush and white bursage.

Three metal cans include one can with church-key-type opening, one can with aluminum top and pull-tab opening, and one undifferentiated metal can. Cans with church-key-type openings first appeared in 1935 and were common until 1960 (Rock 1987:112). The cans at this site likely date toward the end of this date range. Pull-tab beer and soft drink closures first appeared in 1962.

The brass shell casing is marked "MATCH LC 65" on its headstamp. The 7.62mm Match M118 cartridge was first approved for production in August of 1964 with the earliest runs produced at Frankford Arsenal. The "LC" on this casing indicates that it was produced at the Lake City Ordnance Plant, located in Lake City, Missouri (Meketa 2015).

No features or standing structures of any type are present. The dates of the site's artifacts suggest that this site dates to the early 1960s.

6.1.11 MCLB-SITE-11

This site consists of a historic refuse scatter of mostly military-related hardware within the LZ 1 buffer area in the Range East and KD Range Complex. The dimensions of the site are 43 feet (13 meters) north–south by 105 feet (32 meters) east–west, and the site area is 2,971 square feet (276 square meters). There is no evidence of a historic occupation at this location. All of the artifacts are located on the ground

surface, and there is no evidence of a subsurface deposit (Figure 7). Vegetation in the site area includes creosote bush and white bursage.

Three loci (Loci A-C) are present. These loci are described individually below.

- Locus A contains approximately 25 brass shell casings with headstamps marked “LC 53”; also present are 25 M1 magazine cartridges, lead projectiles, approximately 30 12-inch (30-centimeter) long metal rods, 2 padlocks, 75 wire nails, 2 clear glass bottle bases (burned), 1 clear glass bottle, 3 square machine nuts, 3 metal washers, 1 metal spring, 1 metal safety pin, and 2 metal solvent-type cans. Locus A is 5 feet (1.5 meters) north–south by 6 feet (2 meters) east–west.
- Locus B contains one rectangular, metal, solvent-type can with punch-top opening and screw top.
- Locus C contains one metal tobacco tin stamped “PRINCE ALBERT” on its base, with a hinged top.

The M1 carbine was the standard-issue service rifle of the U.S. forces in World War II, the Korean War, and it also had limited use in the Vietnam War. The 1953 headstamp date on the shell casings is contemporaneous with the Korean War (1950 to 1953), and this site likely dates to this era (Headstamp Codes 2015). Prince Albert pocket tobacco tins are found in post-1900 sites; this product was patented in 1907 (Nevada Archaeological Site Stewardship Program 2007). The Prince Albert tobacco tin was first introduced in 1908. In 1913, the tins were changed to the style that was in use through 1987 (Rock 1987:62–63).

No features or standing structures of any type are present. Based on the artifacts present, this site likely dates to the 1950s.

6.1.12 MCLB-SITE-12

This site consists of a historic camp near the southeast corner of the Range East and KD Range Complex. The site is surrounded by a wire fence and has wood posts set at varying distances from each other. The dimensions of the site are 275 feet (84 meters) north–south by 164 feet (50 meters) east–west, and the site area is 41,925 square feet (3,895 square meters). The site is situated on an alluvial fan with sparse desert vegetation including creosote bush and white bursage.

The artifacts and features are on the ground surface, and there does not appear to be a subsurface component. There is no evidence of active mining at this location. There are 11 features or loci (Loci A through K) within the site boundary.

The individual loci are described below.

- Locus A is a barbecue pit consisting of a partially buried 50-gallon (189-liter) drum with a metal spit atop two partially buried forked tree branches (Figure 7). The metal drum contains clear and green glass bottles and steel cans with aluminum tops and pull-tab openings, and aluminum cans including Canada Dry Jamaica Cola, Coors, and Coca-Cola (with Arden Square logo).
- Locus B consists of a pile of lumber with wired and chicken wire and bamboo or reed roofing material (Figure 7). Dimensional lumber includes 1-inch by 12-inch (2.5-centimeter by 30-centimeter), 4-inch by 4-inch (10-centimeter by 10-centimeter), and 1-inch by 2-inch (2.5-centimeter by 5-centimeter) pieces. This structure may have been a corral or pen for animals. The dimensions of Locus B are 16 feet by 16 feet (5 meters by 5 meters).

- Locus C consists of a fire ring with 21 cobbles in a circle, approximately 3.3 feet (1 meter) in diameter (Figure 7).
- Locus D is a fire ring with 23 cobbles in a circle, approximately 3.3 feet (1 meter) in diameter.
- Locus E consists of a wooden gate lying on the ground with dimensions of 13 feet (4 meters) long by 3.3 feet (1 meter) high.
- Locus F is one metal can with church-key-type opening, with bullet holes, and a 2-inch by 4-inch (5-centimeter by 10-centimeter) wood section with wire fencing attached.
- Locus G is a wood pile, possibly a former fence section or gate with dimensional lumber including 1-inch by 12-inch (2.5-centimeter by 30-centimeter), 4-inch by 4-inch (10-centimeter by 10-centimeter), and 1-inch by 2-inch (2.5-centimeter by 5-centimeter) pieces. The extent of Locus G is 16 feet (5 meters) north–south by 10 feet (3 meters) east–west.
- Locus H is a possible prehistoric slab metate, of metavolcanic rock, broken in four pieces. This artifact may have been collected and/or curated by the occupants of this camp; there is no evidence that this site was occupied prehistorically. This artifact (reconstructed) is 18.5 inches (47 centimeters) long by 7 inches (18 centimeters) wide by 2.4 inches (6 centimeters) thick (Figure 8).
- Locus I is a wood-lined well, rectangular in plan view, with dimensions of 42.5 inches (108 centimeters) long by 26 inches (67 centimeters) wide, and partially filled in.
- Locus J is a smaller, rectangular possible well, also wood-lined, with dimensions of 27 inches (68 centimeters) long by 17 inches (44 centimeters) wide.
- Locus K is a possible mining claim marker consisting of a 2-inch by 4-inch (5-centimeter by 10-centimeter) post with nails hammered into it, located near the southwest corner of the site.

In terms of dating the site's artifacts, cans with church-key-type openings first appeared in 1935 and were common until 1960 (Rock 1987:112). The pull-tab beer and soda cans are post-1962. Coca-Cola cans with the Arden Square logo debuted in 1969 (The History of the Coca-Cola Logo 2015). Based on the dates of these artifacts, this site likely dates to the 1960s.

6.1.13 MCLB-SITE-13

This site consists of a prehistoric lithic scatter in the southeastern portion of the Range East and KD Range Complex. The dimensions of the site are 59 feet (18 meters) north–south by 56 feet (17 meters) east–west, and the site area is 2,293 square feet (213 square meters). The ground surface is desert pavement. Several large, partially buried boulders are scattered around the site area. Vegetation in the site area includes creosote bush and branched pencil cholla.

The lithic scatter of CCS material includes 50 or more mostly primary flakes in two loci. This appears to be a location where assaying or primary lithic reduction occurred. Locus A, the main concentration, has 30 or more flakes of brown and white, partially translucent, crypto-crystalline material. Locus B contains approximately 20 CCS flakes. All of the artifacts are located on the ground surface and no diagnostic artifacts are present. This site appears to be limited to a surface expression, and a subsurface component does not appear likely due to the fact that the site is located on desert pavement and soil development is non-existent or extremely limited.

6.1.14 MCLB-SITE-14

The site consists of a historic refuse scatter in the Yermo Stables. The dimensions of the site are 157 feet (48 meters) north–south by 128 feet (39 meters) east–west, and the site area is 10,592 square feet (984 square meters). The site is located on an alluvial terrace. Vegetation on the site is mostly allscale.

This site likely represents refuse discarded at this location. The artifacts are located on the ground surface, and there is no evidence of a subsurface deposit. There are nine loci (Loci A through I) within the site boundary. These loci are described individually below.

- Locus A is one metal can with church-key-type opening.
- Locus B is one metal can with church-key-type opening.
- Locus C is one metal can, crushed.
- Locus D is two metal cans with church-key-type openings.
- Locus E is two metal cans, undifferentiated, and a clear glass bottle base embossed with an "L" inside a circle.
- Locus F is one metal can with church-key-type opening and one church-key-type can lid.
- Locus G is one metal can with church-key-type opening.
- Locus H is one metal can, crushed.
- Locus I is one metal can lid, undifferentiated.

Cans with church-key-type openings were used from ca. 1935 to 1960 (Rock 1987). The bottle maker's mark "L" is likely the Latchford Glass Company which produced glass bottles from 1957 to 1989 (Lockhart et al. 2013).

No features or standing structures of any type are present. Based on the dates of the artifacts, this site likely dates to the late 1950s or early 1960s.

6.1.15 MCLB-SITE-15

This site consists of a historic can scatter (two metal cans and one hole-in-top can) in Yermo Stables. The dimensions of the site are 23 feet (7 meters) north–south by 10 feet (3 meters) east–west, and the site area is 204 square feet (19 square meters). The site is situated on an alluvial terrace. Vegetation on the site is mostly allscale. This site likely represents refuse discarded at this location (Figure 8).

The artifacts are located on the ground surface, and there is no evidence of a subsurface deposit. Hole-in-top cans, especially for condensed milk, were manufactured ca. 1810 into the mid- to late-1900s (Nevada Archaeological Site Stewardship Program 2007; IMACS User Guide 2001). Metal sanitary cans were introduced in 1894 and were in popular use by 1922.

No features or standing structures of any type are present. Based on the artifacts present, this site likely dates to the first quarter of the 20th century.

6.1.16 MCLB-SITE-16

This site consists of a widespread scatter of historic refuse within the LZ 2 buffer area in Yermo Stables. The dimensions of the site are 121 feet (37 meters) north–south by 295 feet (90 meters) east–west, and the

site area is 22,432 square feet (2,084 square meters). The site is situated on an alluvial terrace. Vegetation on the site is mostly allscale.

This site likely represents refuse discarded at this location. The artifacts are located on the ground surface, and there is no indication of a subsurface deposit.

The site consists of a scatter of metal food cans, a steel oil can, and a length of metal pipe. Approximately 25 steel cans are present, including hole-in-top cans, cans with church-key-type openings, and sanitary food cans. Hole-in-top cans, especially for condensed milk, were manufactured ca. 1810 into the mid- to late-1900s (Nevada Archaeological Site Stewardship Program 2007; IMACS User Guide 2001). Cans with church-key-type openings were used from ca. 1935 to 1960 (Rock 1987).

No features or standing structures of any type are present. Based on the artifacts present, this site likely dates to the first half of the 20th century.

6.1.17 MCLB-SITE-17

This site consists of a historic refuse scatter within the LZ 2 buffer area in Yermo Stables. The dimensions of the site are 13 feet (4 meters) north–south by 56 feet (17 meters) east–west, and the site area is 603 square feet (56 square meters). The site is located on an alluvial terrace. Vegetation on the site is mostly allscale.

The site consists of a historic-era refuse scatter with two loci. Locus A contains two metal cans with church-key-type openings. Locus B contains three metal cans with church-key-type openings, one metal can with aluminum top and pull-tab opening, four Champion brand No. F9Y spark plugs, six wire nails, three aluminum pull-tabs, one metal washer, one opaque glass marble, and one .22-caliber shell casing. All of the artifacts are on the ground surface, and there is no indication of a subsurface component.

Pull-tab beer and soft-drink closures were introduced in 1962. The Vaughn Novelty opener, or church key, was introduced in 1935 (Rock 1993). Cans with church-key-type openings were used from ca. 1935 to 1960 (Rock 1987). Champion F9Y spark plugs were used from ca. 1959 to 1974 in Ford Mercury cars (Champion Spark Plugs Catalogue 2010).

No features or standing structures of any type are present. Based on the artifacts present, this site likely dates to the late 1950s or early 1960s.

6.1.18 MCLB-SITE-18

This site consists of a small prehistoric lithic scatter within the LHA/LHD buffer area in Range West. The dimensions of the site are 20 feet (6 meters) north–south by 20 feet (6 meters) east–west, and the site area is 344 square feet (32 square meters). The site is located on an alluvial terrace. The ground surface is desert pavement. Vegetation includes creosote bush, Mojave yucca, Engelmann's hedgehog cactus, and white bursage.

This lithic scatter consists of two loci. Locus A contains five CCS flakes and one CCS core. Locus B contains five CCS flakes and two CCS cores. Three CCS flakes are located outside of the two loci but within the greater site boundary. All of the artifacts are located on the ground surface. This site is limited to a surface expression, and a subsurface component does not appear likely due to the fact that the site is located on desert pavement and soil development is non-existent or extremely limited.

6.1.19 MCLB-SITE-19

This site consists of a prehistoric lithic scatter within the LHA/LHD buffer area in Range West. The dimensions of the site are 29 feet (9 meters) north–south by 36 feet (11 meters) east–west, and the site area is 883 square feet (82 square meters). The site is located on a sloping terrace just west of a dry desert wash. The ground surface is desert pavement. Vegetation nearby includes creosote bush and white bursage.

The site consists of two chert flakes and two CCS cores. Both chert flakes are caramel-colored. The artifacts are located on the ground surface. This site is limited to a surface expression, and a subsurface component does not appear likely due to the fact that the site is located on desert pavement and soil development is non-existent or extremely limited.

6.1.20 MCLB-SITE-20

This site is a historic can scatter in the Range East and KD Range Complex. The dimensions of the site are 226 feet (69 meters) north–south by 141 feet (43 meters) east–west, and the site area is 18,869 square feet (1,753 square meters). The site is on a gently sloping alluvial fan. Vegetation on the site includes cheesebush, cholla, creosote bush, ephedra, and white bursage.

Approximately eight steel cans with aluminum soft tops are present, including one Bubble Up soft drink can with pull-tab opening. Rock (1993) indicates that metal beer cans with aluminum tops are from the 1950s or 1960s. Aluminum pull-tab openings first appeared in 1962. The Bubble Up can is painted with green paint with a white bubble and white text reading “A Lemon/Lime Carbonated Beverage, Kiss of Lemon, Kiss of Lime.” Bubble Up began in 1919 as a lemon-lime, carbonated soft drink (Dad’s Root Beer Company 2015). Originally the brand was owned by Sweet Valley Products of Sandusky, Ohio. Subsequently the brand was owned by the Bubble Up Company, Inc. of Chicago. With the tag line, “A Kiss of Lemon, A Kiss of Lime,” Bubble Up was distributed in the Coca-Cola bottler network prior to Sprite. The Monarch Company of Atlanta purchased Bubble Up in 1978.

No features or standing structures of any type are present. Based on the artifacts present, this site likely dates from the 1950s or 1960s.

6.1.21 MCLB-SITE-21

This site is a historic refuse scatter in the Range Main Supply Route. The dimensions of the site are 88 feet (27 meters) north–south by 111 feet (34 meters) east–west, with a site area of 7,707 square feet (716 square meters). The site is on a gently sloping alluvial fan. Vegetation on the site includes cheesebush, cholla, creosote bush, ephedra, and white bursage.

Steel cans and glass bottles or fragments are present. Steel cans include short, sanitary food cans and beverage cans with aluminum soft tops with pull-tab openings. Rock (1993) indicates that metal beer cans with aluminum tops are from the 1950s or 1960s. Aqua-colored glass bottle fragments are present, including one jug neck with a metal lightning-type closure. A clear Coca-Cola bottle is embossed on its base “NOT TO BE REFILLED 71_13_4” and “Coca-Cola” in script writing on the bottle’s side. This bottle likely dates to 1971 (History of the Coca-Cola Company 2015).

No features or standing structures of any type are present. Based on the artifacts present, this site likely dates to the 1960s or early 1970s.

6.1.22 MCLB-SITE-22

This site is a historic refuse scatter in the Range Main Supply Route. The dimensions of the site are 148 feet (45 meters) north–south by 121 feet (37 meters) east–west, with a site area of 9,203 square feet (855 square meters). The site is on a gently sloping alluvial fan. Vegetation on the site includes cheesebush, cholla, creosote bush, ephedra, and white bursage.

The site contains a scatter of historic steel cans and glass bottles/fragments. Most beverage cans are steel with aluminum tops and pull-tab openings. Steel sanitary cans and beverage cans with church-key-type openings are present. One steel beer can with aluminum top and pull-tab opening has embossing on its top "OLYMPIA, PLEASE DON'T LITTER." The aluminum top and pull-tab opening on this can dates this can to 1962 or later (Rock 1993). Due to recycling laws, "Dispose of Properly" as well as "Please Don't Litter" were embossed on pull-tab lids during the early 1970's (Keep America Beautiful 2015).

A steel sardine can is embossed on its base, "NORWAY, 204, NORVEGE." Clear glass bottle fragments are present, along with a light green bottle base; also present are two Coca-Cola bottle fragments. Other artifacts include: two-ply, aqua-colored safety glass from an automobile windshield or window; one steel crimp-type jar lid; a rifle magazine cartridge; and a steel, 1-gallon paint can.

The Olympia Brewing Company was a brewery firm in Tumwater, Washington, which operated from 1896 until 2003. The brewery was known as the Capital Brewing Company from 1896 until 1902. Owner SABMiller closed the operating brewery on 1 July 2003 (Flynn 2004). The Old Brewhouse remains Tumwater's best known landmark as part of Tumwater's New Market District, and is listed on the Washington Register of Historic Places and on the NRHP (Flynn 2004).

No features or standing structures of any type are present. Based on the artifacts present, the site likely dates to the early-to-mid 1960s to the early 1970s.

6.1.23 MCLB-SITE-23

This site contains a historic refuse scatter in the Range Main Supply Route. The dimensions of the site are 230 feet (70 meters) north–south by 210 feet (64 meters) east–west, with a site area of 39,191 square feet (3,641 square meters). The site is on a gently sloping alluvial fan. Vegetation includes creosote bush, Mojave indigo bush, white bursage, and yucca.

Steel cans and glass bottles are present in the site. Steel cans with aluminum tops and pull-tab closures are the predominant type of can. These cans were produced after 1962 (Rock 1993). One steel can with an aluminum top is embossed on its top, "PLEASE DON'T LITTER." Due to recycling laws, "Dispose of Properly" as well as "Please Don't Litter" were embossed on pull-tab lids during the early 1970s (Keep America Beautiful 2015). Modern refuse and debris are also present on the site including Dr. Pepper, Budweiser, Coors, and Pepsi-Cola bottles.

No features or standing structures of any type are present. Based on the artifacts present, the site likely dates to the mid-to-late 1960s or early 1970s.

6.1.24 MCLB-SITE-24

This site contains a historic can scatter in the Range Main Supply Route. The dimensions of the site are 36 feet (11 meters) north–south by 98 feet (30 meters) east–west, with a site area of 2,992 square feet (278 square meters). The site is on a gently sloping alluvial fan. Vegetation on the site includes creosote bush, Mojave indigo bush, white bursage, and yucca.

Steel cans with aluminum tops and pull-tab closures are the predominant type of can. These cans were produced after 1962 (Rock 1993). Two steel cans with church-key-type openings are also present. Can labels include “CRASMONT,” “COCA-COLA,” “ORANGE SODA,” and “LEMON LIME SODA.”

No features or standing structures of any type are present. Based on the artifacts present, the site likely dates to the mid-to-late 1960s or early 1970s.

6.1.25 MCLB-SITE-25

This site consists of a prehistoric lithic scatter near the southern boundary of the Range East and KD Range Complex. The dimensions of the site are 20 feet (6 meters) north–south by 16 feet (5 meters) east–west, with a site area of 274 square feet (25.5 square meters). The site is on the terminus of a ridge. The ground surface is desert pavement. Vegetation on the site includes creosote bush and white bursage (Figure 8).

There are 22 lithic flakes and 1 core fragment on the ground surface at this location. The raw material is red jasper. Flakes are primary reduction flakes. No diagnostic stone artifacts, such as projectile points or tools, or any other artifact types are present.

Several brass shell casings and one ammunition clip are within the site boundary. Headstamps on the brass shell casings include “DEN 42,” “TW 56,” and “EW 43.” These headstamps represent the location and date of manufacture; for example, “DEN 42” indicates that the casing was manufactured at the Denver Ordnance Plant, Denver, Colorado, in the year 1942. TW 56 indicates that the casing was manufactured at the Twin Cities Ordnance Plant, Minneapolis, Minnesota, in the year 1956. EW 43 indicates that the casing was manufactured at the Eau Claire Ordnance Plant, Eau Claire, Wisconsin, in 1943. A historic site is not present and these shell casings are likely related to USMC training.

6.1.26 MCLB-SITE-26

This site consists of a historic refuse scatter in Yermo Stables. The dimensions of the site are 50 feet (14 meters) north–south by 111 feet (34 meters) east–west, with a site area of 4,112 square feet (382 square meters). The site is on a gently sloping alluvial fan. Vegetation on the site includes creosote bush, Mojave indigo bush, white bursage, and yucca.

Historic artifacts on the site include bottles, steel cans, and ceramics. Clear glass whiskey bottles and amber beer bottles are present in the site. Approximately 12 steel cans include sanitary cans, cans with church-key-type openings, and hole-in-top cans. A clear glass bottle base with an Owens-Illinois mark is embossed “56 (OI mark) 8.” Toulouse (1971), in ***Bottle Makers and Their Marks***, clearly notes on pps. 403–407 for Owens-Illinois marks that the plant designation is on the left side of the diamond [56] and the year designation is on the right side of the diamond [8]. However, Toulouse (1971:395) lists only 26 plants. Therefore, this bottle base may not conform to the plant and date codes. Lockhart (2004) in his article, *The Dating Game*, lists several variations for the Owens-Illinois date codes. A date of 1956 would square with the other artifacts from this site. A ceramic teacup is broken into many fragments.

No features or standing structures of any type are present. Based on the artifacts present, the site likely dates to the late 1950s or early 1960s.

6.2 Newly Recorded Isolates

One hundred sixteen locations of isolated artifacts were recorded during the surveys. These artifacts are listed below in Table 6. The isolated artifacts possess no unique characteristics and are ineligible for listing in the NRHP.

Table 6. Newly Recorded Isolated Artifacts

Temporary Isolate Number	Isolate Description
MCLB-ISO-1	Two metal cans, one with church-key-type opening and one with aluminum top and pull-tab opening.
MCLB-ISO-2	One metal can with church-key-type opening.
MCLB-ISO-3	One metal fuel or oil can.
MCLB-ISO-4	One metal can with church-key-type opening.
MCLB-ISO-5	One green glass 7UP bottle.
MCLB-ISO-6	One metal can with church-key-type opening.
MCLB-ISO-7	One metal can with church-key-type opening.
MCLB-ISO-8	One metal can with church-key-type opening.
MCLB-ISO-9	One metal can with church-key-type opening.
MCLB-ISO-10	One metal can with church-key-type opening.
MCLB-ISO-11	One metal can with church-key-type opening.
MCLB-ISO-12	Lithic flake of CCS material.
MCLB-ISO-13	Lithic flake of CCS material.
MCLB-ISO-14	Two metal cans, one with church-key-type opening and one with aluminum top and pull-tab opening.
MCLB-ISO-15	One metal can with aluminum top.
MCLB-ISO-16	One metal can with church-key-type opening.
MCLB-ISO-17	One lithic flake of CCS material and one metal can with aluminum top.
MCLB-ISO-18	One metal can with aluminum top.
MCLB-ISO-19	One metal can with aluminum top.
MCLB-ISO-20	One metal can with aluminum top and pull-tab opening.
MCLB-ISO-21	One metal can with church-key-type opening.
MCLB-ISO-22	One steel can with friction lid.
MCLB-ISO-23	One metal can with church-key-type opening.
MCLB-ISO-24	Glass bottle manufactured by Hazel Atlas Co.
MCLB-ISO-25	One metal can with church-key-type opening and one metal can fragment.
MCLB-ISO-26	One metal can with aluminum top and one metal can base.
MCLB-ISO-27	One aqua glass bottle base, embossed; and one crushed metal can.
MCLB-ISO-28	One metal hole-in-top can fragment.
MCLB-ISO-29	One crushed metal can.
MCLB-ISO-30	One metal can with aluminum top and pull-tab opening.
MCLB-ISO-31	One small metal can and one metal toy shovel.
MCLB-ISO-32	One crushed metal can.
MCLB-ISO-33	One metal can with church-key-type opening and one metal sanitary can lid.
MCLB-ISO-34	One metal can fragment and one metal oil or solvent can and one round metal can with wire handle and friction lid.
MCLB-ISO-35	One crushed metal can.
MCLB-ISO-36	One metal can with church-key-type opening and one metal sanitary can lid.
MCLB-ISO-37	One metal hole-in-top can.
MCLB-ISO-38	One metal sanitary can and one metal oil or brake fluid can and two metal can fragments.
MCLB-ISO-39	One clear glass jug base.
MCLB-ISO-40	One lithic shatter fragment of CCS material.
MCLB-ISO-41	One chert flake.
MCLB-ISO-42	One metal can with church-key-type opening.

Table 6. Newly Recorded Isolated Artifacts (continued)

Temporary Isolate Number	Isolate Description
MCLB-ISO-43	One chert flake, red.
MCLB-ISO-44	One solarized or amethyst glass bottle base and one peach-colored flat glass fragment, embossed.
MCLB-ISO-45	Military magazine.
MCLB-ISO-46	One crushed metal can.
MCLB-ISO-47	One CCS core.
MCLB-ISO-48	One CCS flake.
MCLB-ISO-49	Prehistoric biface mid-section fragment.
MCLB-ISO-50	Two steel cans, one with church-key-type opening.
MCLB-ISO-51	Milk glass jar base.
MCLB-ISO-52	Steel can with church-key-type opening.
MCLB-ISO-53	Steel can with church-key-type opening.
MCLB-ISO-54	Two steel, 1-gallon fuel cans.
MCLB-ISO-55	Steel beverage can, labeled "CHOCOLATE FLAVORED DRINK."
MCLB-ISO-56	Steel sanitary can with twist-key opening.
MCLB-ISO-57	Steel beer can with aluminum top, labeled "OLYMPIA."
MCLB-ISO-58	Two steel Bubble Up cans with aluminum tops.
MCLB-ISO-59	All-steel can with church-key-type opening.
MCLB-ISO-60	Two steel cans with aluminum tops and pull-tab closures and one partial, cone-top steel can.
MCLB-ISO-61	Two steel cans with church-key-type openings.
MCLB-ISO-62	Two steel cans with aluminum tops; one is a FANTA soft drink can.
MCLB-ISO-63	Steel can with aluminum top, labeled "SCHLITZ."
MCLB-ISO-64	All-steel can, opened with a knife.
MCLB-ISO-65	Steel sanitary can with twist-key opening.
MCLB-ISO-66	Three steel cans. One is solder dot closure and two are twist-key-type openings.
MCLB-ISO-67	Steel sanitary can with twist-key-type opening.
MCLB-ISO-68	Two steel cans. One with twist-key-type opening and one with church-key-type opening.
MCLB-ISO-69	Two steel cans with twist-key-type openings and two steel sanitary cans.
MCLB-ISO-70	Steel can with church-key-type opening and interlocking side seam.
MCLB-ISO-71	Steel can with church-key-type opening.
MCLB-ISO-72	Steel can with church-key-type opening.
MCLB-ISO-73	Three steel cans with church-key-type openings and one crushed steel can.
MCLB-ISO-74	Five steel cans including one with aluminum top and pull-tab closure.
MCLB-ISO-75	Steel can with solder dot closure.
MCLB-ISO-76	Steel can with solder dot closure.
MCLB-ISO-77	Steel can with church-key-type opening.
MCLB-ISO-78	Steel can with church-key-type opening.
MCLB-ISO-79	Steel can with church-key-type opening.
MCLB-ISO-80	Steel can with church-key-type opening.
MCLB-ISO-81	Four steel cans with church-key-type openings.
MCLB-ISO-82	Three steel cans with church-key-type openings.
MCLB-ISO-83	Five steel cans, four with church-key-type openings and one with solder dot closure.
MCLB-ISO-84	Five steel cans with church-key-type openings.
MCLB-ISO-85	Three steel cans with church-key-type openings.
MCLB-ISO-86	Five steel cans, three with church-key-type openings and two with solder dot closures.
MCLB-ISO-87	Steel can with church-key-type opening.
MCLB-ISO-88	Steel can with church-key-type opening.
MCLB-ISO-89	Two steel cans, one with church-key-type opening and one with twist-key-type opening.
MCLB-ISO-90	Steel can with church-key-type opening.
MCLB-ISO-91	Steel can with solder dot closure.

Table 6. Newly Recorded Isolated Artifacts (continued)

Temporary Isolate Number	Isolate Description
MCLB-ISO-92	Two steel cans with church-key-type openings.
MCLB-ISO-93	Two steel cans with church-key-type openings.
MCLB-ISO-94	Steel can with church-key-type opening.
MCLB-ISO-95	Steel can with church-key-type opening.
MCLB-ISO-96	Two steel cans with church-key-type openings.
MCLB-ISO-97	Two steel cans with church-key-type openings.
MCLB-ISO-98	Two steel cans with church-key-type openings.
MCLB-ISO-99	Four steel cans with church-key-type openings.
MCLB-ISO-100	Steel can with church-key-type opening.
MCLB-ISO-101	Two steel cans with church-key-type openings.
MCLB-ISO-102	Steel can, crushed.
MCLB-ISO-103	Steel can with solder dot closure.
MCLB-ISO-104	Steel can with solder dot closure.
MCLB-ISO-105	Steel can with church-key-type opening.
MCLB-ISO-106	Amethyst glass bottle neck.
MCLB-ISO-107	Steel can with church-key-type opening.
MCLB-ISO-108	Amethyst glass fragment.
MCLB-ISO-109	Steel can with church-key-type opening.
MCLB-ISO-110	Steel can with solder dot closure.
MCLB-ISO-111	Steel can with solder dot closure.
MCLB-ISO-112	Prehistoric chalcedony core.
MCLB-ISO-113	Steel can with church-key-type opening.
MCLB-ISO-114	Amethyst bottle glass (10 fragments).
MCLB-ISO-115	Steel can with church-key-type opening.
MCLB-ISO-116	Steel can with church-key-type opening.
Note: CCS = crypto-crystalline silicate; MCLB = Marine Corps Logistics Base.	

6.3 Discussion/Interpretation of the Newly Recorded Sites

6.3.1 Prehistoric Sites

Seven of the newly recorded sites are identified as prehistoric: MCLB-SITE-7, -8, -9, -13, -18, -19, and -25. Of these, six are lithic scatters that appear to represent the opportunistic testing (assaying) of available stone and minimal flaking of reduced cores (MCLB-SITE-8, -9, -13, -18, -19, and -25). No formal flaked stone tools, such as projectile points, were present, nor were any other artifact classes, such as ground stone, bone, or ceramics, present.

The sites feature a limited variety and quantity of lithic artifacts and lack ecofacts or any indications of subsurface deposits. Moreover, desert pavement surfaces are not conducive to buried deposits (refer to Berryman and Bull 2003:28).

These findings related to prehistoric sites are consistent with the findings of earlier studies on MCLB Barstow, including those of Berryman and Cheever (2003), Berryman and Bull (2003), Willey et al. (2005), and Daniels et al. (2011). All of the previous studies have identified sparse lithic scatters on desert pavement surfaces with no diagnostic artifacts.

The natural landform of the Range Complex is elevated gravel bars with intact desert pavement. Natural cobbles of chert or CCS material are embedded in, or are eroding out of, this pavement. Many of these cobbles have been shattered, either from natural causes (e.g., weathering, freezing and thawing cycles) or

from sporadic prehistoric quarry activity. Berryman and Cheever (2003:18) observed that large portions of the existing desert pavement contain suitable raw materials that were used for "opportunistic quarry activity." They suggested that chert/silicate cobbles were randomly shattered to determine their suitability for tool use and that most of the local silicate cobbles have numerous inclusions and that they are not suitable for flaked stone tool manufacture (Berryman and Cheever 2003:18). They also suggested that prehistoric people were using lithic material as they moved through the area, because there is no evidence to suggest that they stayed for any length of time (Berryman and Cheever 2003:22). These observations remain true for the present surveys. No prehistoric settlement sites were observed during the archaeological surveys, and it is theorized that this could be due to the lack of available surface water sources.

Although no definitive statement can be made regarding the age of the seventh site, MCLB-SITE-7 (a rock ring), this site may be from the prehistoric era. The location of this site at the terminus of a ridgeline suggests that it may have been used as a hunting lookout or as a vision quest site. The site offers a commanding view of the surrounding terrain.

6.3.2 Historic Sites

Nineteen newly recorded, historic-era sites consist of historic refuse scatters, historic can scatters, or historic camps. Some of these sites likely represent refuse discarded from vehicles, such as the sites located along the Range Main Supply Route. Historic refuse scatters typically contain bottles, cans, and other household-type remains. Only 2 of the 19 sites appear to represent short-term occupations, as opposed to scatters of refuse.

MCLB-SITE-6 is a historic camp. There are no standing structures or intact architectural remains at this location. This site appears to represent a temporary camp, given the two fire rings and scatter of refuse.

MCLB-SITE-12 is a historic camp. There are no standing structures or intact architectural remains. This site appears to represent a temporary camp. Although there are no standing structures, there are a number of features at this site, including a barbecue pit, two fire rings, and two apparent wood-lined features. The entire site is surrounded by a wire fence.

6.4 Additional Survey Findings

6.4.1 Recent Dog Burials

Two recent dog burials are located in the Range East and KD Range Complex (refer to Confidential Appendix B, Figure B-1). The Base kennel was located in the general vicinity of the burials between the late 1950s and 1960s.

Feature 1, the westernmost grave, is 8.5 feet (2.6 meters) northeast–southwest by 6.5 feet (2 meters) northwest–southeast. Approximately 100 rocks were placed in a pile on top of the gravesite. A wooden cross at the head of the grave is marked "…OUP" and "TOM." The "…OUP" marking may have stood for "GROUP." The height of the cross is 36 inches (92 centimeters) and the cross-beam is placed at approximately 27 inches (68 centimeters) above the ground surface (Figure 8).

Feature 2, the easternmost grave, has dimensions of 6.5 feet (2 meters) northeast–southwest by 4.5 feet (1.4 meters) northwest–southeast. Approximately 120 rocks were placed in a pile on top of the gravesite. A wooden cross at the head of the grave appears to be unmarked (Figure 8).

The two features are approximately 6.5 feet (2 meters) apart. Both graves are oriented northeast–southwest. The graves overlook the lower slopes of the alluvial fan and the Mojave River Basin to the northeast. Both wooden crosses are manufactured from knotty pine and are held together with wire nails. Wire nails were used from 1890 until the present time.

Leidos personnel excavated two 3.3-feet by 3.3-feet (1-meter by 1-meter) test units at the grave locations (Figure 8). All fill from the test units was passed through 1/8-inch (3-millimeter) hardware cloth. No artifacts were recovered. Excavation proceeded in 3.9-inch (10-centimeter) levels. At around 15.7 inches (40 centimeters) below the ground surface in both excavation units, the remains of a small dog were encountered. Once the dog's remains were encountered, the excavations were terminated, and the test units were backfilled and restored to their former appearance.

6.4.2 Military Fighting Positions

Military fighting positions are located in the Range East and KD Range Complex. These features are located on a ridgetop south of the KD Rifle Range (refer to Confidential Appendix B, Figure B-1). Approximately 10 fighting positions are located in this vicinity. Most of these are approximately 10 feet (3 meters) long by 6.5 feet (2 meters) wide and are roughly rectangular. Two to three courses of stacked rock are placed around the perimeter of the features. Several smaller depressions or "foxholes" are also present.

Numerous brass rifle shell casings, mostly blanks, are present along with steel sanitary cans (military rations). Headstamps on the brass shell casings include "LC 68" and "LC 86," likely representing the dates 1968 and 1986, respectively.

7 Summary and Conclusions

7.1 Summary of Findings

The results of the surveys led to the identification, recordation, and documentation of 26 newly recorded archaeological sites and 116 newly recorded isolated finds within the APE. Six of the newly recorded sites are prehistoric in age, one site is of undetermined age but most likely prehistoric, and 19 of the newly recorded sites are historic in age. Additionally, 17 previously recorded archaeological sites are located in the APE.

7.2 Survey Reliability

Because of the excellent ground surface visibility (averaging 90 percent surface visibility) and the relatively closely spaced (82-foot [25-meter]) transect interval, reliable survey coverage was achieved for identifying and recording historic properties within the APE that may be impacted by the proposed undertaking. Therefore, no further survey of the APE is required.

7.3 Recommendations

7.3.1 National Register of Historic Places Eligibility

To qualify for the NRHP (36 *CFR* Section 60.4), a property must possess integrity of location, design, setting, material, workmanship, feeling, and association and meet one or more of the following eligibility criteria:

A. *Is associated with events that have made a significant contribution to the broad patterns of our history;*

B. *Is associated with the lives of persons significant in our past;*

C. *Embodies the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; and/or*

D. *Has yielded, or may be likely to yield, information important in prehistory or history.*

A site is defined as the location of a significant event, a prehistoric or historic occupation or activity, or a building or structure, whether standing, ruined, or vanished, where the location itself possesses historic, cultural, or archaeological value regardless of the value of any existing structure. A site can possess associative significance or information potential or both, and can be significant under any or all of the four criteria.

Most archaeological sites are evaluated in terms of their information potential, or Criterion D. Archaeological sites may be eligible if they have yielded, or may be likely to yield, information important in prehistory or history. For example, certain important research questions about human history can only be answered by the actual physical material of cultural resources (United States Department of the Interior 1990). Criterion D has two requirements, both of which must be met in order for a historic property to qualify:

1. The property must have, or have had, information to contribute to our understanding of human history or prehistory; and
2. The information must be considered important.

Under the first requirement, a property is eligible if it has been used as a source of data and it contains more, as yet unretrieved, data. A property is also eligible if it has not yet yielded information but, through testing or research, is determined to be a likely source of data. Under the second requirement, the information potential of the property must be carefully evaluated within an appropriate context to determine its importance. Information is considered “important” when it is shown to have a significant bearing on a research design that addresses areas such as current data gaps or alternative theories that challenge existing theories. Archaeological sites may also be considered eligible under Criteria A, B, and C if enough information is available to support a finding of significance under these requirements.

7.3.2 National Register Eligibility of Previously Recorded Sites

Table 7 summarizes the recommendations for National Register eligibility for the 17 previously recorded archaeological sites in the APE.

Three of the previously recorded sites, CA-SBR-73, CA-SBR-8319, and CA-SBR-11840, are considered potentially eligible for listing on the National Register. These three sites should be avoided if possible, and considered when consulting with Native Americans. For the remaining 14 previously recorded lithic scatter sites, based on the limited variety and quantity of stone artifacts and the absence of ecofacts or subsurface deposits, it is not possible to address research domains such as site formation, geomorphological reconstruction, chronology and dating, settlement organization, or subsistence. Although none of the identified sites have been formally evaluated for significance or National Register eligibility, based on their definition as sparse lithic scatters, none of the previously identified prehistoric lithic scatters are eligible.

Table 7. NRHP Eligibility Recommendations for Previously Recorded Sites

Site Number/Trinomial	Description	NRHP Recommendation	Recommendation for Further Work
CA-SBR-73	Rattlesnake Rock Petroglyph Site	Potentially Eligible; listed on California Points of Historical Interest	Avoid; initiate Native American consultation
CA-SBR-8319	Sleeping Circles	Potentially Eligible	Avoid or evaluate; initiate Native American consultation
CA-SBR-11299	Prehistoric Lithic Scatter	Ineligible	None
CA-SBR-11301	Prehistoric Lithic Scatter	Ineligible	None
CA-SBR-11837	Prehistoric Lithic Scatter	Ineligible	None
CA-SBR-11838	Prehistoric Lithic Scatter	Ineligible	None.
CA-SBR-11840	Prehistoric Rock Ring	Potentially Eligible	Avoid or evaluate; initiate Native American consultation
CA-SBR-11841	Prehistoric Lithic Scatter	Ineligible	None
CA-SBR-11842	Prehistoric Lithic Scatter	Ineligible	None
CA-SBR-11843	Prehistoric Lithic Scatter	Ineligible	None
CA-SBR-11844	Prehistoric Lithic Scatter	Ineligible	None
CA-SBR-11845	Prehistoric Lithic Scatter	Ineligible	None
CA-SBR-11846	Prehistoric Lithic Scatter	Ineligible	None
CA-SBR-11847	Prehistoric Lithic Scatter	Ineligible	None
CA-SBR-11850	Prehistoric Lithic Scatter	Ineligible	None
CA-SBR-14835	Prehistoric Lithic Scatter	Ineligible	None
CA-SBR-14836/H	Prehistoric Lithic Scatter and Historic Hearth	Ineligible	None
NRHP = National Register of Historic Places.			

7.3.3 National Register Eligibility of Newly Recorded Sites

Based on survey observations, six newly recorded prehistoric archaeological sites (MCLB-SITE-8, -9, -13, -18, 19, and -25) appear ineligible for listing in the National Register because they contain minimal research value. The prehistoric sites are small, sparse lithic scatters with few artifacts and no diagnostic artifacts (e.g., projectile points). No other artifact classes, such as ground stone, fire-affected rock,

pottery, or faunal remains are present. A subsurface component is unlikely because the sites occur on top of well-consolidated desert pavement surfaces. Therefore, these sites appear unlikely to yield information important in prehistory (Criterion D). Furthermore, the sites have no known association with significant events or persons (Criteria A and B), nor do they represent a type, nor are they part of a distinguishable entity (Criterion C). In addition, the information that the sites contain has largely been exhausted through the sites' recording.

Newly recorded historical archaeological sites (MCLB-SITE-1, -2, -3, -4, -5, -6, -10, -11, -12, -14, -15, -16, -17, -20, -21, -22, -23, -24, and -26) represent refuse scatters, can scatters, and camps. Based on archival research, none of these historical-aged sites appear to be associated with events that have made a significant contribution to the broad patterns of history (Criterion A), and the sites do not appear to be associated with the lives of persons significant in our past (Criterion B). As undistinguished refuse or can scatters and camps without specific associations, the sites do not embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic value, or represent a significant and distinguishable entity whose components may lack individual distinction (Criterion C). The sites appear unlikely to yield information important in history (Criterion D). The 19 historic-era sites appear to be ineligible for listing in the National Register. None of the sites contain unique artifacts or structural or architectural remains. In addition, the sites' information potential has largely been exhausted through the sites' recording.

Site MCLB-SITE-7, a rock ring, cannot be ascribed to a particular temporal period since no diagnostic artifacts are present. This site is similar in its nature to previously recorded site CA-SBR-11840, although the rocks at MCLB-SITE-7 do not appear to be as deeply embedded in the ground surface. If this site is from the prehistoric era, it may have Native American values. The location of this site, at the terminus of a ridge, with a commanding view of the countryside, suggests that it may have been a hunting station. Another possibility is that this site could be of significance to Native Americans; for example, as a spiritual or vision quest site. As such, this site may potentially contain information important in prehistory (Criterion D). Until more information is obtained on this site, it should be considered eligible for listing in the NRHP, and treated as if it is significant.

Table 8 shows the recommendations for National Register eligibility for the 26 newly identified sites.

Table 8. NRHP Eligibility Recommendations for Newly Recorded Sites

Temporary Site Number	Description	NRHP Eligibility Recommendation	Rationale for Recommendation	Recommendations for Further Work
MCLB-SITE-1	Historic Refuse Scatter	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None
MCLB-SITE-2	Historic Can Scatter	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None
MCLB-SITE-3	Historic Refuse Scatter	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None
MCLB-SITE-4	Historic Refuse Scatter	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None

Table 8. NRHP Eligibility Recommendations for Newly Recorded Sites (continued)

Temporary Site Number	Description	NRHP Eligibility Recommendation	Rationale for Recommendation	Recommendations for Further Work
MCLB-SITE-5	Historic Can Scatter	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None
MCLB-SITE-6	Historic Refuse Scatter and Camp	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None
MCLB-SITE-7	Rock Ring	Potentially Eligible	Site may contain information important in prehistory or history and/or Native American spiritual values.	Avoid or evaluate; initiate Native American consultation
MCLB-SITE-8	Prehistoric Lithic Scatter	Ineligible	No subsurface deposit appears likely. No diagnostic artifacts, such as projectile points, or other datable materials are present. The site is unlikely to contain information important in prehistory. The site's data potential has largely been exhausted through the site's recording.	None
MCLB-SITE-9	Prehistoric Lithic Scatter	Ineligible	No subsurface deposit appears likely. No diagnostic artifacts, such as projectile points, or other datable materials are present. The site is unlikely to contain information important in prehistory. The site's data potential has largely been exhausted through the site's recording.	None
MCLB-SITE-10	Historic Can Scatter	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None
MCLB-SITE-11	Military Hardware Scatter	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None
MCLB-SITE-12	Historic Camp	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None
MCLB-SITE-13	Prehistoric Lithic Scatter	Ineligible	No subsurface deposit appears likely. No diagnostic artifacts, such as projectile points, or other datable materials are present. The site is unlikely to contain information important in prehistory. The site's data potential has largely been exhausted through the site's recording.	None

Table 8. NRHP Eligibility Recommendations for Newly Recorded Sites (continued)

Temporary Site Number	Description	NRHP Eligibility Recommendation	Rationale for Recommendation	Recommendations for Further Work
MCLB-SITE-14	Historic Can Scatter	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None
MCLB-SITE-15	Historic Can Scatter	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None
MCLB-SITE-16	Historic Can Scatter	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None
MCLB-SITE-17	Historic Refuse Scatter	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None
MCLB-SITE-18	Prehistoric Lithic Scatter	Ineligible	No subsurface deposit appears likely. No diagnostic artifacts, such as projectile points, or other datable materials are present. The site is unlikely to contain information important in prehistory. The site's data potential has largely been exhausted through the site's recording.	None
MCLB-SITE-19	Prehistoric Lithic Scatter	Ineligible	No subsurface deposit appears likely. No diagnostic artifacts, such as projectile points, or other datable materials are present. The site is unlikely to contain information important in prehistory. The site's data potential has largely been exhausted through the site's recording.	None
MCLB-SITE-20	Historic Can Scatter	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None
MCLB-SITE-21	Historic Refuse Scatter	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None
MCLB-SITE-22	Historic Refuse Scatter	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None
MCLB-SITE-23	Historic Refuse Scatter	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None

Table 8. NRHP Eligibility Recommendations for Newly Recorded Sites (continued)

Temporary Site Number	Description	NRHP Eligibility Recommendation	Rationale for Recommendation	Recommendations for Further Work
MCLB-SITE-24	Historic Can Scatter	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None
MCLB-SITE-25	Prehistoric Lithic Scatter	Ineligible	No subsurface deposit appears likely. No diagnostic artifacts, such as projectile points, or other datable materials are present. The site is unlikely to contain information important in prehistory. The site's Data potential has largely been exhausted through the site's recording.	None
MCLB-SITE-26	Historic Refuse Scatter	Ineligible	Site is not associated with significant events or persons, and does not represent the work of a master. Recording has exhausted the site's data potential.	None
MCLB = Marine Corps Logistics Base; NRHP = National Register of Historic Places.				

Table 9 provides a summary of recommendations and/or possible constraints to the proposed undertaking, assuming State Historic Preservation Officer (SHPO) concurrence on the National Register eligibility recommendations. It is recommended that avoidance measures and/or mitigation measures include clearly defined limits on construction, ground training, aircraft operations, and range maintenance and sustainment activities and operator education to ensure no effects to potentially eligible archaeological resources within the APE. If sites cannot be avoided, then the next step would be to determine the effects of the proposed undertaking on the identified sites and, if the effects are adverse, to determine what measures could be implemented to mitigate the adverse effects. Note that additional cultural resources may be considered sensitive based on future Native American consultation, and this should be taken into consideration when developing final avoidance and/or mitigation measures.

Table 9. Survey Findings and Recommendations

Location	Recommended Eligible Site	Possible Constraints and Recommendation
Range West (near northern existing utility access route)	MCLB-SITE-7 (Rock Ring)	Evaluate or avoid MCLB-SITE-7. No construction, ground training, and/or range maintenance and sustainment activities should occur within a 50-foot (15-meter) buffer zone and no aircraft training activities should occur within a 350-foot (107-meter) buffer zone. Establishment of a buffer zone would avoid impacts to MCLB-SITE-7.
Range East and KD Range Complex (west of LZ 1)	CA-SBR-8319 (Sleeping Circles)	Evaluate or avoid CA-SBR-8319. No construction, ground training, and/or range maintenance and sustainment activities should occur within a 50-foot (15-meter) buffer zone and no aircraft training activities would occur within a 350-foot (107-meter) buffer zone. Establishment of a buffer zone would avoid impacts to CA-SBR-8319.

Table 9. Survey Findings and Recommendations (continued)

Location	Recommended Eligible Site	Possible Constraints and Recommendation
Range West (near existing trail)	CA-SBR-11840 (Prehistoric Rock Ring)	Evaluate or avoid CA-SBR-11840. No construction, ground training, and/or range maintenance and sustainment activities should occur within a 50-foot (15-meter) buffer zone and no aircraft training activities should occur within a 350-foot (107-meter) buffer zone. Establishment of a buffer zone would avoid impacts to CA-SBR-11840.
Yermo Stables (west of LZ 2)	CA-SBR-73 (Rattlesnake Rock petroglyph site)	Any effects to the Rattlesnake Rock petroglyph site (CA-SBR-73) should be avoided. No construction, ground training, and/or range maintenance and sustainment activities would occur within a 50-foot (15-meter) buffer zone and no aircraft training activities would occur within a 350-foot (107-meter) buffer zone. The CA-SBR-73 buffer zones would be established around the existing fencing that protects the site. Establishment of a buffer zone would avoid impacts to CA-SBR-73.
KD = Known Distance; LZ = landing zone; MCLB = Marine Corps Logistics Base.		

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Confidential Appendix A

Native American Consultation Information

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Confidential Appendix B

Figures

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State of California Department of Parks and Recreation (DPR) 523 Forms—Isolate Forms

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Appendix F

Hydrology Study

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Final Hydrology Study for Barstow Training and Range Environmental Assessment, Marine Corps Logistics Base Barstow

Prepared for:

Marine Corps Logistics Base

Barstow, CA

Under Contract to:

U.S. Department of the Navy

Naval Facilities Engineering Command Southwest

1220 Pacific Highway, Building 1 CIPT

San Diego, CA 92132-5190

Phone: (619) 532-3844

Point of Contact: Jesse Martinez

REGISTERED PROFESSIONAL ENGINEER
JOEL STEVEN DEGNER
C 83284
CIVIL
STATE OF CALIFORNIA

10/29/2015

Prepared by:

Joel S. Degner, P.E.

5464 Carpinteria Avenue, Suite K

Carpinteria, California 93013

leidos

October 2015

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Acronyms

°F	Degrees Fahrenheit
cfs	cubic feet per second
EA	Environmental Assessment
GPS	Global Positioning System
HEC-GeoHMS	Hydrologic Engineering Center's Geospatial Hydrologic Modeling Extension
HEC-HMS	Hydrologic Engineering Center's Hydrologic Modeling System
HEC-RAS	Hydrologic Engineering Centers River Analysis System
HUC	hydrologic unit code
I MEF	First Marine Expeditionary Force
KD	Known Distance
LHA	Landing Helicopter Assault
LHA/LHD	Simulated Flight Deck
LHD	Landing Helicopter Dock
LID	Low Impact Development
LZ	landing zones
MAGTF	Marine Air-Ground Task Force
MCLB	Marine Corps Logistic Base
mph	miles per hour
MS4	Municipal Separate Storm Sewer Systems
NPDES	National Pollutant Discharge Elimination System
ROW	right-of-way
U.S.	United States
UFC	United Facilities Criteria
USGS	United States Geological Survey
USMC	United States Marine Corps

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1 Introduction

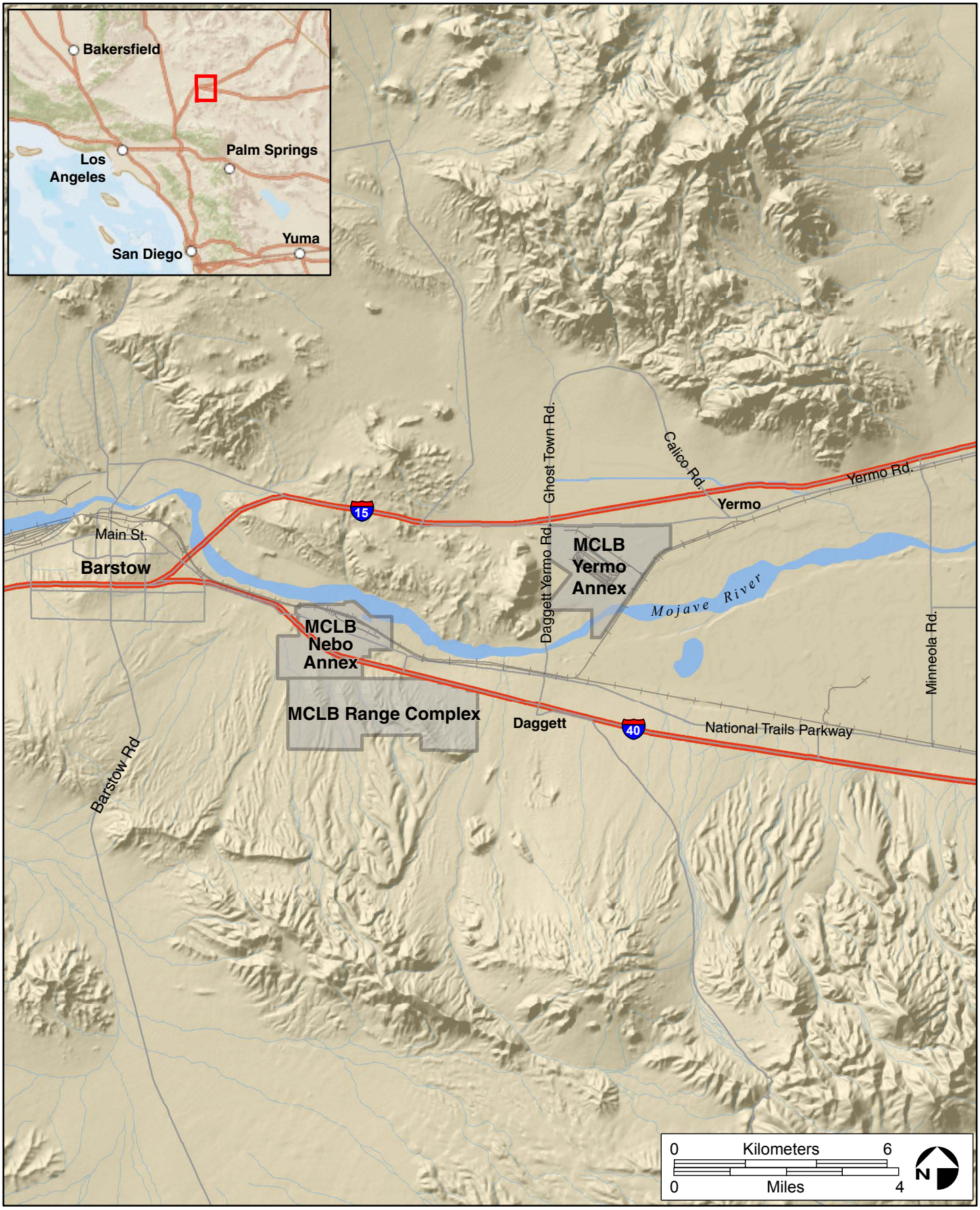
This hydrology study was prepared in support of the Barstow Training and Range Environmental Assessment (EA), Marine Corps Logistics Base (MCLB) Barstow, California (hereinafter "proposed action"). The proposed action is located on MCLB Barstow, which is in western San Bernardino County, California, approximately 3.5 miles east of the City of Barstow (Figure 1.1). MCLB Barstow encompasses 5,567 acres and is separated into three parcels: Nebo Annex; Range Complex; and Yermo Annex. The project footprint is located on the Range Complex and Yermo Annex.

This study provides an analysis of the drainage systems in the project footprint and evaluates flood impacts associated with development of the proposed action. The drainage area and flow paths were mapped and rainfall-runoff modeling was performed to evaluate the potential flood impacts for the each of the proposed designated aircraft landing areas. In addition, the drainage areas of all washes which cross existing access routes/trails and proposed access roads were mapped to evaluate the erosion potential for each crossing.

1.1 Proposed Action

The proposed action would enhance and integrate independent and combined ground and aviation training on MCLB Barstow, California. Proposed training activities would occur on the Range West training area, Range East and Known Distance (KD) Range Complex training area, Range Main Supply Route training area, and Yermo Stables training area. The proposed action would update operational capabilities of existing training areas and ranges on MCLB Barstow to support combat readiness of United States Marine Corps (USMC) operating forces. Depending on the specific mission, ground training could range from a single company commander conducting maneuvers with three infantry platoons to battalion or larger headquarters/command post training (300 personnel), with integrated air and logistics support. All the training ranges and areas would support general aviation maneuver areas and designated landing zones (LZs), including a Simulated Flight Deck (Landing Helicopter Assault [LHA] or Landing Helicopter Dock [LHD]) site. Tactical aircraft operations would occur on suitable landing areas within the general aviation maneuver areas.

Three new aircraft landing areas – two proposed LZs and a LHA/LHD – and access routes/trails and roads to these landing areas would be established to support aviation training operations. The designated LZs would consist of an approximately 300-foot by 300-foot (i.e., 90,000-square-foot) landing area (i.e., where the aircraft would physically land). The proposed LZs would be rough graded/leveled and stabilized (e.g., application of dust palliatives [e.g., polymer emulsion or synthetic fluid]) to reduce impacts from dust and debris. The LHA/LHD landing platform would be approximately 850 feet by 150 feet and would resemble an amphibious assault ship deck. The total construction area for the LHA/LHD site would be approximately 300 feet by 1,000 feet, which includes all laydown/staging areas. A footprint would be established around the LZs and LHA/LHD landing platform to account for areas disturbed by aircraft rotor wash, grading/vegetation clearing, construction, and operations (training and range maintenance and sustainment activities).



Location of Marine Corps Logistics Base Barstow
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
1.1

2 Background Information

2.1 Climate and Rainfall Patterns

The climate of the project region is characterized as very arid. High temperatures range from 60 degrees Fahrenheit (°F) during the winter to 100°F during the summer. Winds primarily originate from the west at monthly average speeds approaching 8 to 9 miles per hour (mph); gusts exceeding 40 to 50 mph are not uncommon. The area receives an average of 4.6 inches of precipitation annually, with an annual minimum precipitation of 1.08 inches and an annual maximum precipitation of 15.6 inches recorded between 1913 and 2013 (Figure 2.1). The majority of the rainfall occurs from mid-latitude Pacific cyclonic storms during the winter. The highest flow measurements in the Mojave River have all occurred from December to April. However, summer thunderstorms occur frequently in July, August, and September. Most of the worst flooding events on record occur due to heavy thunderstorms in the summer which affect the small washes and drainages in the Mojave Desert (NOAA 2010). Flash floods result from strong, localized thunderstorms which produce considerable rain in a short period of time, fueling a surge of runoff in dry washes. In the Mojave Desert, the main erosion and sedimentation process is caused by flash floods and debris flows which move with tremendous force and can transport massive loads of sediment (USGS 2004).

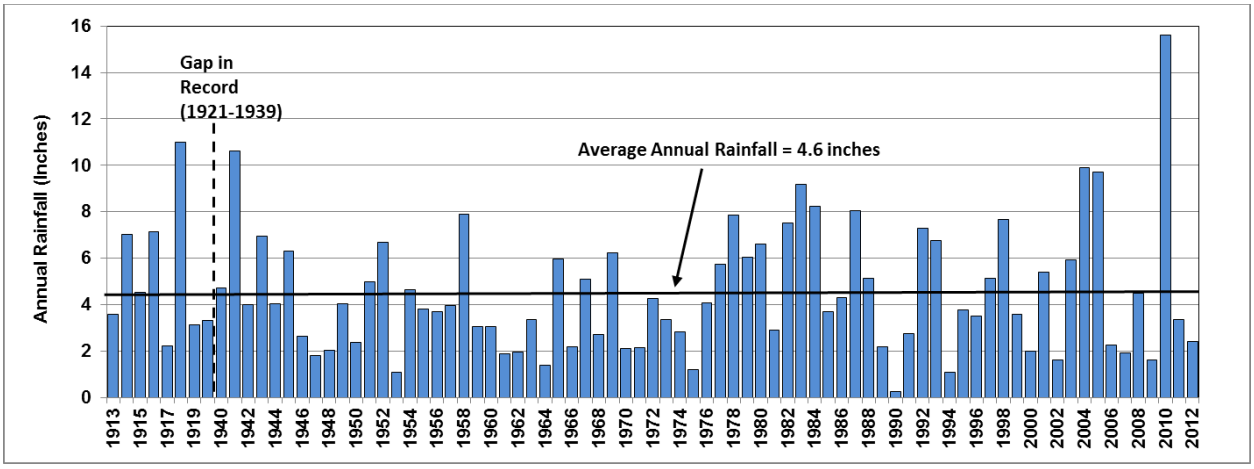


Figure 2.1. Annual Rainfall for Barstow, California (Western Regional Climate Center 2013)

Summer thunderstorms often generate locally intense precipitation on only a portion of a watershed. This can produce short-duration, high-energy flow in some areas and no flow in other areas. The lack of consistent flow along with the immature and/or poorly consolidated soils typically found on MCLB Barstow make both the channel shape and channel location highly variable (Lichvar and McColley 2008).

Major flood events have occurred frequently at MCLB Barstow in the past. While the overall rainfall totals are low, the intense summer thunderstorms can cause major flooding. This rainfall and runoff pattern is typical of desert terrain. The lack of vegetation and often hard, packed soils result in relatively small amounts of the precipitation being infiltrated and large percentages of the precipitation contributing to surface runoff. There is limited forewarning of these storm

events and the runoff can travel long distances once concentrated in a watercourse (Table 2.1). On 3 September 2013, an intense thunderstorm caused widespread flooding at MCLB Barstow. Buildings were flooded near the front gate, portions of Interstate 40 were closed, and sections of the Range Main Supply Route were damaged. Approximately 0.5 inch of rain fell in under 20 minutes. While low in overall volume, the intensity of the rainfall event led to large amounts of runoff and flood damage. Based on the estimated precipitation frequency for the location, this storm was between a 10-year and 25-year event using the 30-minute time interval (NOAA 2013).

2.2 Topography and Drainage

2.2.1 Topography

The Mojave Desert region is comprised of basin and ranges. In past Ice Ages, large lakes filled the lower valleys. However, in the current Holocene interglacial period (11,400 years ago to present), the region has dried, leaving behind dry lake beds. Between the basin and the ranges are regions covered by coalescing alluvial fans (also referred to as *bajadas* or piedmonts) (USGS 2004). Alluvial fans are alluvium deposited by a stream flowing from a canyon onto the valley floor. In the valley, the stream spreads out, depositing alluvial sediments across a broad, typically fan-shaped area.

MCLB Barstow is located in the lower Mojave River Valley Basin. It is characterized by low ridges and terraces that surround and slope downward toward the Mojave River Valley Basin. The Mojave River Valley runs in a west-to-east direction. The Mojave River channel is typically dry at MCLB Barstow, with surface flows only present during winter storms. The Range Complex contains ephemeral washes that drain Daggett Ridge and trend from south to north to the Mojave River. Figure 2.2 shows a conceptual drawing of the ephemeral washes draining from the ridges to the Mojave River Valley Basin.

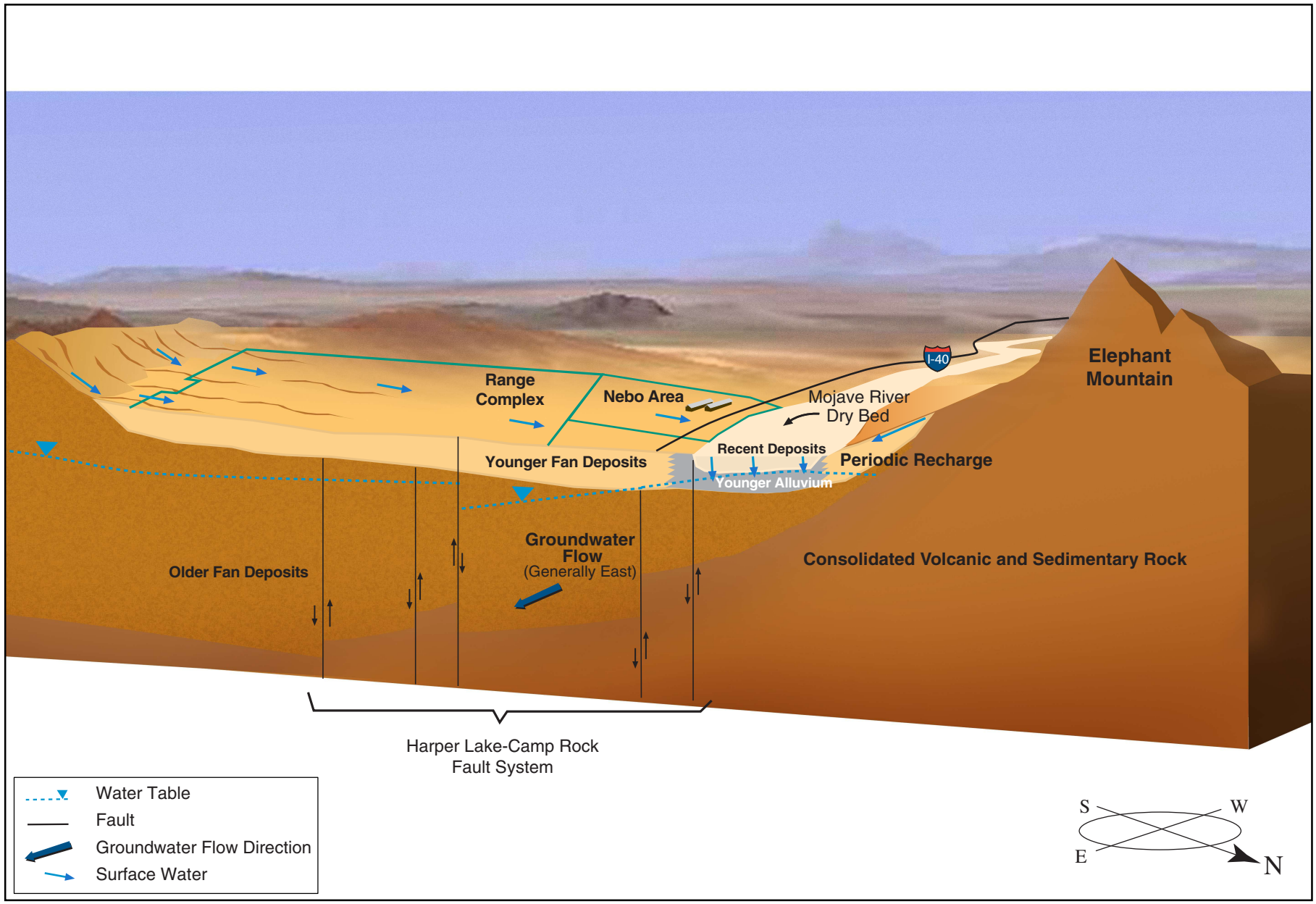
2.2.2 Drainage

The locations of the LZs, LHA/LHD, and overall watersheds and drainage patterns are shown in Figure 2.3. The LHA/LHD site is located in an alluvial wash surrounded on the east and west by steep, rocky ridges. LZ 1 is located on an alluvial piedmont (or *bajada*), where numerous small canyons have created a series of alluvial fans that have coalesced to create a broad, sloping piedmont. LZ 2 is located in a flat area adjacent to the Mojave River; no drainages are located near this site.

Table 2.1. History of Significant Weather Events near Barstow, California

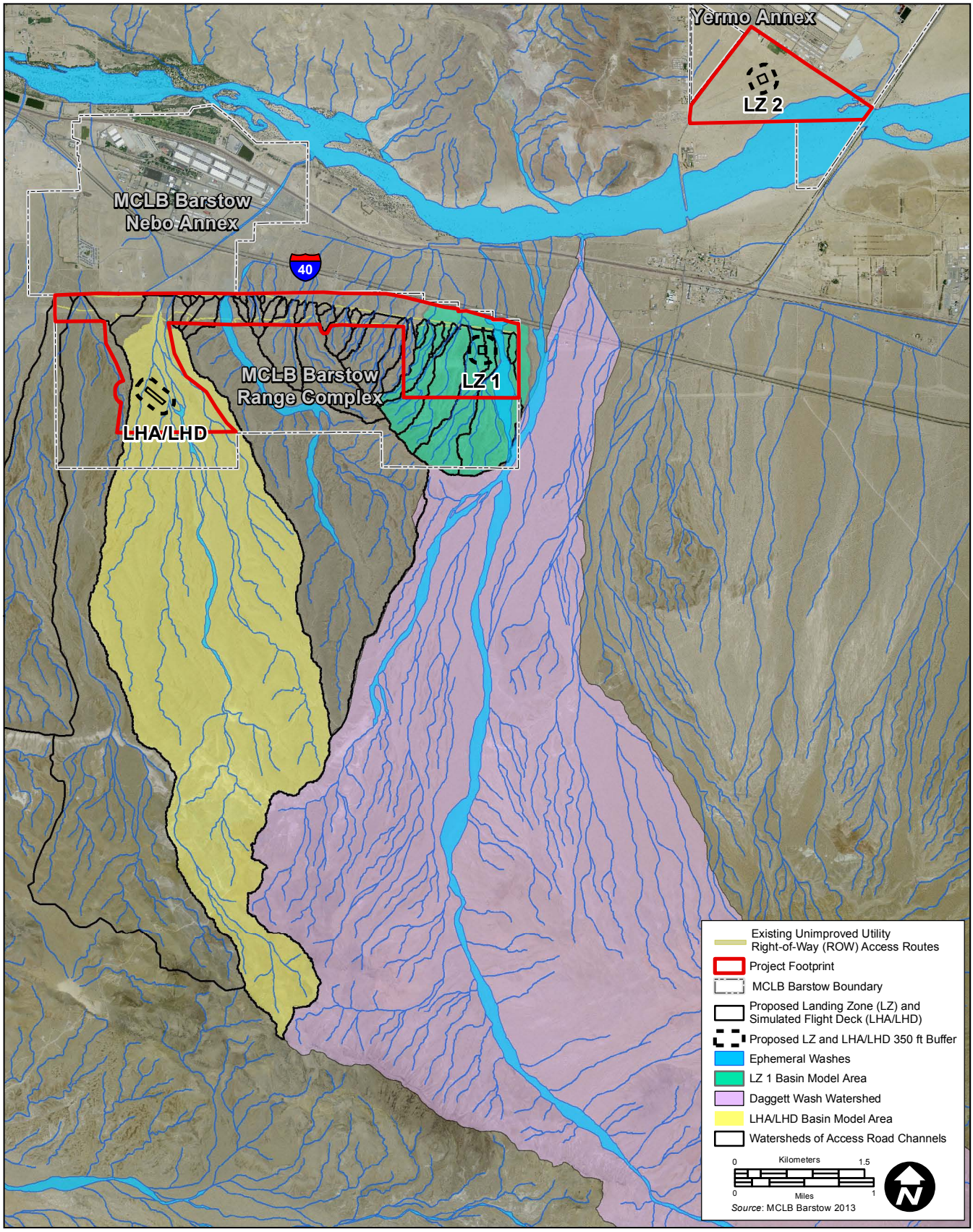
Dates	Weather	Damage
7.16.1954	A northward-moving hurricane made landfall in central Baja California with the remnants moving into Arizona. Rainfall of up to 2 inches occurred in the mountains and deserts. This occurred during the El Niño of 1953–54.	On 16 July 1954, a severe thunderstorm struck the Daggett area east of Barstow. Eight miles of Highway 66 were flooded. The highway was also flooded near Hinkley with 18 inches of water.
7.19.1956	Heavy thunderstorms struck desert areas of Twentynine Palms and Barstow. One cloudburst hit Cherry Valley with 3 inches of rain in 30 minutes.	A 75-foot stream of water crossed Highway 66 at Hodge, southwest of Barstow. Washouts were also reported around Twentynine Palms.
8.23.1955	Heavy thunderstorms hit the San Bernardino Mountains and deserts.	Highways 66 and 91 were blocked by "wide rivers" of flash flood waters. Rocks and mud covered roadways west of Barstow.
4.18.1956	Heavy thunderstorms struck Barstow and Victorville with an estimated 1.25 inches of rain. One quarter inch of hail was also reported covering the ground.	A wall of water 2 feet deep damaged 40 homes in west Barstow.
7.28–30.1958	Moisture from a west-northwestward moving tropical storm which dissipated west of central Baja California generated up to 2 inches of rainfall in the deserts and mountains. On 30 July 1958, a severe thunderstorm brought heavy rain and large hail to Barstow. It was called "the worst storm in 60 years."	On 30 July 1958, a flash flood struck Barstow and actually moved a house off its foundation. Residents had to escape through windows from flooded houses in Lenwood. Tons of mud engulfed Highway 66.
9.1.1960	A noon thunderstorm hit the Barstow area.	Mud and debris were deposited on Barstow streets.
9.24.1962	Thunderstorms hit the high desert around Barstow.	Flash flooding occurred east of Barstow.
8.10.1963	A heavy thunderstorm struck Lenwood and Barstow.	In Lenwood a boy was swept 200 feet by a flash flood before clinging to a telephone pole. A loaded trailer was also carried 150 feet off the highway.
9.6.1967	A heavy thunderstorm struck the west Barstow area.	Flash floods hit a neighborhood in west Barstow. Some homes and yards were filled with up to 3 feet of mud.
6.7.1968	Heavy thunderstorms struck the high desert.	Flash flooding closed several roads in the Barstow and Yermo areas.
1.18.1969 to 2.26.1969	Heavy rains of tropical origin hit California and continued in waves for over a month.	In the upper desert farmlands became lakes and more than 100 homes along the Mojave River were damaged. Roads and bridges were washed out and destroyed.
9.16.1969	A heavy thunderstorm hit Barstow.	Flash flooding flowed through the streets of Barstow. Water washed into 40 homes.
6.7.1972	Thunderstorms struck the Barstow and Helendale area with about 0.5 inch of rainfall in a short time.	Several structures, many streets, and yards were inundated with water and debris.
8.2.1972	Thunderstorms hit San Bernardino County.	Flash floods covered portions of highways with mud, including a stretch of Interstate 15 between Barstow and Baker for eight hours.
8.12.1972	Tropical Storm Diane sent moisture into the region which produced thunderstorms across Southern California. The Lucerne Valley received 2.1 inches of rain in less than one hour.	Flash floods left a foot of silt on downtown Lucerne Valley and closed several highways, including Interstate 15 northeast of Barstow. Other roads and railroads were washed out.
8.29–9.6.1972	Hurricane Hyacinth sends moisture throughout Southern California during the El Niño of 1972–73.	On 3 September 1972, flash flooding resulted in closing Interstate 40 at Ludlow, east of Barstow, for two hours. Railroads were also damaged.

Source: NOAA 2010.



Conceptual Site Model from Malcolm Pirnie 2009
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
2.2



Drainage Areas for the Proposed Landing Zones and Access Routes
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
2.3

The characteristics of the watershed (slope, area, geology, and vegetation) and the local rainfall/runoff patterns control the geometry the channel forms and the adjacent floodplains. The channel form is generally dictated by the amount of sediment deposited and eroded in the channel. As described by Lichvar and McColley (2008), the geometry of ephemeral/intermittent channels generally consists of three units (Figure 2.4):

- Low-flow channel – Conveys the low-to-moderate discharge events (2-year storms). Unstable over time and shifts with the low-to-moderate discharge events;
- Active floodplain – Conveys the 10-year storm event, generally stable over time with a break in bed and bank and change in vegetation. The active floodplain is where the majority of the erosion and deposition occurs; and
- Low terrace floodplain – Floods only during the greater than 10-year storm event. Overbank flow during extreme events, with isolated depressions and paleochannels (i.e., channels that are no longer active).

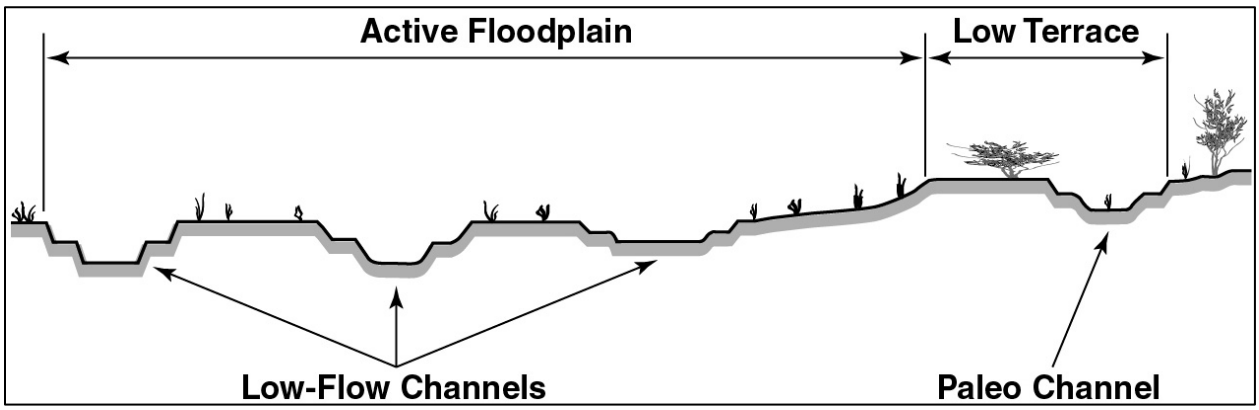
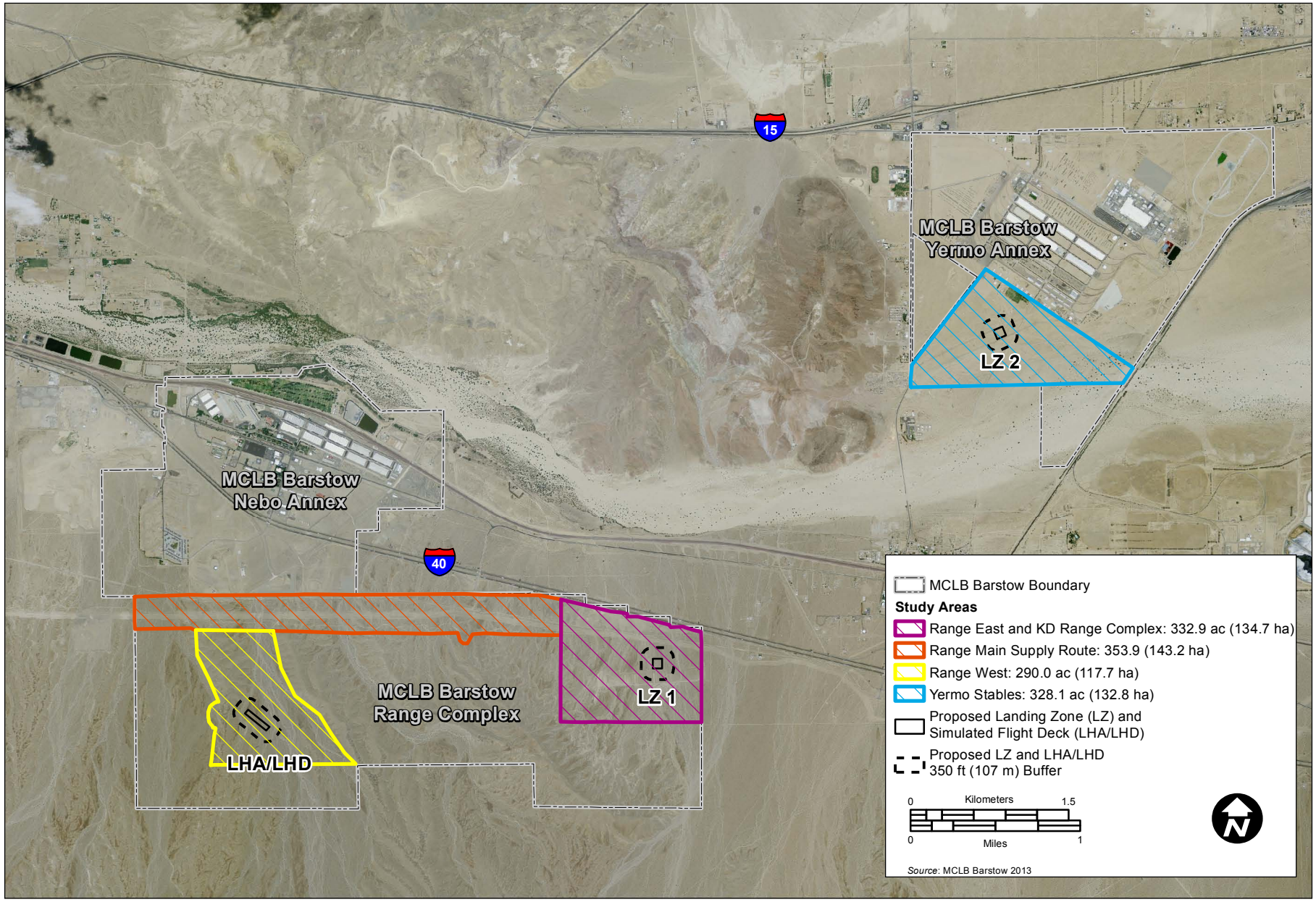


Figure 2.4. Representative Cross Section Showing Intermittent and Ephemeral Channel Forms (Lichvar and McColley 2008)

During 2013 and 2014, the Ordinary High Water Mark (OHWM) indicators were mapped for the project footprint according to the *Field Guide to the Identification of the Ordinary High Water Mark in the Arid West Region of the Western United States* (Lichvar and McColley 2008) (Figure 2.5). Field mapping, aerial topography, and detailed contour data were used to map the active floodplains and low terrace floodplain geomorphic unit in the project footprint. The results and methods of this mapping are provided in the *Final Jurisdictional Determination Report for Barstow Training and Range Environmental Assessment, MCLB Barstow* (Leidos 2015). According to the Arid West Classification System, most washes would be classified as Foothill, Soft Rock, Compound or Discontinuous Ephemeral Channels with Sand-dominated Active Channels (Lefebvre et al. 2013).



Hydrology Study Area
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
2.5

The Range Complex is located on alluvial fans. Alluvial fans distribute sediment across a broad area. Because of the low depths and frequently changing microtopography, it is difficult to accurately delineate the extent of a 100-year storm event discharge (FEMA 2003). Channels shift from side to side over time as sediment is deposited in the fan. Therefore, for the purposes of this study, the extent of the 100-year storm event is approximated by the extent of the low terrace geomorphic unit (Leidos 2015). In alluvial fan environments, the geomorphic mapping of the extent of the active alluvial fan is an appropriate method of determining the 100-year flood hazard risk areas (FEMA 2003).

3 Methodology

The hydrology developed for the project footprint was based on detailed modeling for proposed aircraft landing areas, flood-frequency regression equations for the numerous channel crossings along the two existing unimproved, utility right-of-way (ROW) access routes in the Range Main Supply Route training area, and existing studies for the Mojave River.

LHA/LHD, LZ 1, and KD Range Complex Channels: Hydrology and hydraulic models containing a network of drainage basins were developed to model runoff for the LHA/LHD site, LZ 1, and the KD Range Complex. Since there is no evidence of stormwater runoff at LZ 2 due to the flat topography, no estimates of stormwater runoff were developed. The U.S. Army Corps of Engineers Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS) was used to develop the event-based model to estimate the design storms peak runoff rates that could affect the proposed designated aircraft landing areas. The key steps in developing a rainfall-runoff model include delineating the watersheds, developing the design storm, and determining the hydrologic condition of the land surface based on the soil and existing vegetation conditions. These steps are discussed in detail below in Sections 3.1 to 3.4. Since the LHA/LHD site extends into the active floodplain, the Hydrologic Engineering Center's River Analysis System (HEC-RAS) was used to develop cross sections and model wetted area and water elevation at the LHA/LHD site and proposed LHA/LHD access road. HEC-RAS modeling assumptions are provided in Section 3.5.

Range Main Supply Route: Flood-frequency regression estimates based on drainage area were used to estimate the peak runoff rates for numerous channel crossings along the existing utility ROW access routes in the Range Main Supply Route training area. These equations are provided in Section 3.6.

Mojave River: The Mojave River flows into the southeastern portion of the Yermo Stables training area. No facilities are proposed in the Mojave River floodplain. Existing Federal Emergency Management Agency (FEMA) Flood Insurance Studies and California Department Water Resources Awareness 100-year floodplain mapping were used to estimate the peak discharge and floodplain extent of the Mojave River in the Yermo Stables training area. No modeling was completed for the Mojave River.

3.1 Watershed Delineation

The watershed delineation provided in the California Watershed Boundary Dataset was reviewed. The watershed boundary dataset provides watershed delineations down to the hydrologic unit code-12 level. For the rainfall-runoff modeling, the hydrologic unit code-12 watersheds encompassed too large of an area and did not provide sufficient detail to accurately estimate the flows in the channels near the LZs and LHA/LHD site. Two-foot contour data provided by MCLB Barstow and 10-foot contour data from the United States Geological Survey (USGS) National Elevation Dataset 10-meter grid were used to determine the watershed basin boundaries and sub-basin drainage areas tributary to the LZs and LHA/LHD site. The drainage area maps are provided in Appendix A. The watershed delineation was performed using the Hydrologic Engineering Center's Geospatial Hydrologic Modeling Extension (HEC-GeoHMS), which is a geospatial hydrology toolkit for ArcGIS.

3.2 Design Storms

Point precipitation frequency estimates based on National Oceanic and Atmospheric Administration Atlas 14, Volume 6, Version 2 were used to determine the rainfall depths for average yearly recurrence intervals and durations. The point precipitation frequency estimates are provided in Appendix B.

The *Unified Facilities Criteria (UFC) 3-320-15FA Surface Drainage Facilities for Airfields and Heliports* specifies the use of a 2-year design storm frequency; however, *UFC 3-230-17FA Drainage in Areas Other than Airfields* specifies the use of a 10-year design storm frequency in the design of roadway culverts. Because the proposed action includes improvements to existing access routes and construction of new access roads and an Arizona crossing, the more conservative 10-year, 1-hour design storm was modeled. In addition, according to the County of San Bernardino Hydrology Manual, drainage plans for all habitable and non-floodproof structures must demonstrate 100-year flood protection criteria. Therefore, the worst-case scenario, 100-year, 24-hour design storm was also modeled.

3.3 Hydrologic Conditions

The major factors affecting stormwater runoff include the type of soil and existing vegetative cover. The combined effect of soil type and vegetative cover are represented in the model by runoff curve numbers.

Soil Type - The hydrologic soil groups for the sub-basin areas were provided by the Web Soil Survey produced by the National Cooperative Soil Survey operated by the United States Department of Agriculture Natural Resources Conservation Service. The hydrologic soil group summary is provided in Appendix C**.**

Vegetative Cover - Soil Conservation Service runoff curve numbers for arid and semi-arid rangelands were computed for each drainage area based on the hydrologic soil group using desert shrub as the ground cover type description. The runoff curve numbers for arid and semiarid rangelands are provided in Appendix D.

3.4 HEC-HMS Model Development

HEC-HMS input data are divided into three sections: Basin Models; Meteorological Models; and Control Specifications. Each of these sections must be created before a simulation can run. A model was developed to simulate the design storm peak runoff rate tributary to each of the designated landing areas: one for the area tributary to the LHA/LHD site and one for the area tributary to LZ 1.

Basin Models - The two basin models developed represent the current physical condition of the LHA/LHD basin and LZ 1 basin. The parameters used to describe the hydrologic conditions within the basins are defined for each individual sub-basin. The LHA/LHD basin was delineated and divided into 13 sub-basins, with two sub-basins specifically tributary to the LHA/LHD site. The LZ 1 basin was delineated and divided into 18 sub-basins, with three sub-basins specifically tributary to LZ 1. Table 3.1 provides a summary of sub-basin areas for each basin.

Table 3.1. Summary of Sub-Basin Areas

LHA/LHD Basin	
Sub-basin Designator	Area (square miles)
DA-1	0.035
DA-2	0.006
DA-3	0.144
DA-4	0.265
DA-5	0.073
DA-6	0.007
DA-7	0.414
DA-8	0.556
DA-9	0.693
DA-10	0.826
DA-11	0.360
DA-12	0.663
DA-13	0.644
Total =	4.686
LZ 1 Basin	
Sub-basin Designator	Area (square miles)
DA-1	0.082
DA-2	0.033
DA-3	0.099
DA-4	0.0002
DA-5	0.151
DA-6	0.084
DA-7	0.115
DA-8	0.029
DA-9	0.012
DA-10	0.125
DA-11	0.010
DA-12	0.003
DA-13	0.004
DA-14	0.014
DA-15	0.020
DA-16	0.020
DA-17	0.005
DA-18	0.164
Total =	0.970

Stormwater runoff generated from the sub-basins is routed through a flow network that models shallow concentrated flow and stream systems.

Meteorological Models - The meteorological model in HEC-HMS is used to represent climatic conditions such as precipitation, evapotranspiration, and snowmelt. The models for this report estimate design stormwater runoff based on precipitation only. The 10-year, 1-hour design storm and the 100-year, 24-hour design storm from the point precipitation frequency estimates in Appendix B were used to determine the stormwater runoff at the LHA/LHD site.

3.5 Post-Development Runoff

The rational method was utilized to estimate the pre- and post-development peak runoff rate for a 10-year, 24-hour design storm and a 100-year, 24-hour design storm for the LHA/LHD site and LZ 1. The peak runoff rate for the LHA/LHD site and LZ 1 was used to estimate the volume of storm water detention such that the post-development stormwater release rate does not exceed that of the pre-project conditions.

3.6 HEC-RAS Model Development

Caution must be exercised in applying the results of hydraulic analysis methods such as HEC-RAS to alluvial fan systems. To evaluate the potential wetted area and water elevation during the 10-year and 100-year floods at key locations, a preliminary HEC-RAS model was developed. Channel cross sections were extracted from the 2-foot contour data of the Range Complex provided by MCLB Barstow utilizing the HEC-GeoRAS software, Version 10. Manning's roughness coefficient(n) of 0.05 was assumed to represent the channel and floodplain. Estimated flood flows were bulked by a factor of 2, according to recommendations by San Bernardino County to account for sediment carried by the runoff. This assumes sediment would comprise 50 percent of the flows by volume.

3.7 Flood-frequency Regression Equations

To evaluate the potential magnitude and frequency of discharge at road crossings throughout the Range Main Supply Route training area outside of the LHA/LHD and LZ 1 modeling areas, flood-frequency regression equations were utilized. In cooperation with FEMA, the USGS has performed a regional regression analysis to develop a set of equations for estimating the magnitude and frequency of floods at ungaged sites in California. These equations relate the 50-, 20-, 10-, 4-, 2-, 1-, 0.5-, and 0.2-percent flows and are computed based on peak flow records from stream gages in the desert region. The equations relate drainage area (in square miles) to the estimated peak flows (in cubic feet per second [cfs]). For the desert region (region 6), the 10-year (10-percent) and 100-year (1-percent) peak discharges can be estimated by the following equations (Gotvald *et al.* 2012):

$$\text{10-year peak discharge (cfs)} = 151\ (\text{Drainage area [square mile]})^{0.506}$$

$$\text{100-year peak discharge} = 1{,}350\ (\text{Drainage area [square mile]})^{0.506}$$

4 Stormwater Runoff

A 10-year, 1-hour design storm and 100-year, 24-hour design storm runoff simulation in HEC-HMS for each basin provided peak runoff rates at the LHA/LHD site and LZ 1.

4.1 LHA/LHD

The total stormwater runoff for the LHA/LHD basin is provided in Table 4.1. The stormwater runoff rates from sub-basins DA-5 and DA-9 at Junction J-3 are specifically tributary to the LHA/LHD site. The flow rate tributary to the LHA/LHD site for the 10-year, 1-hour design storm and the 100-year, 24-hour design storm is 50.80 cfs and 1613.30 cfs, respectively. A zero flow rate in the table indicates no stormwater runoff (i.e., the rainfall infiltrated in the soil within the sub-basin).

Table 4.1. Stormwater Runoff for the LHA/LHD Site

LHA/LHD Basin		
Sub-basin Designator	10-Year, 1-Hour Peak Discharge (cfs)	100-Year, 24-Hour Peak Discharge (cfs)
DA-12	28.00	597.90
DA-13	18.20	526.90
J-6	46.20	1124.80
Reach-6	29.80	991.30
DA-9	29.40	627.20
DA-8	19.60	479.40
J-4	48.90	1106.60
Reach-4	48.60	1092.90
DA-7	2.20	273.60
DA-6	0.00	1.00
J-3	50.80	1613.30
Reach-3	46.60	1444.30
DA-4	20.60	262.80
DA-5	0.00	27.60
J-2	62.10	1730.20
Reach-2	59.00	1679.60
DA-10	35.00	747.30
DA-11	5.80	266.40
J-5	40.80	1013.60
Reach-5	38.30	905.20
DA-3	0.20	90.00
DA-2	0.00	1.50
J-1	97.50	2676.30
Reach-1	90.00	2575.80
DA-1	0.60	26.10
Main Road Crossing	90.50	2601.80
Notes: cfs = cubic feet per second.		

With the establishment of the concrete landing platform at the LHA/LHD site, runoff rates would increase. The pre- and post-development peak runoff rates for a 10-year, 24-hour design storm

and a 100-year, 24-hour design storm for the LHA/LHD landing platform are provided in Table 4.2. The peak runoff rates for the LHA/LHD site would increase from 1.06 cfs to 5.92 cfs in the 10-year storm and from 1.81 cfs to 10.24 cfs in the 100-year storm event. For the 100-year storm event, this would result in an increase in runoff of 0.3 percent for the wash downstream of the LHA/LHD site. The storage volume required to reduce the increase in peak flows for the 10-year event would be 1,483 cubic feet and for the 100-year event would be 2,670 cubic feet.

Table 4.2. Pre- and Post-Development Peak Runoff Estimates for the LHA/LHD Site

Design Storm	Pre-Development Peak Runoff (cfs)	Post-Development Peak Runoff (cfs)	Storage Volume (cubic feet)
10-Year	1.06	5.9	1,483
100-Year	1.81	10.2	2,670
Notes: cfs = cubic feet per second.			

4.2 KD Range Complex and LZ 1

The total stormwater runoff for the KD Range Complex and LZ 1 is provided in Table 4.3. Stormwater runoffs from sub-basin DA-5 at Junction J-5 and sub-basin DA-9 at Junction J-7 are the closest tributaries to LZ 1. The flow rate for the tributary west of LZ 1 (J-5, DA-5) for the 10-year, 1-hour design storm and the 100-year, 24-hour design storm is 0.3 cfs and 94.3 cfs, respectively. The flow rate for the tributary east of LZ 1 (J-7, DA-9) for the 10-year, 1-hour design storm and the 100-year, 24-hour design storm is 0.0 cfs and 1.7 cfs, respectively. A zero flow rate indicates no stormwater runoff where the rainfall infiltrated in the soil within the sub-basin.

With the establishment of the graded and compacted landing pad at LZ 1, runoff rates would increase. The pre- and post-development peak runoff rate for a 10-year, 24-hour design storm and a 100-year, 24-hour design storm for LZ 1 are provided in Table 4.4. The peak runoff rates for LZ 1 would increase from 0.68 cfs to 4.14 cfs in the 10-year storm and from 1.17 cfs to 7.15 cfs in the 100-year storm event. For the 100-year storm event, this would result in a 1.5 percent increase of runoff from the KD Range Complex. The storage volume required to retain the increase in peak flows for the 10-year event would be 1,070 cubic feet and for the 100-year event would be 1,920 cubic feet.

Table 4.3. Stormwater Runoff for the KD Range Complex and LZ 1

KD Range Complex and LZ 1 Basin		
Sub-basin Designator	10-Year, 1-Hour Peak Discharge (cfs)	100-Year, 24-Hour Peak Discharge (cfs)
DA-18	1.8	115.3
DA-17	0.0	0.7
DA-16	0.0	5.7
J-11	0.0	5.7
Reach-11	0.0	4.9
J-10	1.8	120.9
Reach-10	1.5	118.0
DA-15	0.0	2.9*
DA-14	0.0	2.1*
J-9	0.0	5.0*
Reach-9	0.0	4.2*
DA-13	0.0	0.6
DA-12	0.0	0.4
J-8	1.5	123.2*
Reach-8	1.3	100.8*
DA-11	0.0	1.4
DA-10	0.0	18.2
DA-9	0.0	1.7
J-7	0.0	1.7
Reach-7	0.0	1.2
J-6	1.3	121.4*
Reach-6	0.9	106.4*
DA-8	0.0	4.2
DA-7	3.3	94.4
DA-6	0.9	58.9
DA-5	0.3	94.3
J-5	0.3	94.3
Reach-5	0.2	83.9
J-4	4.2	237.2
Reach-4	4.1	234.6
DA-4	0.0	0.0
J-3	4.1	345.2
Reach-3	3.8	335.8
DA-3	2.2	77.2
J-2	6.0	412.9*
Reach-2	4.0	359.5*
DA-1	0.1	51.0
DA-2	0.0	14.5
J-1	4.0	425.0*
Reach-1	4.0	409.9*
Outlet Culvert	4.0	409.9*

Notes: * The Daggett Wash Watershed contributes approximately 6,700 cfs at these locations which could contribute to a flooding situation (refer to Table 4.5).
cfs = cubic feet per second, KD = Known Distance.

Table 4.4. Pre- and Post-Development Peak Runoff Estimates for LZ 1

Design Storm	Pre-Development Peak Runoff (cfs)	Post-Development Peak Runoff (cfs)	Storage Volume (cubic feet)
10-Year	0.68	4.14	1,070
100-Year	1.17	7.15	1,920
Notes: LZ = landing zone; cfs = cubic feet per second.			

4.3 Range Main Supply Route

The total stormwater runoff for each of the drainage areas where road crossings of channels occurs is provided in Table 4.5. The stormwater runoff was estimated based on the drainage area utilizing regional regression equations for the California desert developed by the USGS (Gotvald et al. 2012).

Table 4.5. Stormwater Runoff for the Range Main Supply Route

Existing Utility ROW Access Route Crossings			
Drainage Area Designator	Drainage Area (square miles)	10-year Peak Discharge (cfs)	100-year Peak Discharge (cfs)
DA-1	4.72	331	2,961
DA-2	0.02	19	166
DA-3	0.00	9	81
DA-4	0.00	7	59
DA-5	0.02	19	169
DA-6	0.04	28	254
DA-7	2.00	214	1,916
DA-8	0.01	15	131
DA-9	0.00	8	71
DA-10	0.01	14	127
DA-11	0.02	20	176
DA-12	0.00	6	51
DA-13	0.01	17	156
DA-14	0.01	14	121
DA-15	0.11	50	443
DA-16	0.01	13	118
DA-17	0.22	70	624
DA-18	0.01	11	99
DA-19	0.01	16	147
DA-20	0.04	31	273
DA-21	0.01	13	114
DA-22	0.03	25	221
DA-23	0.12	51	457
DA-24	0.05	33	291
DA-25	0.05	33	293
DA-26	0.01	16	142
DA-27	0.06	36	324
DA-28	0.01	16	146
DA-29	0.09	45	405
DA-30	0.18	63	559
DA-31	0.19	64	576
DA-32	0.02	22	198
DA-33	0.26	77	688
DA-34	0.01	16	143
DA-35	1.40	179	1,600
DA-36	2.59	244	2,184
Daggett Wash	23.39	744	6,654

Notes: Based on regional U.S. Geological Survey regression equations (Gotvald et al. 2012).
cfs = cubic feet per second, ROW = right-of-way.

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5 Results

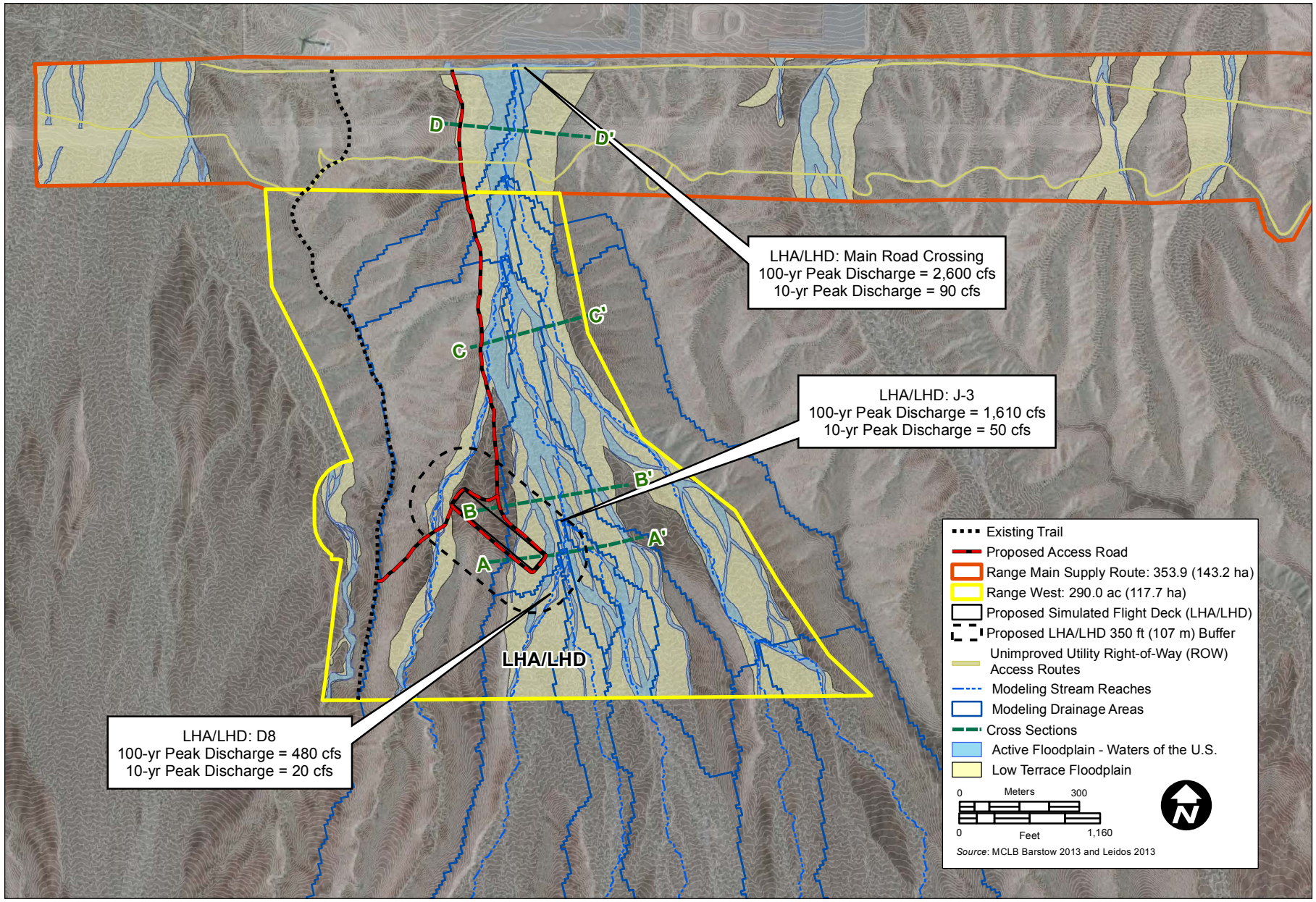
5.1 LHA/LHD

The LHA/LHD site is located on the western part of a large alluvial fan wash. During a 100-year storm event, the combined flow of water through the wash near the LHA/LHD site is estimated to be 1,610 cfs (Figure 5.1). Applying a bulking factor of 2 according to San Bernardino County recommendations, the overall runoff volume, including sediments, is estimated to be 3,210 cfs. Modeling the wetted area of the 100-year flows indicates that the northeast corner of the LHA/LHD landing platform would be within 50 feet of the modeled 100-year floodplain.

Figure 5.2 provides cross sections of the alluvial fan wash in the LHA/LHD basin (Cross Sections A and B). The estimated water elevation for the 10-year and 100-year events is provided. The northeast corner of the LHA/LHD landing platform (Cross Section A) would be approximately 2 feet above the water surface elevations of the 100-year flood. Alluvial fan channels can change course rapidly, especially in this location where flow would be laden with sediment and the channels are not deeply incised. Geomorphologic mapping can be used as an alternate method for determining the 100-year floodplain in alluvial fan systems (FEMA 2003). Two-thirds of the LHA/LHD landing platform is located on inactive desert pavement terrace not subject to flooding (Photograph 1). However, approximately a third of the LHA/LHD landing platform overlaps into the low terrace geomorphic unit of the alluvial fan channel system (Photograph 2). The proposed configuration of the LHA/LHD landing platform would encroach approximately 280 feet into the low terrace geomorphic unit from the west bank and overlap a small active channel (Figure 5.2). Therefore, due to the shifting nature of alluvial fan systems, structures placed at the LHA/LHD site in the low terrace portion of the alluvial fan wash could be damaged during a 100-year storm event.

The proposed LHA/LHD access road that would connect to the existing utility ROW access route would be located on the western edge of the wash at the toe of the hill slope, which is outside the approximate 100-year floodplain. This location would minimize potential damage to the road and limit impacts to the floodplain. Several small channels located along the length of the proposed access road drain the ridge on the west of the LHA/LHD basin.

The concrete LHA/LHD landing platform would also increase the storm water runoff off-site. Overall, the added impervious surface would minimally increase flows by 0.3 percent at the downstream end of DA-1 (i.e., where the runoff flows into a constructed channel into the Nebo Annex). With implementation of Low Impact Development (LID) runoff-reduction measures, this flow impact would be reduced.



Modeling Results - LHA/LHD
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE 5.1

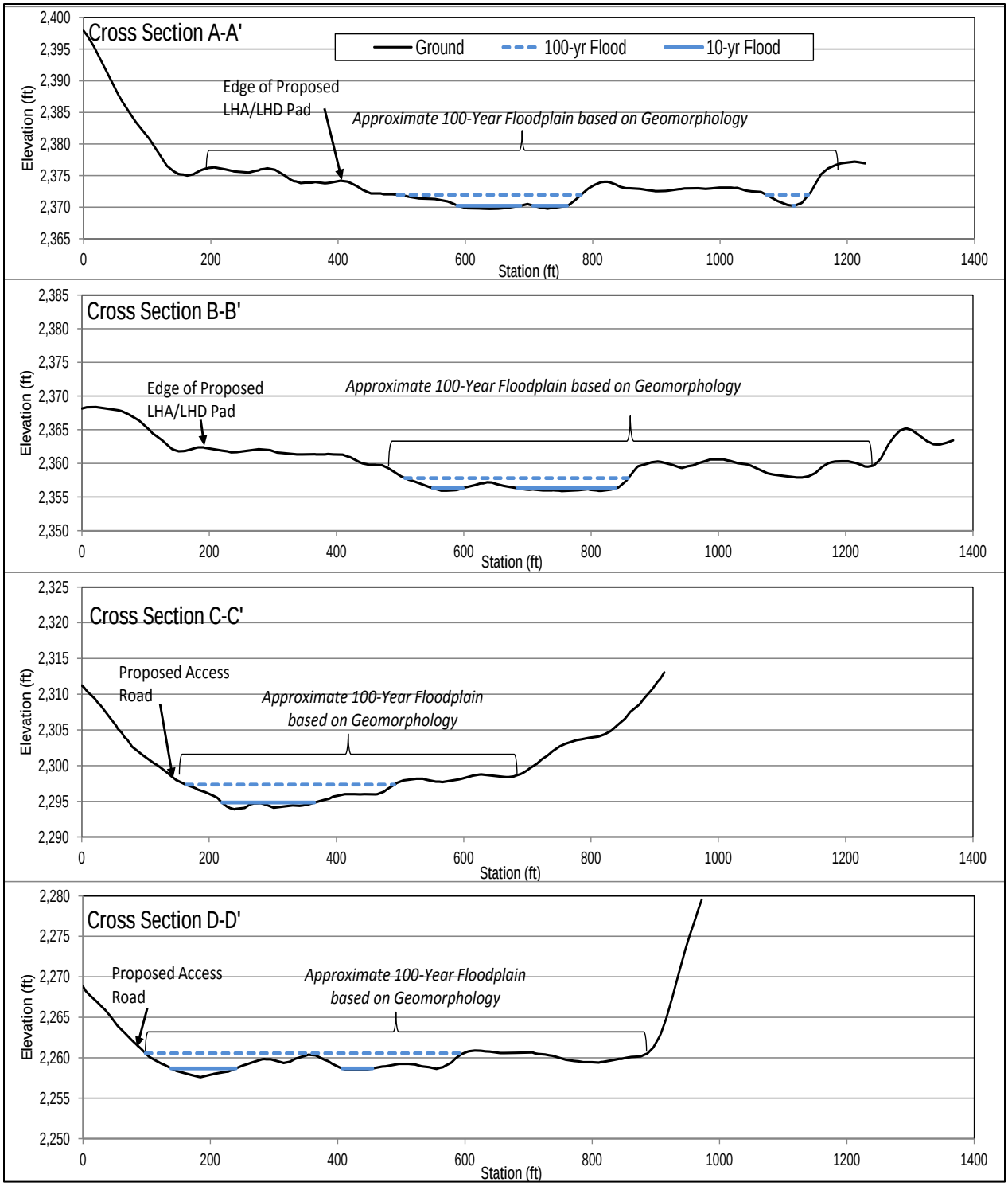


Figure 5.2. LHA/LHD Drainage Cross Sections

NOTE: The wetted perimeter and water elevations for the 10-year and 100-year events will change over time with each major storm event as channel conditions are unstable in alluvial fan systems. The approximate 100-year floodplain is based on geomorphology and used for planning purposes.

Photograph 1 is looking southeast at the desert pavement terrace (inactive fan deposits) on which two-thirds of the LHA/LHD landing platform would be located.

Photograph 2 is looking across the large channel that crosses through the eastern portion of the LHA/LHD site.

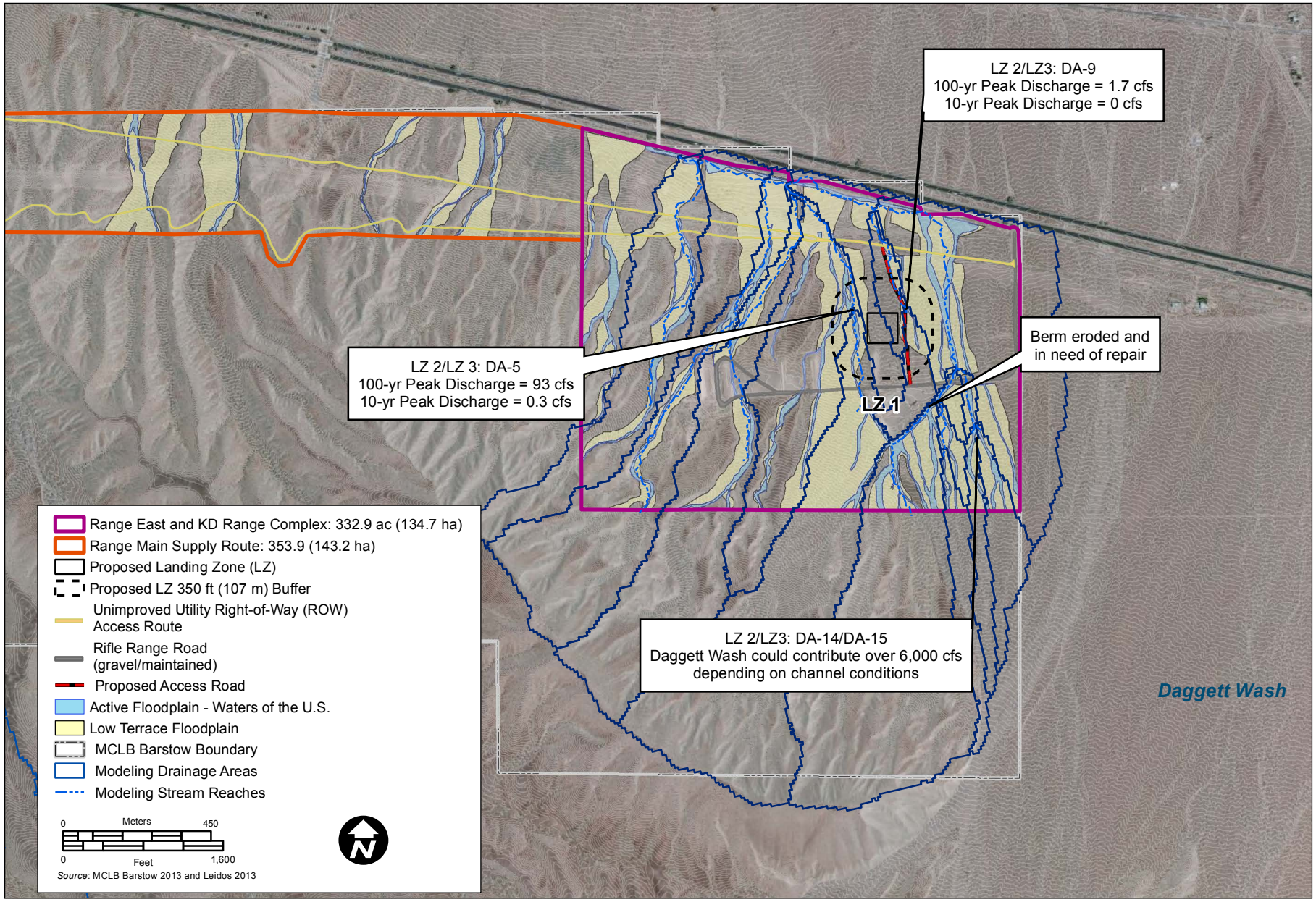
5.2 KD Range Complex and LZ 1

The LZ 1 site is located north and downstream of the KD Range Complex parking area. Two small levees protect the buildings/structures in the KD Range Complex administrative area, diverting the flow into two main channels. These levees would also provide protection for LZ 1 down slope. There are no active floodplain channels within the LZ 1 site (Photograph 3). With the protection of the upstream levees that route the flow around the proposed landing area, there would be minimal risk of major flooding at LZ 1 (Figure 5.3). However, one of the levee's banks has eroded (Photograph 4) and should the levee fail, flooding could occur at LZ 1. The graded landing pad at LZ 1 would also increase the storm water runoff off-site. Overall, the added impervious surface would slightly increase flows by 1.5 percent at the outlet culvert downstream of the KD Range Complex. With implementation of LID runoff-reduction measures described in Section 6, this flow impact would be reduced.

The proposed action would include installation of new 700-yard, 800-yard, and 900-yard line berms at the KD Rifle Range to provide more advanced requirements for sniper team training. The 800-yard line would be located adjacent to the active floodplain of the largest desert wash in the KD Range Complex. The western edge of the 800-yard line berm would obstruct the floodplain and would be susceptible to erosion during a major flood event.

Photograph 3 is looking south from the center of LZ 1. This area is flat with no drainage channels.

Photograph 4 is looking northeast along an eroded levee face that protects the KD Range Complex administrative building and parking lot. This eroded levee has a nearly vertical face and could fail without repair.



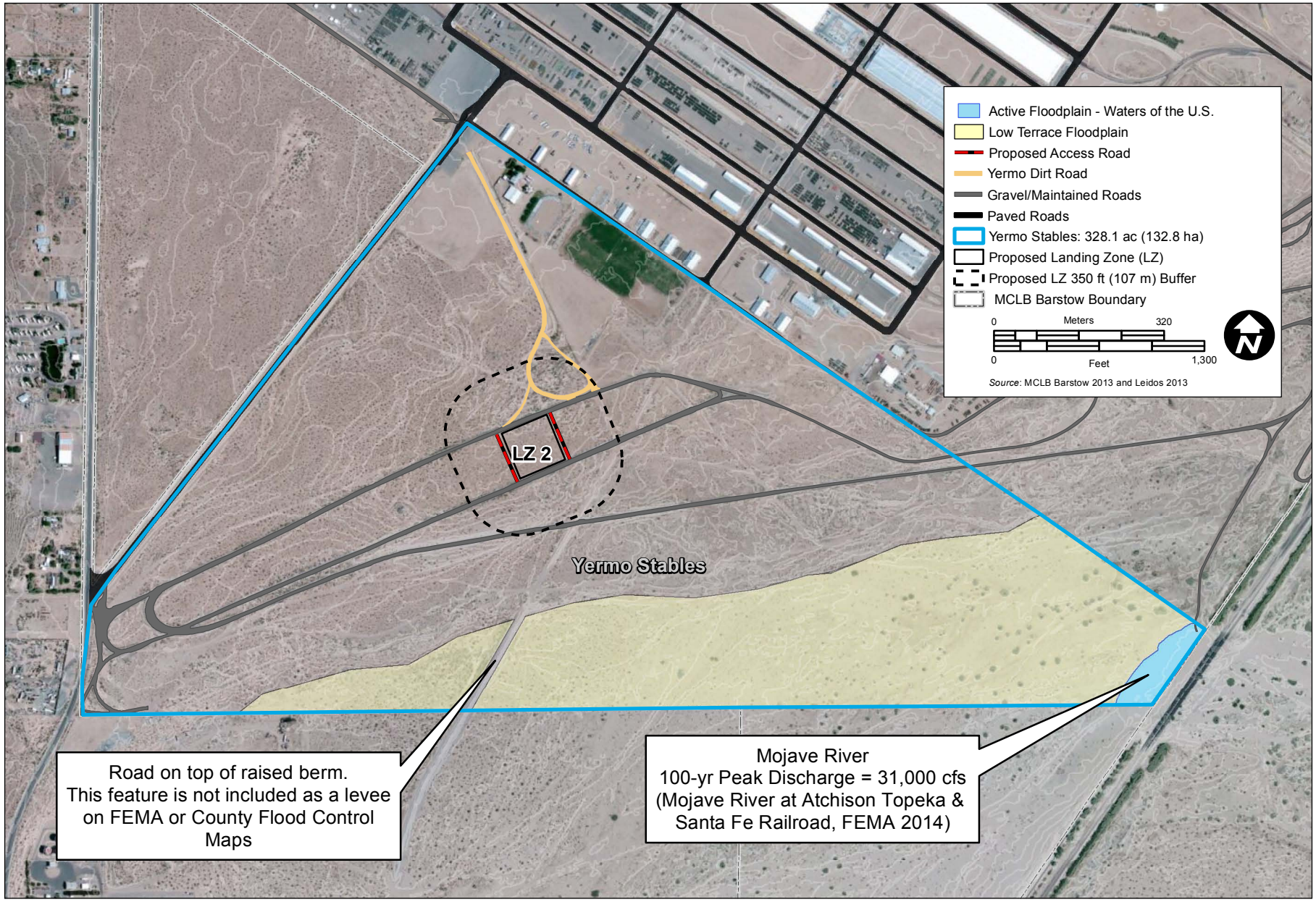
Modeling Results - KD Range Complex - LZ 1
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE 5.3

5.3 Yermo Stables and LZ 2

The Yermo Stables training area includes portions of the Mojave River channel and floodplain to the south of LZ 2 (Figure 5.4). Most of the time the wash is dry but large discharges can occur during major storm events. The estimated 100-year flood peak discharge is 31,000 cfs at the Mojave River at the Atchison, Topeka, and Santa Fe Railroad Bridge (FEMA 2014). There are no channels in the LZ 2 area that would convey runoff through the site (Photograph 5). Small depressions at the site could temporarily pond water for several hours or days following a storm event.

Photograph 5 depicts the terrain at LZ 2. The topography is flat and no drainage channels have developed in the area.



Waters of the U.S. - Yermo Stables - LZ 2
Barstow Training and Range
MCLB Barstow, San Bernardino County, California

FIGURE
5.4

5.4 Range Main Supply Route

The existing utility ROW access routes in the Range Main Supply Route training area, which would provide primary access to the LHA/LHD site and LZ 1, cross numerous drainages. Due to flooding from a thunderstorm in September 2013, many parts of the roadbed were damaged and the route was passable only with vehicles with high clearance and/or four-wheel drive. During the October 2013 survey, Global Positioning System (GPS) coordinates and photographs were taken of the access route channel crossings. During the watershed delineation step of the rainfall-runoff modeling, the drainage areas were calculated for each of the route channel crossings. The map of the drainage area of the channels that cross the existing utility ROW access routes is provided in Figure 2.3 and Appendix E. Photographs across, upstream, and downstream of the channels at the existing utility ROW access routes crossings are also included in Appendix E. The location, current status, and contributing drainage areas of the channel crossings are useful to determine the type of improvements required to support the proposed action. Of the 36 drainages delineated, 32 are less than one square mile with estimates of 10-year peak discharge less than 100 cfs. Four drainages are greater than one square mile (DA-1, DA-7, DA-35, and DA-36) with estimates of 10-year peak discharge greater than 100 cfs.

The topography along the existing utility ROW access routes has been altered by the installation of gas pipelines along the corridor as well as downslope grading likely associated with the construction of Interstate 40. This has resulted in a hydraulic drop on the downstream side of most the road crossings of the channels. Due to the increased energy from the hydraulic drop, several small gullies have formed at the downstream side that could cut into the roadway (Appendix E). In total, 15 of the 36 drainage crossings have potential issues with gullying. Where road crossings are at grade with the natural channel beds, limited erosion problems were noted. Channel DA-1 has been mostly blocked downstream of the Range Complex by the construction of a landfill. The historic landfill has been capped and is part of the installation restoration program. During flood events, water is ponded at the end of DA-1 in the Range Complex until it overflows into the constructed storm drain channel downstream of the landfill. Following the September 2013 storm event, the ponded water lasted several days with muddy road conditions lasting several weeks. Under its current configuration the road crossing at DA-1 could become impassable for several days or weeks following runoff events.

6 Recommendations

The proposed action requires compliance with the most current versions of UFC for LID (3-210-10), National Pollutant Discharge Elimination System (NPDES) General Permit for Waste Discharge Requirements for Storm Water Discharges from Municipal Separate Storm Sewer Systems (MS4) (Order No. 2013-0001-DWQ NPDES No. CAS000004), and the Construction General Permit (Order No. 2010-0014-DWQ NPDES No. CAS000002).

UFC 3-210-10 was adopted specifically for use on all federal facilities as a means to comply with the 2007 Energy and Independence and Security Act. The UFC criteria require implementation of LID design elements to the extent necessary to achieve the following water quality objectives to "the maximum extent technically feasible":

- Provide water quality treatment for all storms up to the 95th percentile, 24-hour event. The 95th percentile depth for a 24-hour storm event at the Barstow Station in the United States Environmental Protection Agency National Stormwater Calculator is 0.8 inch;
- Maintain temperature of storm water discharge to pre-project conditions;
- Maintain rate, volume, and duration of storm water flow to pre-project conditions;
- Maintain pre-project sediment and nutrient loading within storm water discharge; and
- Satisfaction of all applicable state and local water quality standards.

UFC 3-210-10 requirements for capture of a 95th percentile storm event exceed the 85th percentile requirements of capture under the MS4 permit and Construction General Permit. Therefore the proposed action should comply with the UFC criteria.

Runoff reduction features, consisting of swales, infiltration trenches, and/or sediment/detention basins, would be constructed to provide peak flow attenuation and water quality benefits for the 95th percentile, 24-hour storm event. The conceptual layout of runoff reduction features is provided in Appendix A. Additional engineering is required to estimate the infiltration trench and sediment/detention basin capacities, as well as the grading along the proposed access roads. The detailed grading plans and drainage system designs should be developed and finalized before construction. In addition, appropriate permit documentation, including a Stormwater Pollution Prevention Plan (pursuant to the Construction General Permit) and a Water Quality Management Plan (pursuant to the MS4 permit) would be required before construction.

6.1 LHA/LHD

Infrastructure installed at the LHA/LHD site could be at risk to flood damage in a 100-year storm event if the active floodplain channel shifts west in the alluvial fan system. To limit damage to the LHA/LHD landing platform, an earthen levee should be installed upstream of the LHA/LHD site at the west edge of the floodplain and connected to the outer edge of the LHA/LHD landing platform. The levee would protect the LHA/LHD site by re-routing flow of the small channel on the western edge toward the main channel in the center of the floodplain. The access route around the LHA/LHD landing platform would traverse the top of the levee. The low terrace

geomorphic floodplain in this location is over 1,000 feet wide, and would be reduced by approximately 250 feet to 750 feet. The levee would constrain the future movement of the channel throughout the desert wash on the western side, but would not significantly affect the existing flow dynamics (depth and velocity) of the active floodplain, as the footprint of the levee is outside of the HEC-RAS modeled 100-year floodplain.

Conceptual designs of the LHA/LHD landing platform indicate that significant fill (approximately 17,300 cubic yards) would be required to ensure that the LHA/LHD landing platform is raised above the floodplain. This fill would likely be borrowed from two ridges south of the LHA/LHD landing platform. A small erosional channel south of the LHA/LHD landing platform would be routed to the existing wash west of the LHA/LHD landing platform. Infiltration trenches and sediment/retention basins would be used to capture the 95th percentile storm event (0.8 inch in 24 hours for Barstow, California). The conceptual layout of the runoff reduction features is provided in Appendix A.

The proposed access road to the LHA/LHD landing platform would involve the construction of 6,100 linear feet of new road up to 24 feet wide. The proposed access road would be located at the toe of the slope of the ridgeline on the west side of the Range West training area. The road should be constructed outside of the desert wash floodplains to the extent practicable. The following measures should be incorporated into the design of the LHA/LHD access road.

1. The road should be constructed outside of the desert wash floodplains to the extent practicable.
2. Road crossings of desert washes should be constructed perpendicular to the direction of flow. To avoid stream diversion into the roadbed, crossings should drop into the channel bed on the approach and rise away from the channel bed (i.e., designing the crossing as a sag vertical curve). To avoid downstream erosion impacts, the roadbed at the crossing should be at grade with the channel bottom.
3. In addition, to the extent practicable, the road should be constructed with an outsloped roadway configuration to allow sheetflow from the hillsides to continue across the road without disruption. This type of drainage system avoids the construction and maintenance of ditches and other costly drainage features that further concentrate water flows.

6.2 KD Range Complex and LZ 1

There would be minimal risk of major flooding at the LZ 1 site. LZ 1 is protected from flood damage by two upstream levees that route the flow around the KD Range Complex administrative area. However, one of the levees banks has eroded (Figure 5.2, Photograph 4) and should the levee fail, flooding could occur at LZ 1. The eroded levee at the KD Range Complex should be repaired. In the short-term, the eroded section of the levee should be filled with dirt, compacted, and contoured to match the existing dimensions and side bank slope of the undamaged sections of the levee. Following repair, MCLB Barstow would conduct ongoing inspections of the earthen levee at the KD Range Complex, especially following major runoff events. For longer term protection, the southeastern side of the levee could be armored with rock rip-rap.

The western edge of the 800-yard line berm would obstruct the floodplain and would be susceptible to erosion during a major flood event. A floodwall should be installed on the western edge of the proposed 800-yard line to protect the berm from erosion and minimize encroachment to the floodplain. The floodwall would be designed to include a gravity or cantilevered wall constructed of concrete or gabions. Due to the proximity of the 800-yard line to the proposed Arizona crossing, the design of the Arizona crossing should consider construction of the 800-yard line flood wall immediately downstream.

6.3 Yermo Stables and LZ 2

LZ 2 is outside of the Mojave River floodplain and not at risk for flooding. The southern portion of the Yermo Stables training area is within the Mojave River floodplain. Avoidance of infrastructure in the Mojave River floodplain is recommended. There are no roads, LZs, or construction activities proposed within or adjacent to the floodplain.

6.4 Range Main Supply Route

There are fifteen locations where the existing utility ROW access routes channel crossings have potential issues with gully erosion. Gullies have formed in areas where there is a hydraulic drop between the road bed and the downstream channel bed. Due to the underlying utility pipelines in most locations, it may not be feasible to re-grade the road bed. To prevent damage to the road bed, the downstream channels could be armored to dissipate the energy of the water due to the hydraulic drop.

At the DA-1 channel crossing (downstream of the LHA/LHD site), water ponds during runoff events due to the downstream installation restoration program landfill site. This ponding would be improved by cutting a drainage channel from the ponded area to the constructed stormwater channel. This would involve re-grading the fence line road on the Nebo Annex to allow stormflows to flow across the road into the constructed stormwater channel downstream.

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7 References

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Appendix A

Drainage Area Maps and Conceptual Plans

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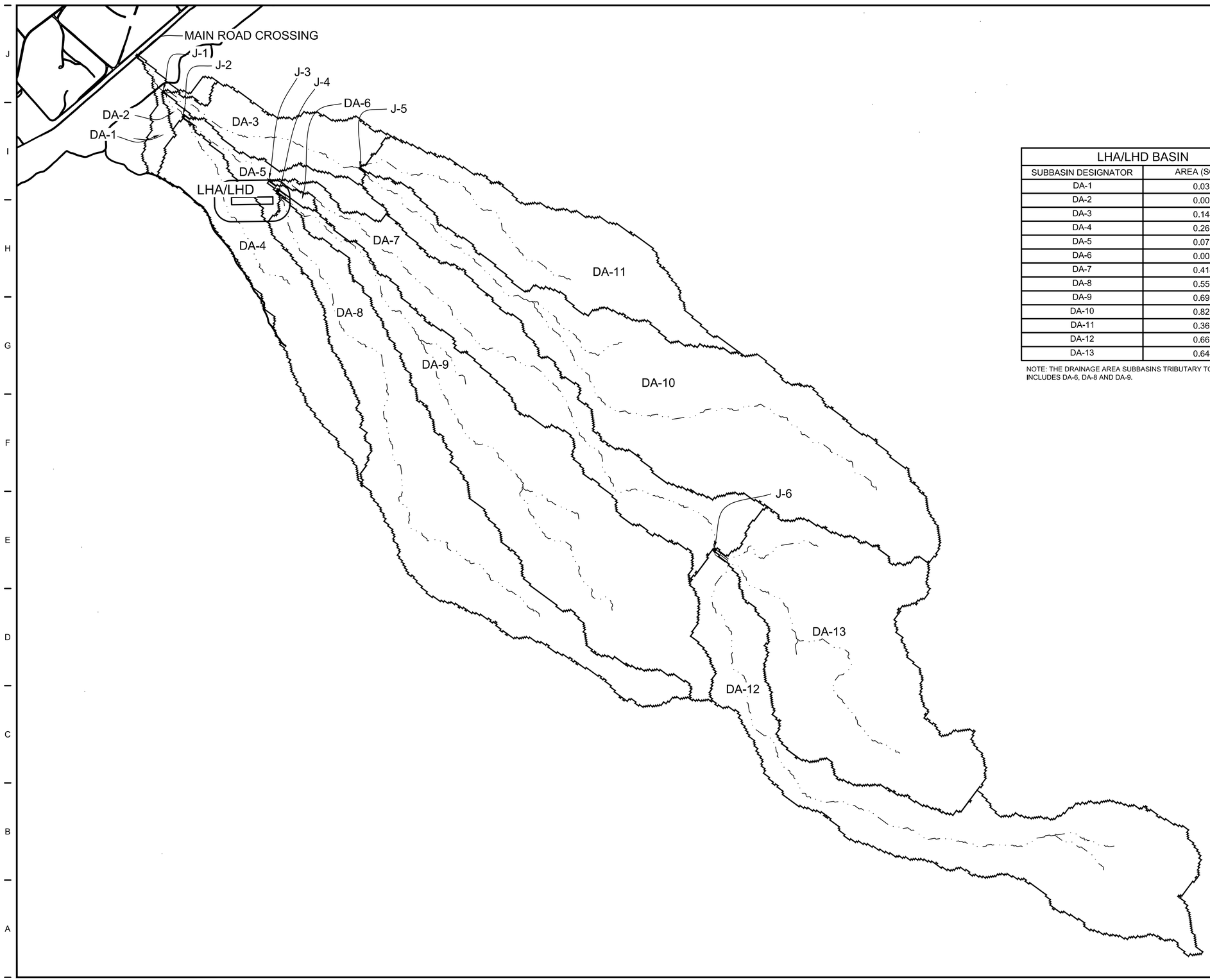

LHA/LHD BASIN	
SUBBASIN DESIGNATOR	AREA (SQ.MI.)
DA-1	0.035
DA-2	0.006
DA-3	0.144
DA-4	0.265
DA-5	0.073
DA-6	0.007
DA-7	0.414
DA-8	0.556
DA-9	0.693
DA-10	0.826
DA-11	0.360
DA-12	0.663
DA-13	0.644

NOTE: THE DRAINAGE AREA SUBBASINS TRIBUTARY TO THE LHA/LHD INCLUDES DA-6, DA-8 AND DA-9.

N

1000 0 500 1000

1"=1000'

REV.	DATE	REVISION DESCRIPTION	BY	CHKD	APP'D
1	01/26/15	REVISED LZ	FB	MS	JD

CLIENT:

MCLB BARSTOW
San Bernardino County, California

ENGINEER:

leidos

622 EMERSON ROAD, SUITE 600
ST. LOUIS, MO. 63141
314-821-7017
www.leidos.com

PROJECT NAME:

BARSTOW TRAINING AND RANGE

TITLE:

DRAINAGE AREA MAP
FOR LZ LHD

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CHECKED BY: MJS	DATE: 11/29/2013
APPROVED BY: MDG	ZONE: -
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DRAWING NUMBER: C-DA-LHD	REV: 1

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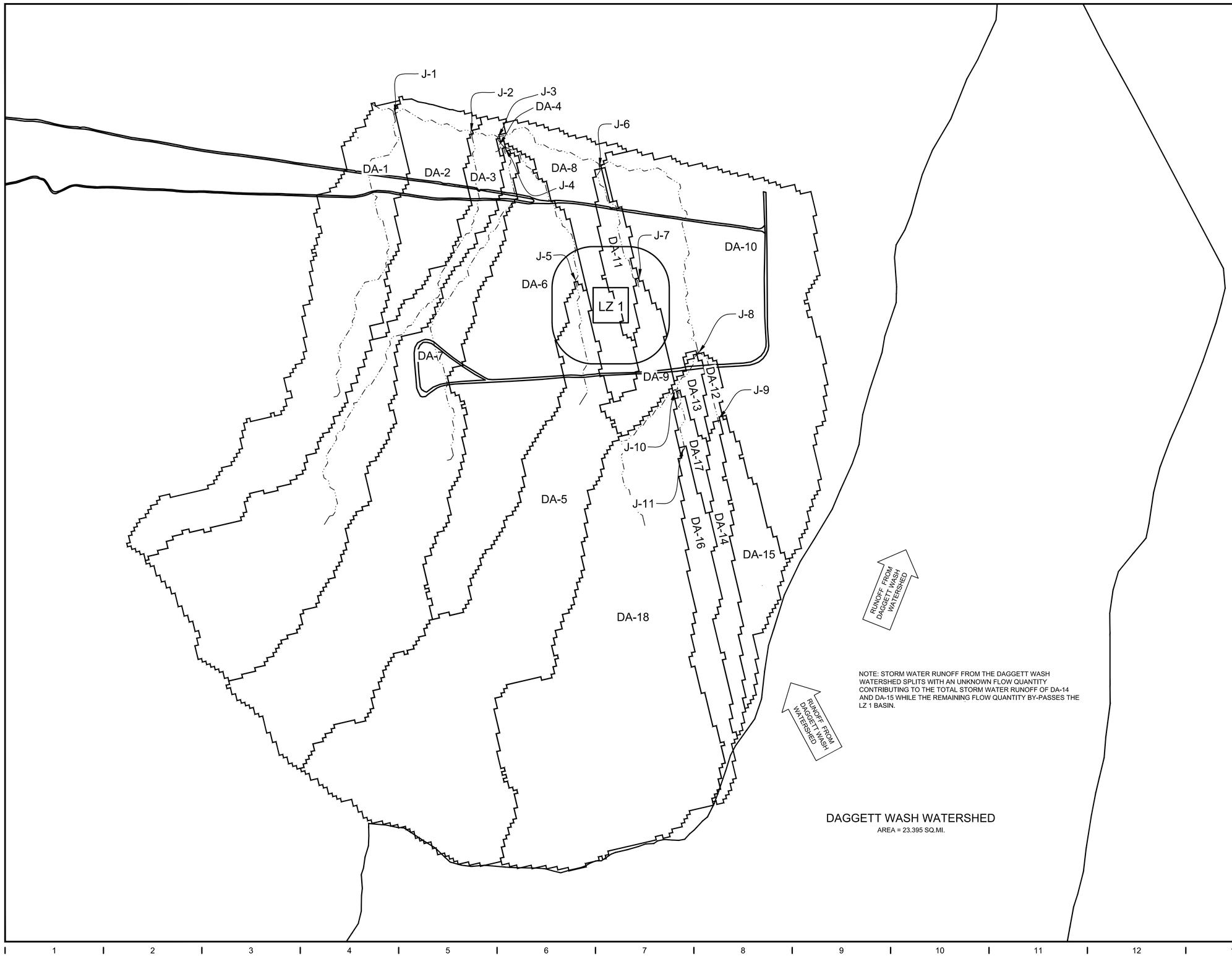

LZ 1 BASIN	
SUBBASIN DESIGNATOR	AREA (SQ.MI.)
DA-1	0.082
DA-2	0.033
DA-3	0.099
DA-4	0.0002
DA-5	0.151
DA-6	0.084
DA-7	0.115
DA-8	0.029
DA-9	0.012
DA-10	0.125
DA-11	0.010
DA-12	0.003
DA-13	0.004
DA-14	0.014
DA-15	0.020
DA-16	0.020
DA-17	0.005
DA-18	0.164

NOTE: THE DRAINAGE AREA SUBBASINS TRIBUTARY TO THE LZ 3 INCLUDES DA-5, DA-9 AND DA-11. THE DRAINAGE AREA SUBBASINS TRIBUTARY TO THE LZ 2 INCLUDES DA-14, DA-15, DA-16, DA-17 AND AN UNKNOWN QUANTITY OF FLOW FROM THE DAGGETT WASH WATERSHED.

NOTE: STORM WATER RUNOFF FROM THE DAGGETT WASH WATERSHED SPLITS WITH AN UNKNOWN FLOW QUANTITY CONTRIBUTING TO THE TOTAL STORM WATER RUNOFF OF DA-14 AND DA-15 WHILE THE REMAINING FLOW QUANTITY BY-PASSES THE LZ 1 BASIN.

DAGGETT WASH WATERSHED
AREA = 23.395 SQ.MI.

REV.	DATE	REVISION DESCRIPTION	BY	CHKD	APP'D
1	01/26/15	REVISED LZ	FB	MS	JD

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SCALE AT ANSI: D 1" = 50'	PROJECT NUMBER: 2554314300
DRAWING NUMBER: C-DA-LZ1	REV: 1

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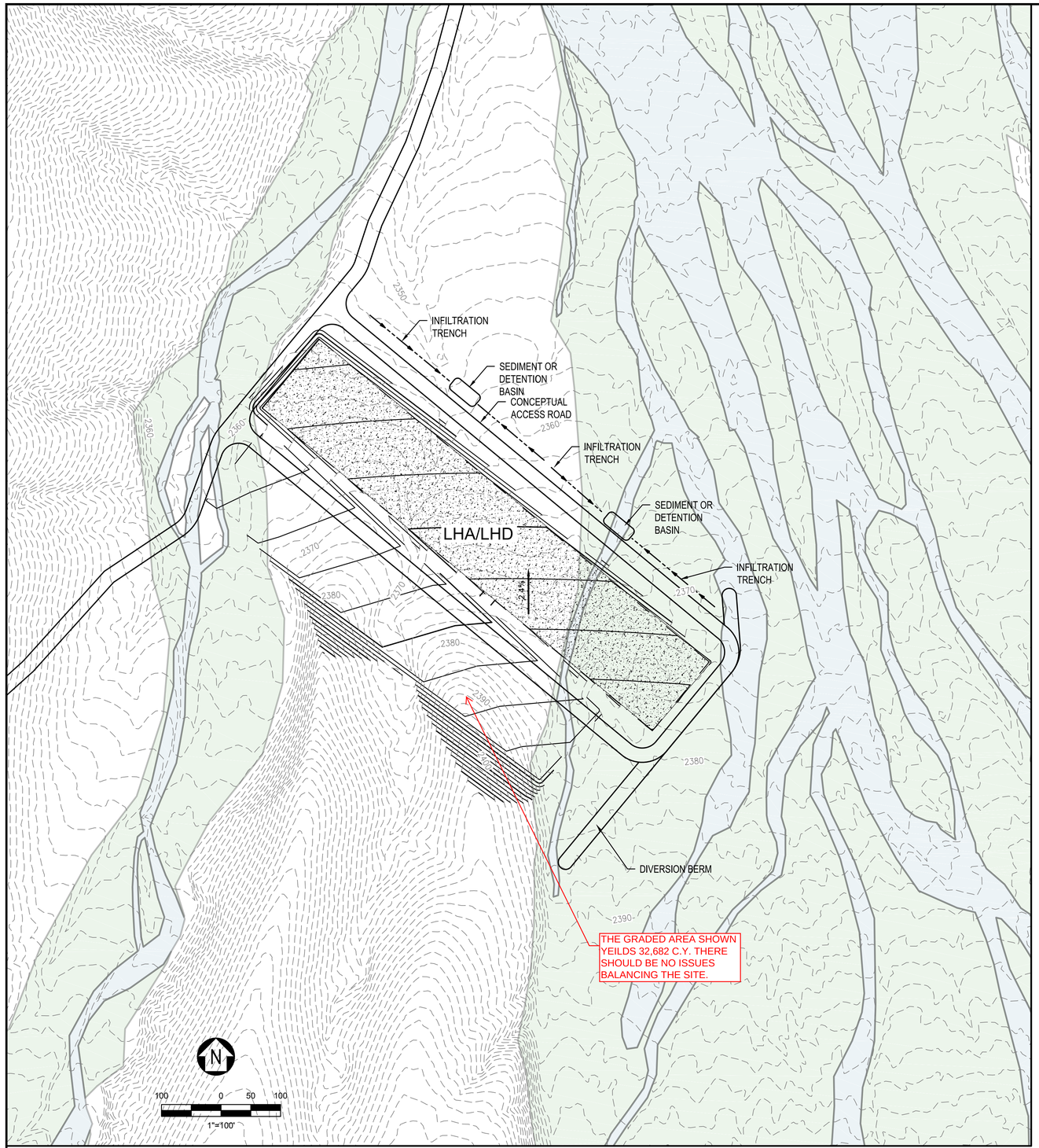

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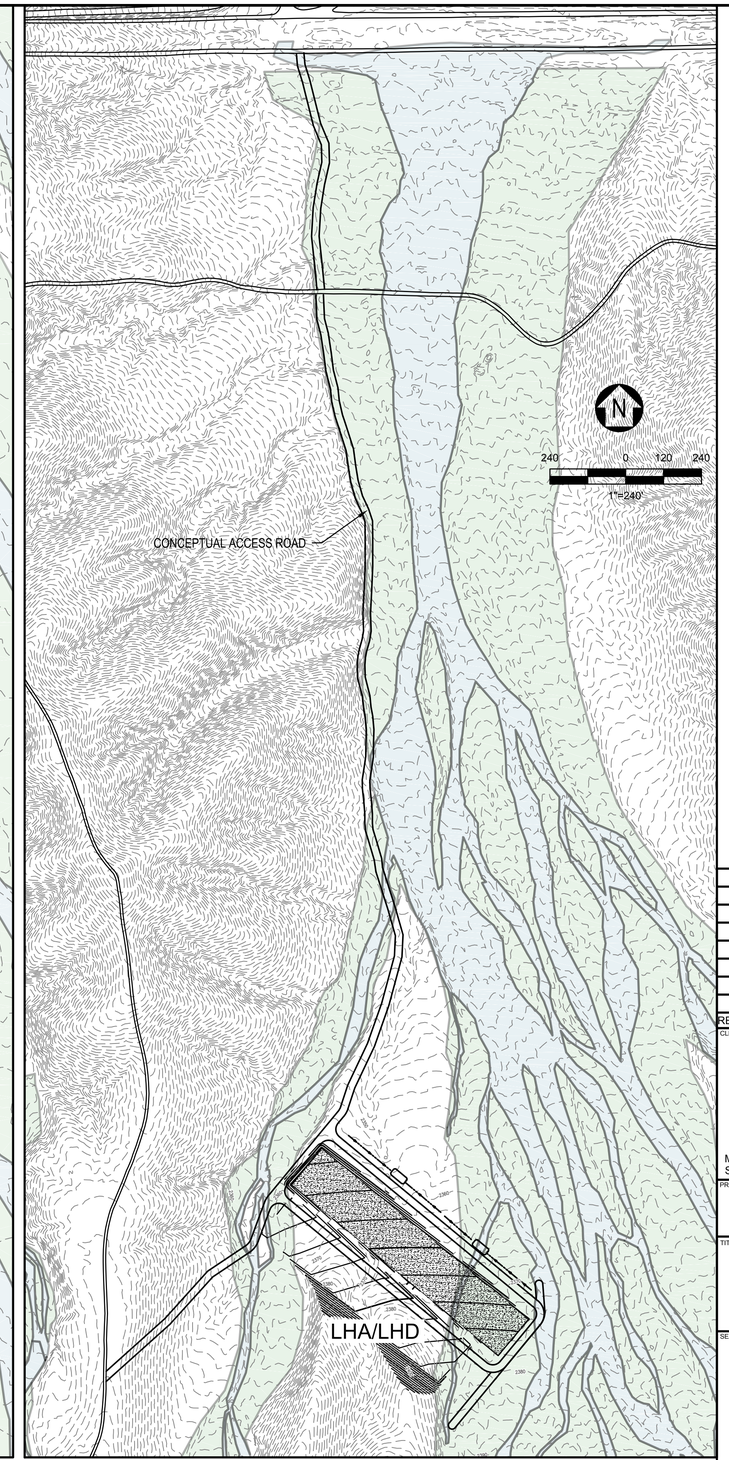
1"=100'



2 OVERALL SITE PLAN
1"=240'

ESTIMATED GRADING QUANTITIES:

CUT: 0 Cubic Yards
FILL: 17,314 Cubic Yards

LEGEND:

- 2170 — EXISTING CONTOUR
- ACTIVE FLOODPLAIN
- LOW TERRACE
- 2170 — PROPOSED CONTOUR
- PROPOSED INFILTRATION TRENCH
- PROPOSED SEDIMENT OR DETENTION BASIN
- PROPOSED CONCRETE PAVEMENT
- PROPOSED ACCESS ROAD

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SCALE AT ANSI: D	PROJECT NUMBER: 2554314300
DRAWING NUMBER: C-P-LHD	REV: 1

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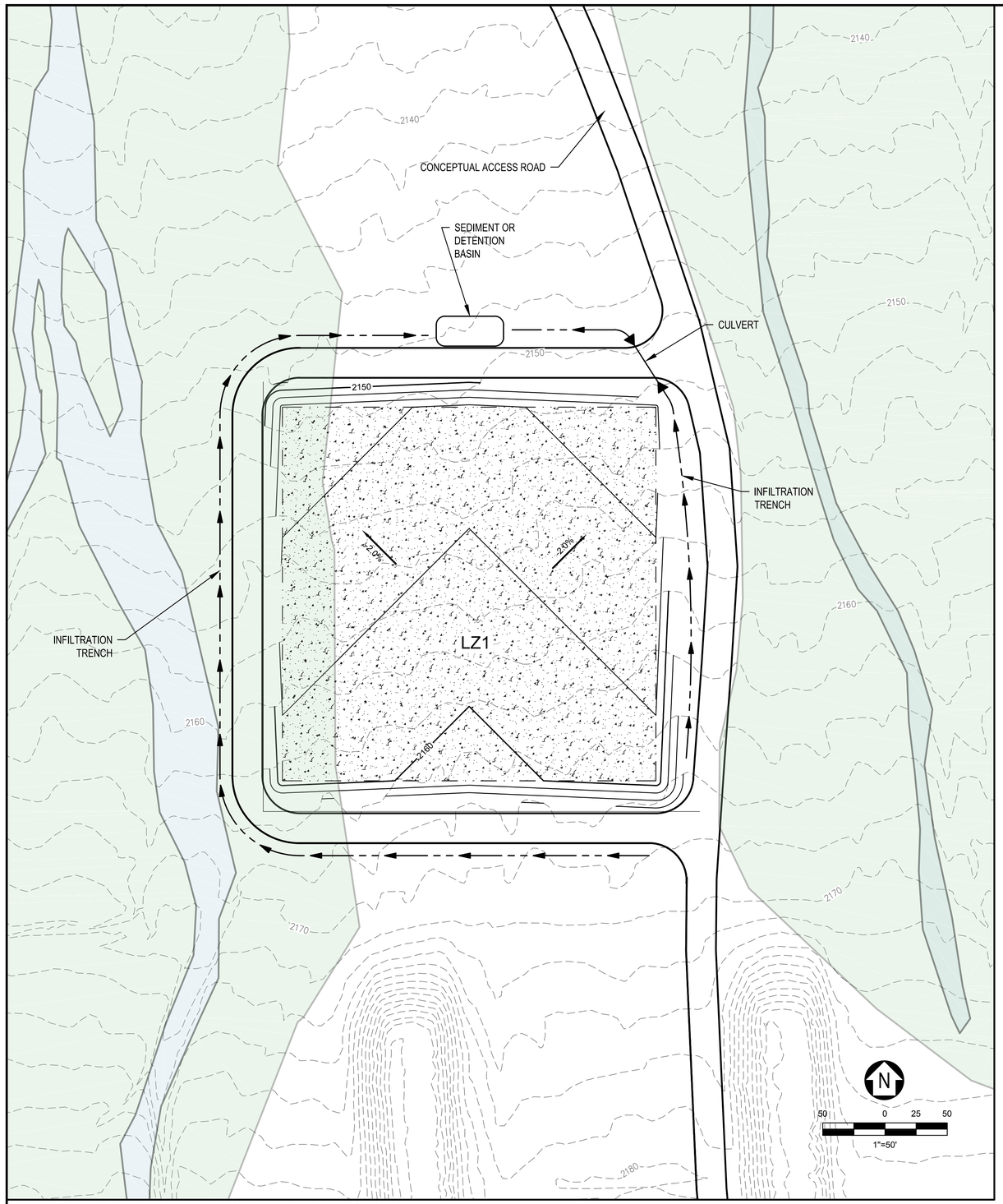
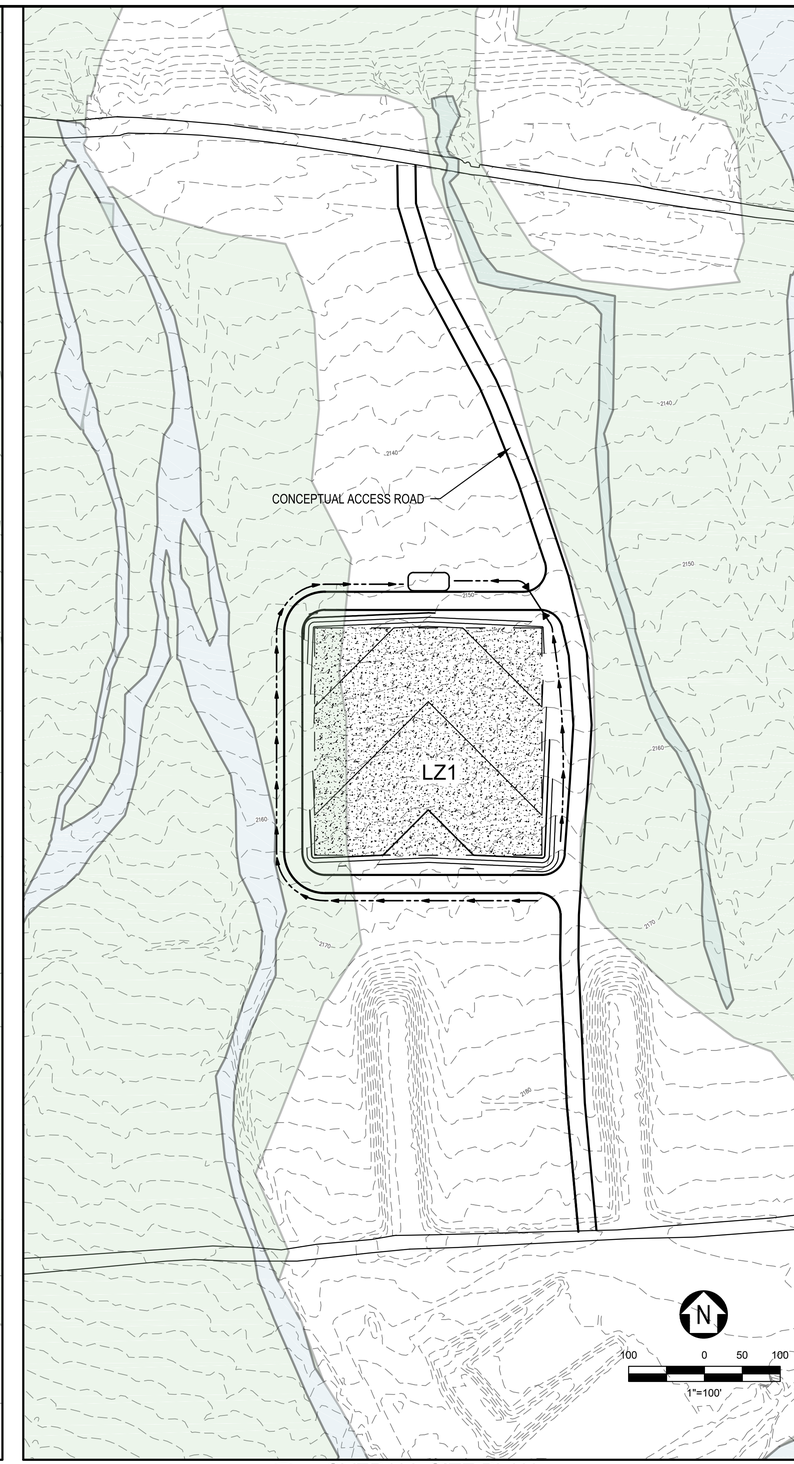


1 CONCEPTUAL SITE AND GRADING PLAN
1"=50'



2 OVERALL SITE PLAN
1"=100"

ESTIMATED GRADING QUANTITIES:

CUT: 4730 Cubic Yards
FILL: 4730 Cubic Yards

LEGEND:

- 2170 — EXISTING CONTOUR
- ACTIVE FLOODPLAIN
- LOW TERRACE
- 2170 — PROPOSED CONTOUR
- PROPOSED INFILTRATION TRENCH
- PROPOSED SEDIMENT OR DETENTION BASIN
- PROPOSED PAD TREATED WITH SOIL STABILIZERS
- PROPOSED ACCESS ROAD

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San Bernardino County, California

ENGINEER:
leidos
622 EMERSON ROAD, SUITE 600
ST. LOUIS, MO. 63141
314-821-7017
www.leidos.com

PROJECT NAME:
BARSTOW TRAINING AND RANGE

TITLE:
CONCEPTUAL SITE AND GRADING PLAN FOR LZ 1

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CHECKED BY: MJS	DATE: 06/30/2015
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Appendix B

Precipitation Frequency Estimates

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NOAA Atlas 14, Volume 6, Version 2
Location name: Barstow, California, US*
Coordinates: 34.9000, -117.0167
Elevation: 2159ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval(years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.084 (0.069-0.104)	0.113 (0.092-0.140)	0.153 (0.125-0.190)	0.188 (0.152-0.235)	0.238 (0.187-0.307)	0.279 (0.214-0.367)	0.323 (0.242-0.434)	0.370 (0.271-0.511)	0.438 (0.308-0.630)	0.495 (0.337-0.735)
10-min	0.120 (0.099-0.149)	0.162 (0.132-0.200)	0.220 (0.179-0.272)	0.269 (0.218-0.336)	0.341 (0.268-0.439)	0.400 (0.307-0.525)	0.463 (0.347-0.622)	0.531 (0.388-0.733)	0.628 (0.442-0.903)	0.709 (0.482-1.05)
15-min	0.146 (0.119-0.180)	0.196 (0.160-0.242)	0.266 (0.217-0.329)	0.326 (0.264-0.407)	0.413 (0.324-0.531)	0.483 (0.372-0.635)	0.559 (0.420-0.752)	0.642 (0.469-0.886)	0.760 (0.534-1.09)	0.858 (0.583-1.27)
30-min	0.204 (0.167-0.252)	0.274 (0.224-0.339)	0.372 (0.304-0.461)	0.456 (0.369-0.570)	0.578 (0.453-0.745)	0.678 (0.521-0.890)	0.784 (0.589-1.05)	0.899 (0.658-1.24)	1.07 (0.749-1.53)	1.20 (0.818-1.79)
60-min	0.275 (0.225-0.339)	0.369 (0.302-0.456)	0.501 (0.409-0.620)	0.614 (0.497-0.767)	0.778 (0.610-1.00)	0.912 (0.701-1.20)	1.06 (0.793-1.42)	1.21 (0.885-1.67)	1.43 (1.01-2.06)	1.62 (1.10-2.40)
2-hr	0.363 (0.297-0.448)	0.483 (0.395-0.596)	0.647 (0.527-0.801)	0.785 (0.635-0.980)	0.981 (0.770-1.26)	1.14 (0.876-1.50)	1.31 (0.980-1.76)	1.48 (1.08-2.05)	1.73 (1.22-2.49)	1.93 (1.32-2.87)
3-hr	0.421 (0.345-0.520)	0.560 (0.458-0.691)	0.747 (0.609-0.926)	0.905 (0.732-1.13)	1.13 (0.883-1.45)	1.30 (1.00-1.71)	1.49 (1.12-2.00)	1.68 (1.23-2.32)	1.95 (1.37-2.81)	2.17 (1.48-3.22)
6-hr	0.521 (0.427-0.643)	0.696 (0.569-0.860)	0.931 (0.759-1.15)	1.13 (0.911-1.41)	1.40 (1.10-1.80)	1.61 (1.24-2.12)	1.83 (1.37-2.46)	2.06 (1.51-2.85)	2.38 (1.68-3.42)	2.64 (1.79-3.92)
12-hr	0.609 (0.499-0.751)	0.821 (0.672-1.02)	1.11 (0.902-1.37)	1.34 (1.09-1.68)	1.67 (1.31-2.15)	1.93 (1.48-2.53)	2.20 (1.65-2.95)	2.47 (1.81-3.42)	2.86 (2.01-4.11)	3.17 (2.16-4.71)
24-hr	0.769 (0.682-0.884)	1.05 (0.930-1.21)	1.42 (1.26-1.64)	1.73 (1.52-2.01)	2.16 (1.83-2.59)	2.49 (2.06-3.05)	2.83 (2.29-3.56)	3.18 (2.51-4.12)	3.67 (2.77-4.95)	4.05 (2.96-5.66)
2-day	0.887 (0.788-1.02)	1.22 (1.08-1.41)	1.66 (1.47-1.91)	2.01 (1.76-2.34)	2.49 (2.11-2.99)	2.85 (2.37-3.50)	3.22 (2.61-4.05)	3.60 (2.83-4.66)	4.10 (3.10-5.54)	4.49 (3.28-6.28)
3-day	0.968 (0.859-1.11)	1.34 (1.19-1.54)	1.81 (1.60-2.09)	2.19 (1.92-2.55)	2.70 (2.29-3.25)	3.08 (2.56-3.79)	3.46 (2.81-4.36)	3.85 (3.03-4.99)	4.37 (3.30-5.90)	4.76 (3.48-6.65)
4-day	1.01 (0.899-1.17)	1.40 (1.24-1.61)	1.89 (1.67-2.18)	2.28 (2.00-2.66)	2.80 (2.37-3.37)	3.19 (2.65-3.92)	3.57 (2.90-4.50)	3.96 (3.12-5.13)	4.48 (3.38-6.04)	4.86 (3.55-6.80)
7-day	1.11 (0.982-1.27)	1.51 (1.34-1.74)	2.03 (1.79-2.34)	2.43 (2.13-2.83)	2.96 (2.51-3.56)	3.35 (2.78-4.11)	3.73 (3.02-4.70)	4.12 (3.24-5.33)	4.62 (3.49-6.23)	4.99 (3.65-6.97)
10-day	1.18 (1.04-1.35)	1.60 (1.42-1.84)	2.13 (1.89-2.46)	2.55 (2.23-2.97)	3.09 (2.62-3.71)	3.48 (2.89-4.28)	3.87 (3.14-4.87)	4.25 (3.35-5.51)	4.75 (3.59-6.41)	5.12 (3.74-7.16)
20-day	1.37 (1.21-1.57)	1.88 (1.66-2.16)	2.51 (2.22-2.90)	3.00 (2.63-3.49)	3.63 (3.08-4.37)	4.10 (3.40-5.03)	4.54 (3.68-5.72)	4.98 (3.93-6.45)	5.55 (4.19-7.49)	5.96 (4.35-8.33)
30-day	1.53 (1.36-1.76)	2.14 (1.89-2.46)	2.89 (2.55-3.33)	3.47 (3.04-4.04)	4.21 (3.57-5.07)	4.76 (3.95-5.85)	5.29 (4.29-6.66)	5.81 (4.58-7.52)	6.48 (4.90-8.74)	6.97 (5.09-9.74)
45-day	1.73 (1.54-1.99)	2.46 (2.18-2.84)	3.37 (2.98-3.89)	4.08 (3.57-4.74)	4.99 (4.23-6.00)	5.65 (4.69-6.94)	6.30 (5.10-7.93)	6.94 (5.46-8.98)	7.76 (5.86-10.5)	8.37 (6.11-11.7)
60-day	1.90 (1.69-2.18)	2.74 (2.43-3.15)	3.79 (3.35-4.37)	4.60 (4.04-5.36)	5.66 (4.80-6.81)	6.44 (5.34-7.91)	7.19 (5.83-9.05)	7.94 (6.25-10.3)	8.90 (6.73-12.0)	9.62 (7.02-13.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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Appendix C

Hydrologic Soil Group

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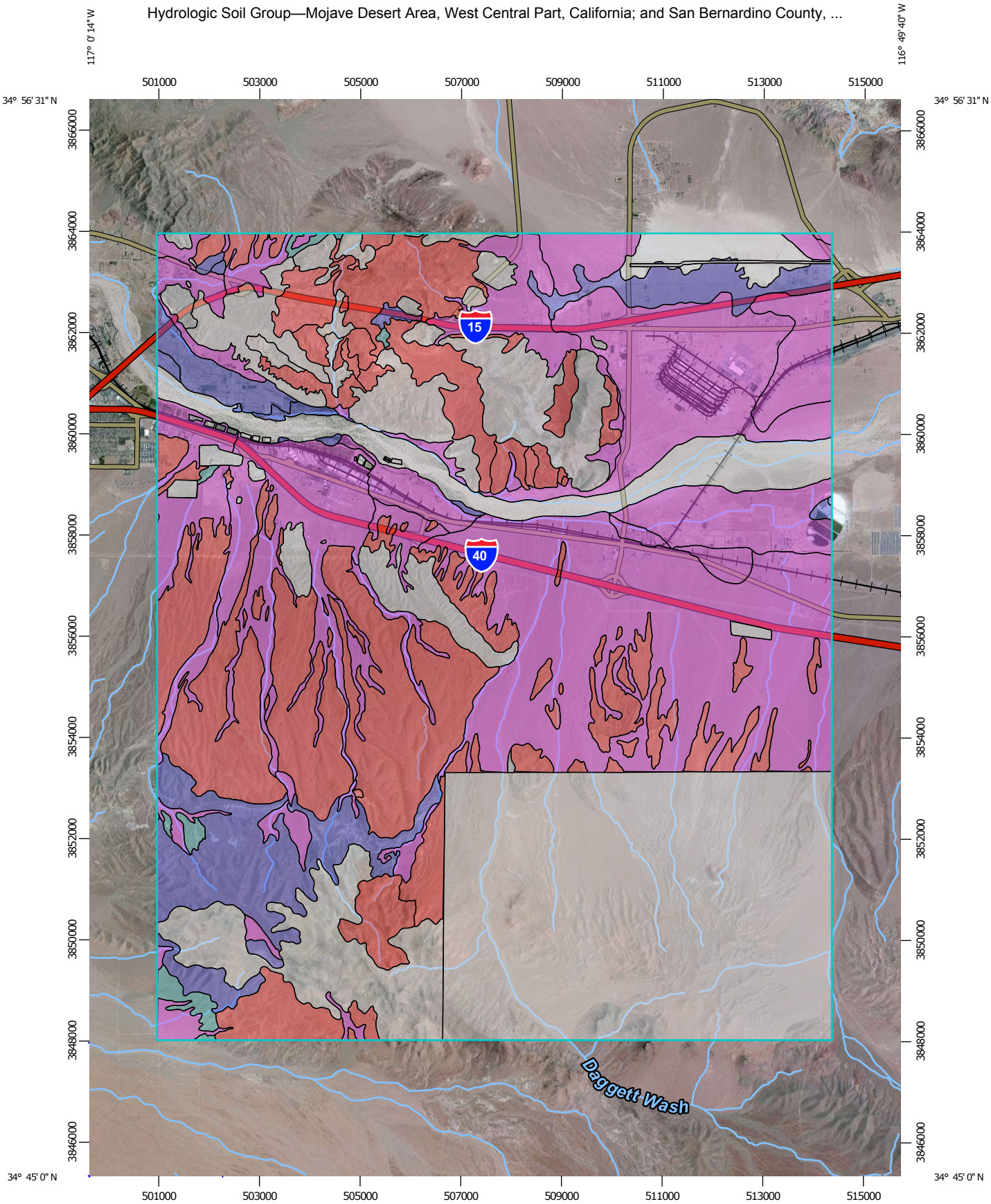

Map Scale: 1:104,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 1500 3000 6000 9000

Feet: 0 5000 10000 20000 30000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Mojave Desert Area, West Central Part, California
Survey Area Data: Version 5, Jun 1, 2012

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 5, Sep 26, 2008

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 5, 2010—Jul 2, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Mojave Desert Area, West Central Part, California (CA698)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
NOTCOM	No Digital Data Available		10,131.3	19.1%
Subtotals for Soil Survey Area			**10,131.3**	**19.1%**
Totals for Area of Interest			**52,973.1**	**100.0%**

Hydrologic Soil Group— Summary by Map Unit — San Bernardino County, California, Mojave River Area (CA671)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
100	ARIZO GRAVELLY LOAMY SAND, 2 TO 9 PERCENT SLOPES	A	2,071.6	3.9%
103	BADLAND		159.2	0.3%
107	BRYMAN LOAMY FINE SAND, 5 TO 9 PERCENT SLOPES	B	13.8	0.0%
112	CAJON SAND, 0 TO 2 PERCENT SLOPES	A	4,759.6	9.0%
113	CAJON SAND, 2 TO 9 PERCENT SLOPES	A	1,739.2	3.3%
115	CAJON GRAVELLY SAND, 2 TO 15 PERCENT SLOPES	A	9,061.9	17.1%
118	CAJON-ARIZO COMPLEX, 2 TO 15 PERCENT SLOPES*	A	515.1	1.0%
132	HELENDALE LOAMY SAND, 2 TO 5 PERCENT SLOPES	B	46.3	0.1%
135	JOSHUA LOAM, 2 TO 5 PERCENT SLOPES	C	32.6	0.1%
137	KIMBERLINA LOAMY FINE SAND, COOL, 0 TO 2 PERCENT SLOPES	B	820.0	1.5%
139	KIMBERLINA GRAVELLY SANDY LOAM, COOL, 2 TO 5 PERCENT SLOPES	B	2.8	0.0%
141	LOVELACE LOAMY SAND, 5 TO 9 PERCENT SLOPES	B	52.1	0.1%
148	MIRAGE SANDY LOAM, 2 TO 5 PERCENT SLOPES*	C	283.0	0.5%

Hydrologic Soil Group— Summary by Map Unit — San Bernardino County, California, Mojave River Area (CA671)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
151	NEBONA-CUDDEBACK COMPLEX, 2 TO 9 PERCENT SLOPES*	D	9,291.9	17.5%
155	PITS		192.7	0.4%
156	PLAYAS		583.0	1.1%
157	RIVERWASH		1,868.5	3.5%
158	ROCK OUTCROP-LITHIC TORRIORTHENTS COMPLEX, 15 TO 50 PERCENT SLOPES*		4,789.0	9.0%
162	SPARKHULE-ROCK OUTCROP COMPLEX, 15 TO 50 PERCENT SLOPES*	D	1,514.7	2.9%
164	TRIGGER GRAVELLY LOAM, 5 TO 15 PERCENT SLOPES	D	362.9	0.7%
166	TRIGGER-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT SLOPES*	D	358.8	0.7%
168	TYPIC HAPLARGIDS-YERMO COMPLEX, 8 TO 30 PERCENT SLOPES*		1,389.0	2.6%
171	VILLA LOAMY SAND	B	450.3	0.9%
172	VILLA LOAMY SAND, HUMMOCKY	B	130.1	0.2%
177	YERMO-KIMBERLINA, COOL, ASSOCIATION, SLOPING*	B	2,253.0	4.3%
178	WATER		68.0	0.1%
179	MISCELLANEOUS WATER		31.8	0.1%
Subtotals for Soil Survey Area			**42,840.8**	**80.9%**
Totals for Area of Interest			**52,973.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Appendix D

Runoff Curve Numbers

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Table 2-2d.—Runoff curve numbers for arid and semiarid rangelands[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition[2]	A[3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

[1]Average runoff condition, and $I_a = 0.2S$. For range in humid regions, use table 2-2c.

[2]*Poor:* <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: >70% ground cover.

[3]Curve numbers for group A have been developed only for desert shrub.

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Appendix E

Channel Crossing Photos

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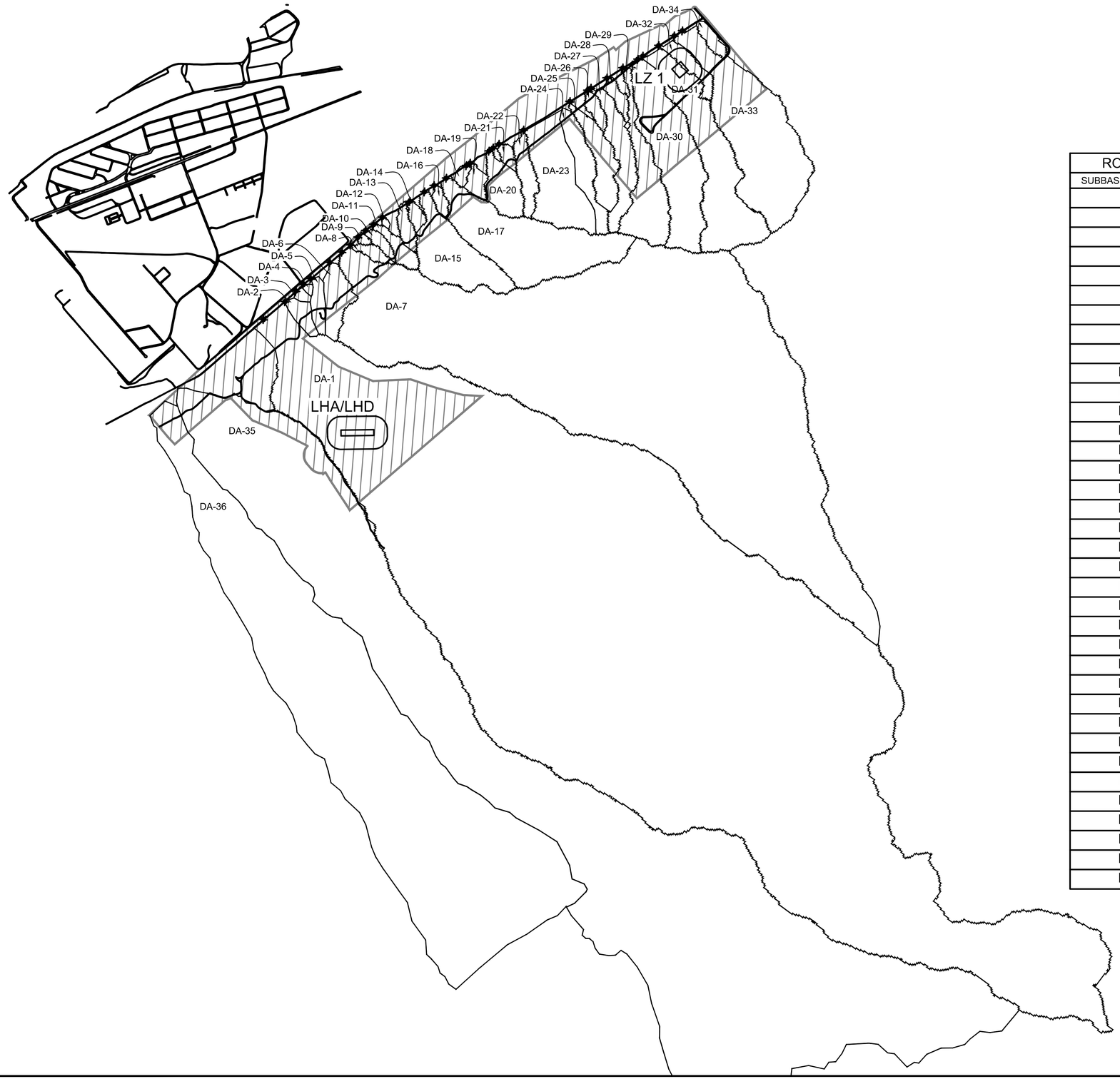

ROAD CROSSING WATERSHED	
SUBBASIN DESIGNATOR	AREA (SQ.MI.)
DA-1	4.721
DA-2	0.016
DA-3	0.004
DA-4	0.002
DA-5	0.016
DA-6	0.037
DA-7	1.998
DA-8	0.010
DA-9	0.003
DA-10	0.009
DA-11	0.018
DA-12	0.002
DA-13	0.014
DA-14	0.009
DA-15	0.111
DA-16	0.008
DA-17	0.217
DA-18	0.006
DA-19	0.013
DA-20	0.042
DA-21	0.008
DA-22	0.028
DA-23	0.118
DA-24	0.048
DA-25	0.049
DA-26	0.012
DA-27	0.060
DA-28	0.012
DA-29	0.092
DA-30	0.175
DA-31	0.186
DA-32	0.023
DA-33	0.264
DA-34	0.012
DA-35	2.59
DA-36	1.40

N

1400 0 700 1400

1"=1400'

REV.	DATE	REVISION DESCRIPTION	BY	CHKD	APP'D
1	01/26/15	REVISED LZ	FB	MS	JD

CLIENT:

MCLB BARSTOW
San Bernardino County, California

ENGINEER:

leidos

622 EMERSON ROAD, SUITE 600
ST. LOUIS, MO. 63141
314-821-7017
www.leidos.com

PROJECT NAME:

BARSTOW TRAINING AND RANGE

TITLE:

DRAINAGE AREA MAP
FOR ROAD CROSSINGS

SEAL:

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DRAWN BY: FPB	DESIGNED BY: FPB
CHECKED BY: MJS	DATE: 11/29/2013
APPROVED BY: MDG	ZONE: -
SCALE AT ANSI: D 1" = 1400'	PROJECT NUMBER: 2554314300
DRAWING NUMBER: C-DA-RD	REV: 1

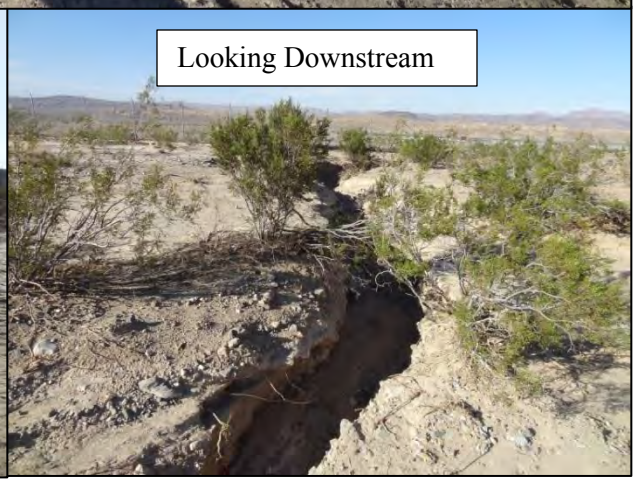
FILE LOCATATION: P:\ECI\1648-STL\2554314300_NAVFAC_SW-LZ_EA_211967\20_DESGN\40_CAD\C\C-DA-RD.DWG
PLOT DATE: 1/27/2015 8:21 AM BY: BAUER, FRANCIS P.

DA-1

This is the main channel which drains the western portion of the Rifle Range. Recent storms in September 2013 had caused sediment to flow onto the roadway.

DA-2

A small gully has formed in the roadway and the vehicles have taken a new path south of the small gully. This area appeared to pond water, then as the ponded water overflowed it downcut small gully in the road bed.



DA-3

There is a small gully forming on the downstream side of this crossing.

DA-4

This is a small drainage with no major erosion issues.

DA-5

This is a small drainage. On the downstream side there is a steep drop and a gully has formed. The gully has yet to encroach on the road.

DA-6

There is a small gully forming on the road edge on the downstream side of the crossing.

DA-7

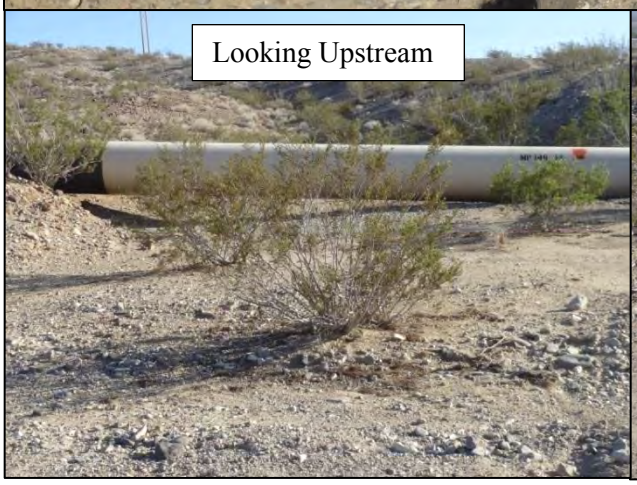
The road is at the same elevation of the channel on both sides and there are no major erosion issues.

DA-8

This is a small drainage and there are no major erosion issues at the crossing.

DA-9

The drainage is blocked by a road berm and flows alongside the road. Additional drainage in the road adds to the drainage from DA-9 and has caused a gully to form on the roadside.



DA-10

The active gas pipeline is raised on abutments on the upstream side of the crossing. A small gully is cutting into the edge of the road on the downstream stream.

DA-11

This is a small drainage with no erosion issues on the road.

DA-12

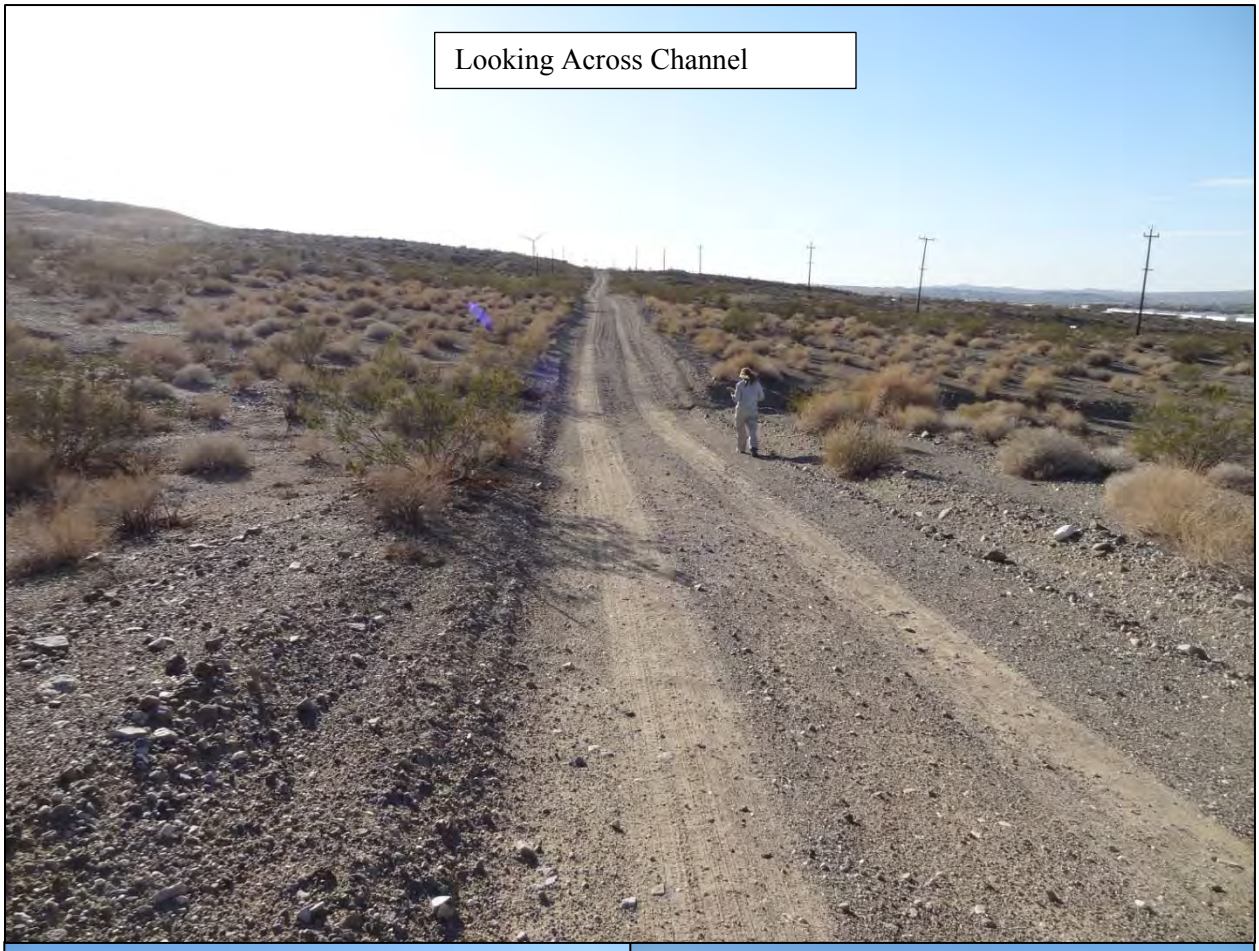
This is a relatively small drainage, but there is a steep drop off on the downstream side. A gully has formed which is migrating into the edge of the road.

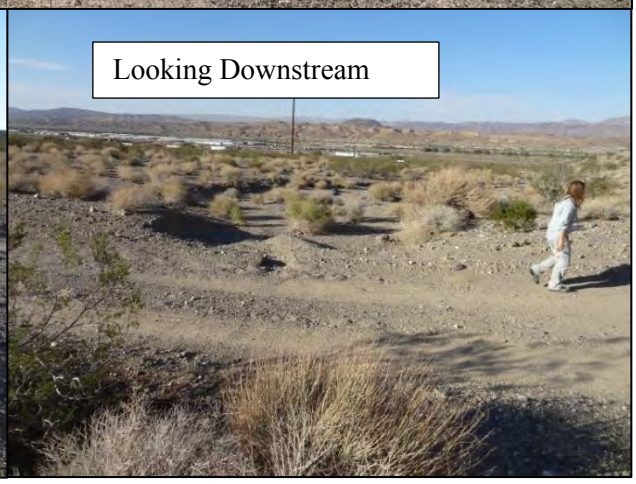
DA-13

This is a small wash with no major erosion problems.

DA-15

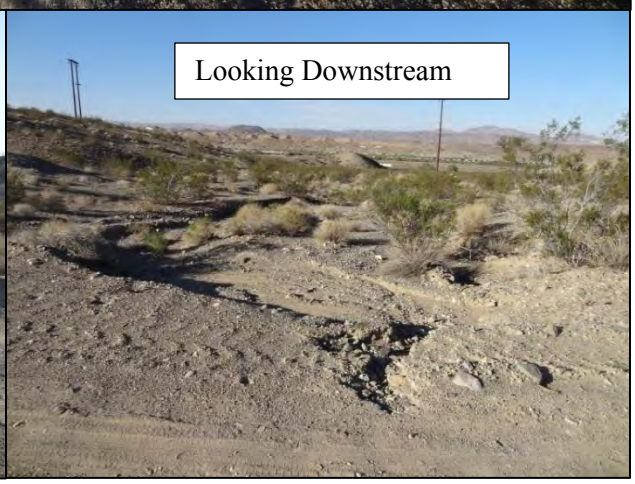
The channel is small with the road dipping to the elevation of the channel bed. There are no signs of major erosion.





DA-16

The road berm blocked the channel, but the flow broke a path through the berm. A small gully is forming on the downstream edge of the road.



DA-17

This channel is wide and flat. There is a small gully forming on the downstream edge.

DA-18

This channel parallels the southern (right) edge of the road and then crosses the road. A small gully is forming on the downstream side of the road.

DA-19

The channel is cutting into the road on the downstream edge.

DA-20

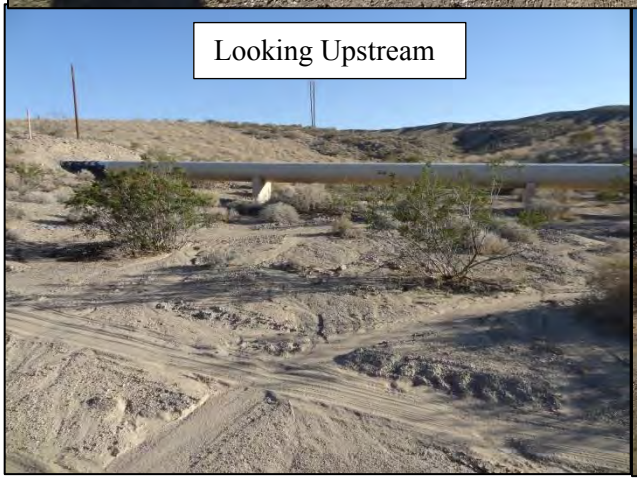
This is a small drainage that crosses the road. There is a small gully on the downstream side of the road.

DA-21

There is an old pipeline buried on the downstream edge of the road. This creates a substantial drop off and erosion of the channel downstream.

DA-21

The active high pressure gas pipeline is exposed at the upstream end of this channel and raised on abutments to allow the flow to pass underneath.

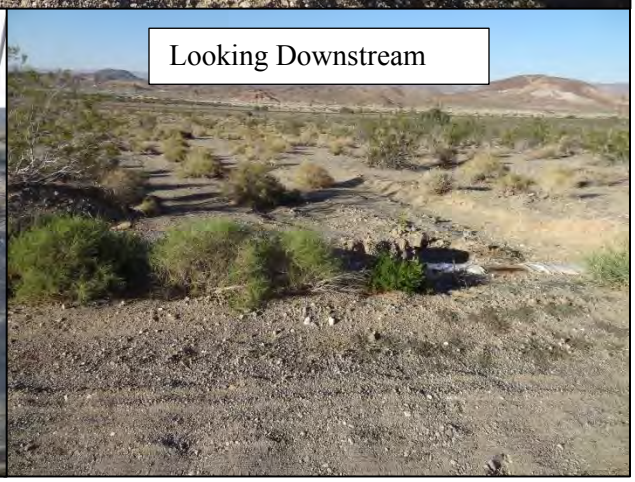


DA-22

There is a small drainage and the crossing appears to be functioning properly.

DA-25

There are no major erosion issues but the old pipeline is slightly exposed on the downstream side.



DA-26

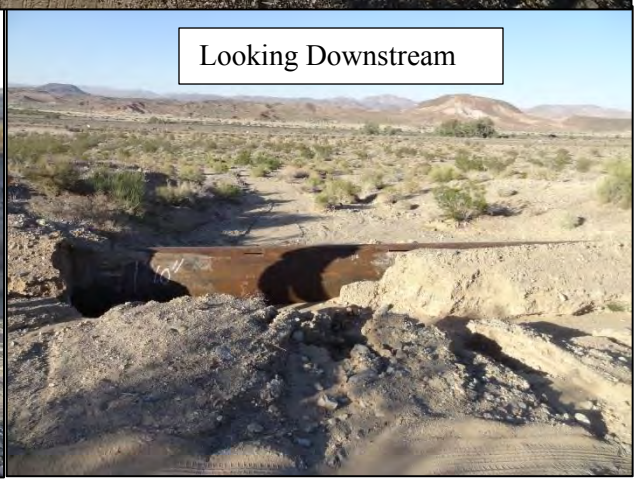
This is a smaller channel and the flow across the road has been blocked by a road berm on the downstream side.

DA-27

The downstream edge of the road is held up by an old buried pipeline. A small hole has formed at the edge of the road where water has found a path to undercut the pipeline. In future storm events this hole will likely expand and headcut into the road upstream.

DA-28

An old pipeline is located on the downstream end of the crossing. The water has undercut the pipeline and is headcutting into the road.



DA-29

The downstream side of the crossing is protected by an old pipeline. The mudcracks in the road are evidence of water ponding behind the road berm and then breaking through.

DA-30

The downstream side of the crossing is protected by an old pipeline. In the September 2013 storm event, water pooled behind the road berm, then cut through and overflowed.

DA-31

This channel crossing was not substantially impacted by the September 2013 storm event. However, on the downstream edge of the channel there is a steep drop off. The drop-off is due to an old pipeline, which prevents the headcut from migrating upstream.

DA-32

This channel is headcutting into the road on the downstream side, creating a dip in the roadway.

DA-33 - West Channel

The channel in DA-33 bifurcates into two large channels. This is the west channel. Both channels are fairly substantial washes. A portion of the flow in Daggett Wash can overflow into these channels. The channel is wide with clear-cut banks and a flat bottom.

DA-33 - East Channel

This is the eastern channel of DA-33. This channel is also fairly substantial, the slope, however, is gentle, and the road crossing was easily passable after the September 2013 storm event.