FINAL

ENVIRONMENTAL ASSESSMENT

for

WATER RECLAMATION AND BIOSOLIDS COMPOSTING

White Sands Missile Range, New Mexico

June 2020

Approved for Public Distribution on 9 April 2020

FINAL

ENVIRONMENTAL ASSESSMENT

FOR

WATER RECLAMATION AND BIOSOLIDS COMPOSTING

WHITE SANDS MISSILE RANGE, NEW MEXICO

PREPARED FOR

U.S. ARMY CORPS OF ENGINEERS

TULSA DISTRICT

1645 S. 101 E. AVE., TULSA, OK 74128

JUNE 2020

U.S. ARMY WHITE SANDS MISSILE RANGE, NEW MEXICO,
FINDING OF NO SIGNIFICANT IMPACT

PROPOSED ACTION TITLE: Water Reclamation and Biosolids Composting White Sands Missile Range, New Mexico

PROPOSED ACTION DESCRIPTION: The US Army Garrison at White Sands Missile Range (WSMR) proposes four projects that would help focus on more sustainable methods for the management of water and biosolids derived from wastewater treatment. Treated wastewater would be reused and raw well water would be repurposed for landscape irrigation and construction activities. WSMR also proposes to find alternatives to off-site disposal of non-hazardous solid waste water generated from research, development, test and evaluation operations, and facility maintenance. Finally, WSMR proposes to compost wastewater treatment biosolids rather than off-site disposal.

PURPOSE AND NEED: The purpose and need of the proposed actions is to support sustainable best management practices for water conservation, reusing and reducing the demand on the potable water supply. Options are needed for reduced off-site disposal management of non-hazardous solid waste water. Composting of wastewater treatment biosolids to produce a beneficial product also reduces off-site disposal. This Environmental Assessment (EA) analyzes the potential environmental impacts from implementing these projects. Legal requirements will be part of the selection criteria for deciding which projects, options and/or alternatives to consider.

ALTERNATIVES CONSIDERED: The preferred alternative, Alternative 3, incorporates various aspects of the four projects, when viable and legally supported, which would provide the maximum benefit for reuse of water and biosolids, and minimize off-site disposal. Alternative 1, continue wastewater effluent flow to Davies Playa for improved wetland function and public access, and Alternative 2, drill a new well, would not reduce the potable water demand from landscape irrigation and construction use. The No Action Alternative would eliminate any beneficial reuse of treated wastewater effluent and continue off-site disposal of non-hazardous solid waste water and biosolids.

ENVIRONMENTAL CONSEQUENCES: The EA evaluated potential environmental consequences for implementing the proposed actions on the natural and human environments. Valued environmental components, aesthetics and visual resources, air quality, biological, cultural, energy, facilities, geology & soils, hazardous materials and wastes, human health and safety, land use, noise, utilities and infrastructure, and water resources, were considered. Reuse of treated wastewater effluent (Project No. 1) would have to meet United States (U.S.) Environmental Protection Agency (EPA) Unrestricted Urban Reuse criteria. Composted biosolids (Project No. 5) would have to meet U.S. EPA Exceptional Quality standards. Impacts to migratory birds and cultural resources from construction activities would be avoided using an environmental review and siting process. Solar powered energy would be used to pump water for irrigation use. Treated effluent would continue to be directed to Davies Playa, even if a portion is used for irrigation. Noise from construction near residential areas would have daily time restrictions. An irrigation management plan would be developed to determine seasonal irrigation requirements and to monitor if favorable water and soil conditions exist. Wildlife exclusion measures would be implemented where needed. Based on WSMR implementing the mitigation measures and meeting the reuse criteria and quality standards mentioned, no significant impacts on the environment have been identified for the proposed action and no incremental effects or significant cumulative impacts are expected.

CONCLUSIONS: Based on the analysis in this EA and in accordance with the guidelines for determining the significance of proposed federal actions (40 C.F.R. 1508.27) and EPA criteria for initiating an Environmental Impact Statement (EIS) (40 C.F.R. 6.207), WSMR has concluded Alternative 3, incorporating viable and legal aspects of the four projects, will not result in a significant effect on the environment. Chapter 4, Resource Impacts, provides criteria for evaluation impacts to each valued environmental component assessed. Each project has a list of forecasted effects and projected outcomes. The prescribed best management practices support WSMR's conclusion of no significant effects on the environment. WSMR has determined that an EIS pursuant to the NEPA is not required, and this Finding of No Significant Impact is hereby submitted.

APPROVED:

CHRISTOPHER J. WARD COL, FA Commanding	17 JUNE 2020 Date

U.S. ARMY WHITE SANDS MISSILE RANGE
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002-5048
ENVIRONMENTAL ASSESSMENT

TITLE: WATER RECLAMATION AND BIOSOLID COMPOSTING AT WHITE SANDS MISSILE RANGE, NEW MEXICO

PROPONENT:

JOSE GALLEGOS
Director
Directorate of Public Works

15 JUN 2020
Date

REVIEWED:

BRIAN KNIGHT
Chief, Environmental Division
Directorate of Public Works

6/[illegible]/20
Date

APPROVED:

CHRISTOPHER J WARD
COL, FA
Commanding

17 JUNE 2020
Date

REPORT DOCUMENTATION PAGE

1. REPORT DATE *(DD-MM-YYYY)*
June 2020

2. REPORT TYPE
Final Environmental Assessment

4. TITLE AND SUBTITLE
Final Environmental Assessment for Water Reclamation and Biosolids Composting on White Sands Missile Range, New Mexico

5a. CONTRACT NUMBER
W912BV-15-D-0017

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
ALL Consulting, LLC

5d. PROJECT NUMBER

5e. TASK NUMBER
W912BV17F0112

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Garrison at White Sands Missile Range New Mexico

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Directorate of Public Works
U.S. Army Garrison
White Sands Missile Range
New Mexico

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release. Operational security review completed on 9 April 2020.

13. SUPPLEMENTARY NOTES

14. ABSTRACT
The US Army Garrison at White Sands Missile Range (WSMR) proposes four projects that would help focus on more sustainable methods for the management of water and biosolids derived from wastewater treatment. Treated wastewater would be reused and raw well water would be repurposed for landscape irrigation and construction activities. Alternatives to off-site disposal of non-hazardous solid waste water generated from research, development, test and evaluation operations and facility maintenance are considered. Composted wastewater treatment biosolids are considered rather than off-site disposal. The results of this environmental assessment are contained within the presented document.

15. SUBJECT TERMS
Water reuse; water reclamation; recreational fields; disposal; treated wastewater; biosolids; composting; non-hazardous solid wast water; military operations; facility maintenance

16. SECURITY CLASSIFICATION OF: a. REPORT	b. ABSTRACT	c. THIS PAGE	17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
U	U	U	UU	76	Debbie Nethers

19b. TELEPHONE NUMBER *(Include area code)*
(575) 678-2298

WATER RECLAMATION AND BIOSOLIDS COMPOSTING
WHITE SANDS MISSILE RANGE, NEW MEXICO

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

ABBREVIATIONS AND ACRONYMS

ac	acre
ADP	Area Development Plan
APE	Area of Potential Effect
AST	aboveground storage tank
ATEC	Army Test and Evaluation Command
BE	Biological Evaluation
bgs	below ground surface
BMP	best management practice
BOD_5	Biological Oxygen Demand
CADD	Computer-Aided Design and Drafting
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm	centimeter(s)
CWA	Clean Water Act
dBA	A-weighted decibel
DoD	Department of Defense
DOT	Department of Transportation
DROS	desalination reverse osmosis system
EA	Environmental Assessment
EC	electrical conductivity
EIS	Environmental Impact Statement
EO	Executive Order
EQ	Exceptional Quality
ESA	Endangered Species Act
ET	evapotranspiration
FACW	Facultative Wet
GIS	Geographic Information Systems
gpd	gallons per day
gpm	gallons per minute
GWQB	Ground Water Quality Bureau
ha	hectare
HDPE	high density polyethylene
HELSTF	High Energy Laser Systems Test Facility
HVAC	heating, ventilating and air conditioning
ICRMP	Integrated Cultural Resource Management Plan
INCRMP	Integrated Natural and Cultural Resources Management Plan and Environmental Assessment
iPaC	Information, Planning, and Conservation

LCTA	Land Condition Trend Analysis
MBTA	Migratory Bird Treaty Act
MCL	maximum contaminant level
MG	millions of gallons
mg/L	milligrams per liter
MGA	millions of gallons annually
MGD	millions of gallons per day
MGPY	millions of gallons per year
mph	miles per hour
MRTFB	Major Range and Test Facility Base
MW	megawatt
MWh	megawatt-hour
N/A	none applicable
NAAQS	National Ambient Air Quality Standards
NEAP	Natural Events Action Plan
NEPA	National Environmental Policy Act of 1969
NGO	non-governmental organization
NHPA	National Historical Preservation Act
NM	New Mexico
NMAC	New Mexico Administrative Code
NMAQB	New Mexico Air Quality Bureau
NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environment Department
NMRPTC	New Mexico Rare Plant Technical Council
NMWRRS	New Mexico Water Rights Reporting System
NPDES	National Pollution Discharge Elimination System
NPK	nitrogen, phosphorous and potassium
NRC	Nuclear Regulatory Commission
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NTU	Nephelometric Turbidity Unit
OSHA	Occupational Safety and Health Administration
OTT	Operational Testing and Training
$PM_{2.5}$	particulate matter 2.5 micrometers or less in diameter (fine particle)
PM_{10}	particulate matter 10 micrometers or less in diameter (coarse particle)
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
RDT&E	Research, Development, Test, and Evaluation
ROW	Right of Way

SAR	sodium adsorption ratio
SBR	Sequencing Batch Reactor
SDWA	Safe Drinking Water Act
SOC	Species of Concern
SOP	Standard Operating Procedure
sq. ft.	square foot/feet
SS	Suspended Solids
SWB	Solid Waste Bureau
TCP	Traditional Cultural Place
TDS	Total Dissolved Solids
TRC	Total Residual Chlorine
TSS	total suspended solids
UIC	Underground Injection Control
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
UV	ultraviolet
VEC	valued environmental component
WDP	Water Development Plan
WIFL	Willow Flycatchers
WOUS	Waters of the United States
WS-DPW	White Sands Directorate of Public Works
WSMR	White Sands Missile Range
WSTF	White Sands Test Facility
WTP	Water Treatment Plant
WWT	Wastewater Treatment
WWTP	Wastewater Treatment Plant

1 PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 Introduction

White Sands Missile Range (WSMR) needs to take feasible steps to reduce the overall consumption of water resources and disposal costs of solid waste. Several identified processes ranging from facility operations to research, development, test and evaluation (RDT&E) of military weapons use water or Wastewater Treatment Plant (WWTP) biosolids that require disposal on a recurring basis. The Army launched the Net Zero Initiative in October 2010, focused on strategies that support sustainable management of energy, water, and solid waste at Army installations. Additionally, Executive Order 13834 addresses potable and non-potable water consumption goals.

This environmental assessment will assess balancing operational requirements, Net Zero principals, and environmental laws with aspects of reclaiming water used in several different processes and alternative means of disposal or composting WWTP biosolids.

1.2 Purpose and Need

White Sands Missile Range is located in the arid southwest (**Figure 1-1**), where water resources are scarce. The Army recognizes that supporting sustainable best management practices (BMPs) for water conservation and reuse is key to ensuring that the Army of tomorrow has access to water in a prudent manner. For many years, WSMR has relied on treated groundwater to meet landscape irrigation and construction water demands. At present, reclamation of water needs to be examined to improve WSMR's water security and minimize solid waste disposal costs.

The US Army Garrison at WSMR proposes to reuse treated wastewater effluent as well as raw water for non-potable water needs such as landscape irrigation and construction activities. The purpose of these proposals is to reduce potable water demand. WSMR proposes to repair Well No. 16 and produce raw water and at the same time divert all or a portion of the treated wastewater effluent from the WWTP for landscape irrigation and construction activities.

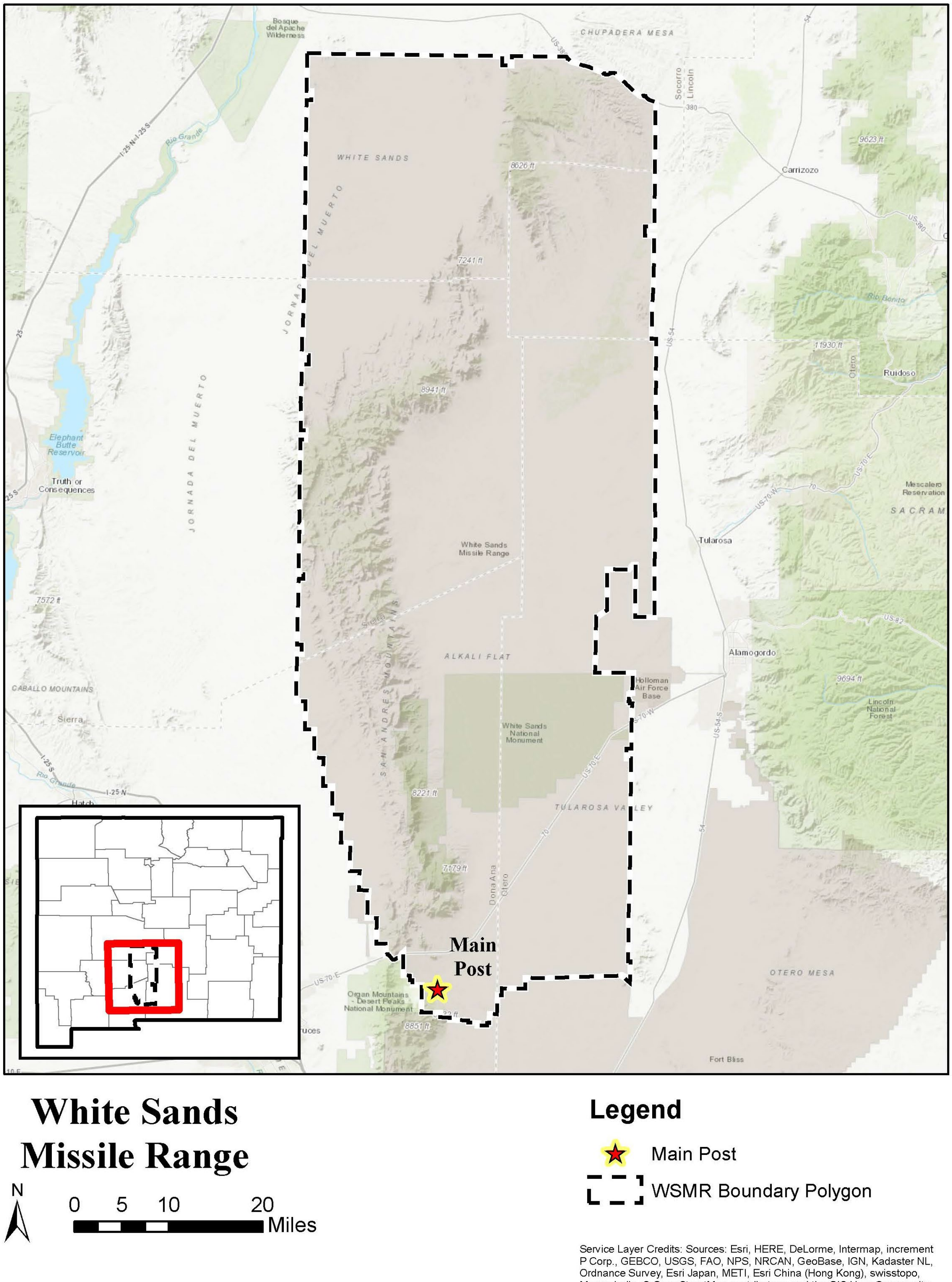
WSMR is also seeking viable, legal alternatives to off-site disposal of non-hazardous solid waste water.[1] (water with higher salt concentration, boiler blow-off water, etc.) such as direct ground discharge, construction and road dust suppression, dust control at weapon impact areas, discharge to a lined evaporation pond, or a reclaimed water treatment plant that uses reverse osmosis and disinfection to produce non-potable water suitable for landscape irrigation or construction activities. The ability to reuse non-hazardous solid waste water would help reduce off-site disposal costs and demands on potable water supplies.

In addition, WSMR is searching for feasible alternatives to dispose of gray water specifically generated from military Operational Testing and Training (OTT) activities (e.g., mobile field kitchens and washing facilities). Viable and legal alternatives would be similar to the ones described for non-hazardous solid waste water.

WSMR also wants to compost WWTP biosolids to produce a safe and simple way to handle product that can be stored and used as a soil conditioner and fertilizer. Composting WWTP biosolids will eliminate a recurring waste stream and improve WSMR's solid waste diversion toward meeting the Army's goal of 50 percent (Net Zero initiative[1,2]).

[1] As used in this document the term "Non-hazardous solid waste water" is water that meets the definition of a RCRA solid waste in accordance with Title 42 USC section 6903 (27).

FIGURE 1-1: WSMR AND MAIN POST LOCATIONS



1.3 Decisions to be Made

The analysis contained within the Environmental Assessment (EA) is the basis for determining whether to move forward with the proposed actions.

WSMR will need to determine, based on the analysis contained in this EA, the following matters:

- Whether to reuse wastewater effluent from the WWTP as a source for landscape irrigation and construction activities.
- Whether to use the water from Well No. 16 as an irrigation and construction activity source.
- Which viable, legal disposal options for test and industrial process water (non-hazardous solid waste water) and gray water will be used.
- Whether to implement WWTP biosolids composting.

The EA provides information regarding potential impacts from analyses conducted for the implementation of the proposed actions as they would affect various valued environmental components. Based on an examination of the data generated and an assessment of the magnitude of the potential impacts, a determination would be made indicating if further study is required, via an Environmental Impact Statement (EIS), or if a Finding of No Significant Impact is warranted.

1.4 Scoping and Public Involvement

This EA evaluates potential direct, indirect, and cumulative effects of improving water security and minimizing solid waste disposal costs by looking at identified processes from facility operations to RDT&E of military weapons and equipment that produce used water or WWTP biosolids that require disposal on a reoccurring basis.

This EA has been prepared in compliance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 United States Code §§ 4321-4370d), and the Department of the Army Environmental Analysis of Army Actions: Final Rule (32 CFR Part 651). The EA will be used to clarify the proposed actions, assess potential impacts, and provide current site conditions. In addition, it will provide the documentation to identify and evaluate all relevant impacts, conditions, and issues known at the time of this analysis associated with the proposed action(s) and its alternatives.

The draft EA will be made available for a 30-day public review and comment period.

1.5 Related Environmental Documentation

The Army encourages their agencies to incorporate existing applicable NEPA documentation. Incorporation reduces duplication of efforts for those programs that are similar in nature or broad in scope (40 CFR 1502.4[c], 1502.20, and 1508.23). This approach to analysis typically eliminates repetitive discussions of the same issues and focuses the review on the key issues at each level of development. Accordingly, when preparing a successive EIS or EA on an action previously addressed in a broad programmatic EA or EIS, one only need summarize issues already discussed and focus on the subjects germane to the ensuing action.

This EA incorporates the *Final Environmental Impact Statement for Development and Implementation of Range-Wide Mission and Major Capabilities* at White Sands Missile Range, New Mexico.[3] The WSMR EIS describes existing resources at the installation, evaluates impacts associated with continued testing of current and future programs, and outlines BMPs to reduce the effect of WSMR activities on the environment. The WSMR EIS was prepared to serve as a baseline document for subsequent project-specific environmental analysis; therefore, it only includes a general evaluation of water use or bio-solid activities. The WSMR FEIS provides information about siting an action on the range, defines land use categories, and considers impacts from groups of activities conducted on WSMR. The evaluations, environmental descriptions, and pertinent information associated with WSMR testing procedures, policies, and plans are hereby incorporated by reference.

Other documents have been reviewed and used as references to support the analysis of the proposed action, and include:

- **White Sands Missile Range, 2015. Integrated Natural and Cultural Resource Management Plan and Environmental Assessment (INCRMP), June**. This plan updates the 2002 Integrated Natural Resources Management Plan. It also updates the 2004-2009 Integrated Cultural Resources Management Plan and combines both plans into a single document with required NEPA documentation (an Environmental Assessment).[4]

- **White Sands Missile Range, 2014. Final Environmental Assessment of Alternative Energy Facility Projects, June** This EA contains the results of an impact analysis of developing, operating, and maintaining alternative energy generation facilities across the range to help continuing efforts to meet the “Net Zero” installation goal. Of particular interest are the development at 108-acre, 16-megawatt (MW) solar facility on the Main Post near the Las Cruces substation and the installation of various solar retrofitting projects throughout the Main Post.[5]

- **U.S. Army. 2012. Programmatic Environmental Assessment Army Net Zero Installations, July.** This EA analyzes the potential environmental impacts of implementing Net Zero at Army installations. The proposed action directs Army installations to make every fiscally prudent effort to reduce their installation’s overall consumption of energy and water resources and disposal of solid waste.[6]

- **Eco-Inc., 2017. Davies Playa Natural Resources and Water Quality Data Evaluation, January**. The objective of this evaluation was to locate, evaluate, and summarize data from natural resource studies and water quality information that has been collected for Davies Playa. Natural resource information presented in the study includes vegetation data on Land Condition Trend Analysis (LCTA) transects, threatened and endangered bird surveys, avian planning level surveys, small mammal surveys, and an amphibian and reptile survey. The historical water data included in the analysis is a compendium of water chemistry data gathered together from WWTP effluent sampling records between 1999 and 2016, a one-time effluent water quality study conducted in 2013, and nearby groundwater monitoring wells samples collected between 1999 and 2016.[7]

- **CB&I Federal Services LLC, 2014. Wastewater Treatment Plant Evaluation Report, White Sands Missile Range, New Mexico, May.** A comprehensive study was completed in 2013 to evaluate the Main Post WWTP for its operational and treatment capabilities. The report discusses existing conditions at the treatment plant, data from influent and effluent sampling and laboratory analyses, and options for upgrades to the treatment equipment. The study also addressed the plant’s ability to meet minimum secondary treatment and public health standards.[8]

2 DESCRIPTION OF THE PROPOSED ACTIONS AND ALTERNATIVES

2.1 Proposed Actions

The proposed action being considered in this EA is comprised of five projects that would help WSMR focus on more sustainable methods and BMPs for the management of water and WWTP biosolids. These projects are described below. See **Figure 2-1** for general location of project components on the Main Post.

2.1.1 Project No. 1: Wastewater Effluent Reuse

This project involves reusing treated wastewater effluent from the WSMR WWTP as a source for landscape irrigation and construction activities. Currently, the wastewater effluent is discharged to a naturally occurring ephemeral playa named Davies Playa. The use of the wastewater effluent for landscape irrigation and construction activities would include a pipeline, a pipe stand, storage tank(s), a solar-powered pumping station, and construction equipment access covering less than 6 acres. A control valve would be used to regulate the amount of water that could be taken for construction projects. Construction and placement of approximately 15,000 feet of pipeline would be required from the WWTP to the highest elevation on the Main Post, near the Desert Emerald Park, which is a rise of 300 feet. When feasible, the placement of the pipeline would be within existing Rights-of-Way (ROWs) near road ways.

The storage tank(s) would be constructed near the Desert Emerald Park, likely near the highest elevation on the Main Post. Wastewater effluent pumping would be accomplished by using solar power generation. The wastewater effluent would have to meet water reuse guidelines established by the United States Environmental Protection Agency (USEPA). The pipeline to Davies Playa would remain in place for continuous or periodic use. See **Figure 2-2** for proposed pipeline routes between the WWTP and Desert Emerald Park.

2.1.2 Project No. 2: Well No. 16 Water Repurpose

Water from Well No. 16 would provide an additional beneficial water use opportunity for WSMR. Raw water from this well has been treated and used for drinking water in the past. Currently, Well No. 16 is out of service due to needed repairs and nitrate concentrations. The nitrate levels are below the National Primary Drinking Water Standards (10 milligrams per liter [mg/L]) as adopted in the New Mexico Drinking Water Regulations [20.7.10 New Mexico Administrative Code {NMAC}]. Raw water from the well would be used for landscape irrigation and construction activities. As with the WWTP effluent reuse project, construction of infrastructure, including a pipeline, a pipe stand, a storage tank, a solar-powered pumping station, an access control valve, and construction equipment access would be required. The pipeline would be up to 15,000 feet and one or more storage tanks located at the well head or at the Desert Emerald Park would be required. This water source could be used to water several sports fields and parks within the cantonment area. Treatment of the water may be required to meet water reuse guidelines established by the USEPA. It could be possible that water from Well No. 16 would be used as a potable water resource again. See **Figure 2-2** for proposed pipeline route from Well No. 16 to the Desert Emerald Park.

FIGURE 2-1: GENERAL SITE LOCATIONS

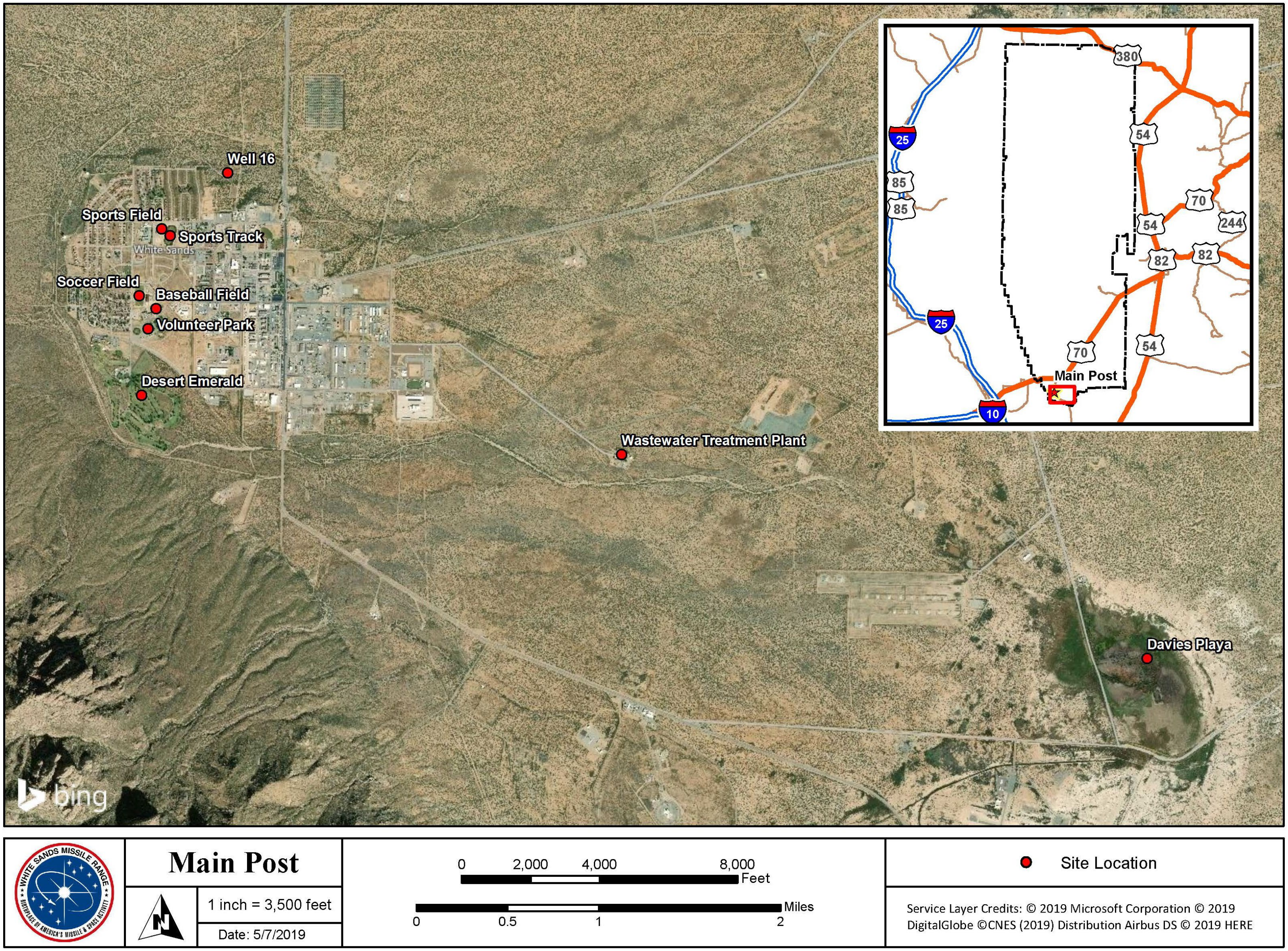
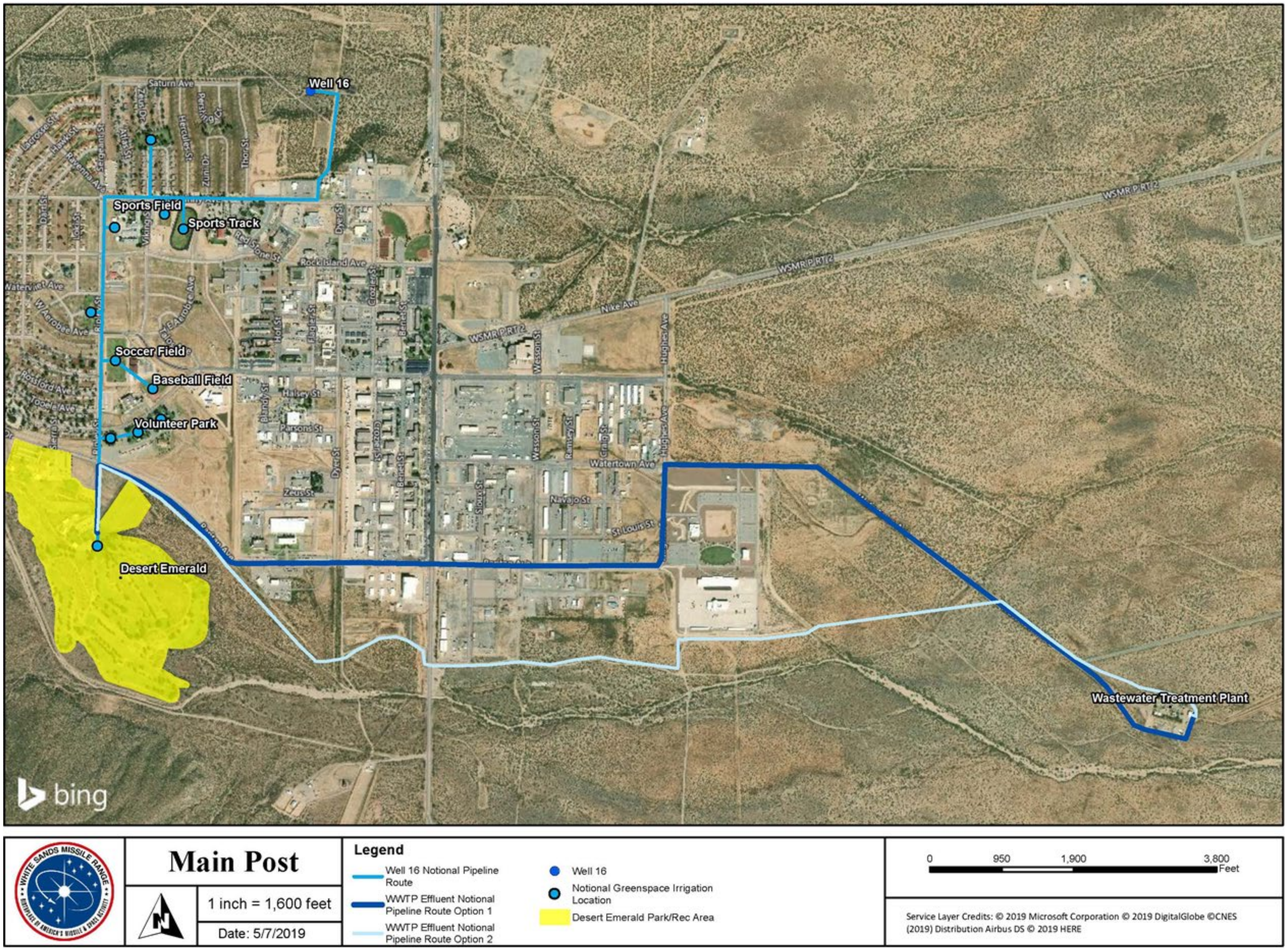


FIGURE 2-2: NOTIONAL PIPELINE ROUTES



2.1.3 Project No. 3: Non-hazardous Solid Waste Water Disposal or Reuse

Non-hazardous solid waste water generated from activities such as military RDT&E operations, boiler blow-off, and heating ventilation and air conditioning (HVAC) maintenance, is currently being disposed of by containerizing and trucking the water off-site for disposal. Other viable and legal methods to manage this water will be considered. It is anticipated that a range of non-hazardous solid waste water (between approximately 60,000 gallons and 450,000 gallons of salt water) would be generated several times a year. This project involves evaluating alternative disposal / beneficial reuse options, including:

- Surface land application or subsurface irrigation;
- Dust suppression on roadways;
- Various off-site disposal options via contracts;
- Application to weapon test impact areas for dust control;
- Discharge into an existing three pond wastewater treatment system at the High Energy Laser Systems Test Facility (HELSTF);
- Discharge into the existing brine pond at the Stallion Range Center;
- Evaporation in a lined pond, which would need to be built; or
- Treatment at a water reclamation plant to be constructed that would employ reverse osmosis and disinfection technology to produce non-potable water suitable for landscape irrigation or construction activities.

If evaporation via an open lined pond were selected, the non-hazardous solid waste water would evaporate through natural processes leaving a concentrated residue necessitating treatment or disposal. If a water reclamation plant were constructed, the treated water would be used for landscape irrigation and construction activities, reducing potable water demand. The equipment and infrastructure needed to use the treated water would be similar as described under Project No. 1: additional pipeline, solar-powered pumping, storage tank(s), pipe stand, and construction equipment access. As part of this proposed action, legal restrictions for disposing of this water type into the sanitary sewer will also be assessed.

2.1.4 Project No. 5: WWTP Biosolids Composting

Currently, biosolids generated during the treatment of domestic wastewater at the WWTP are dried in drying beds prior to disposal as a special waste at an approved landfill. Approximately 50,000 pounds of dried biosolids were disposed in 2018. This project would evaluate the regulatory framework and necessary infrastructure needed to compost WWTP biosolids. Beneficial use of the WWTP biosolids compost may include application to parks, dirt roads and other land areas needing soil or vegetation improvement. The construction of additional drying beds or a holding area will also be considered under this proposed action. See **Figure 2-3** for WWTP biosolid composting location options.

2.2 Alternatives to the Proposed Actions

2.2.1 No Action Alternative

Under the No Action Alternative, there would be no beneficial reuse of treated wastewater effluent, and Well No. 16 would not be repaired for use. In addition, there would be no means other than off-site disposal for non-hazardous solid waste water. Also, WWTP biosolids would continue to be disposed at an off-site approved landfill. This alternative would not meet the objectives of Net Zero.[9]

2.2.2 Alternative 1: Davies Playa Improvements

Under this alternative, wastewater effluent would continue to flow to the playa. The aim of the alternative would be to enhance the functionality of the wetland, improve public access, and allow for the potential construction of public nature trails and/or bird watching stations. The WWTP effluent would have to meet the criteria for urban reuse as specified in the USEPA's "2012 Guidelines for Water Reuse" to allow for any public use. Under this alternative, the WWTP effluent would not be used for landscape irrigation. See **Figure 2-4** for potential nature trails at Davies Playa.

2.2.3 Alternative 2: Drill a New Well

Under this alternative, Well No. 16 would be capped and permanently closed. A new well in an appropriate location would be drilled and used to provide additional potable water necessary for landscape irrigation, construction or other needs. This alternative would not meet the objectives of Net Zero.

2.2.4 Alternative 3: Implement Viable and Legally Supported Aspects of Projects 1 – 5

Under this alternative, various aspects of Projects 1 through 5 could be selected, if viable and legally supported. This would provide the maximum benefit for reuse of water and WWTP biosolids and minimize disposal costs.

2.3 Alternatives to the Proposed Actions Eliminated from Consideration

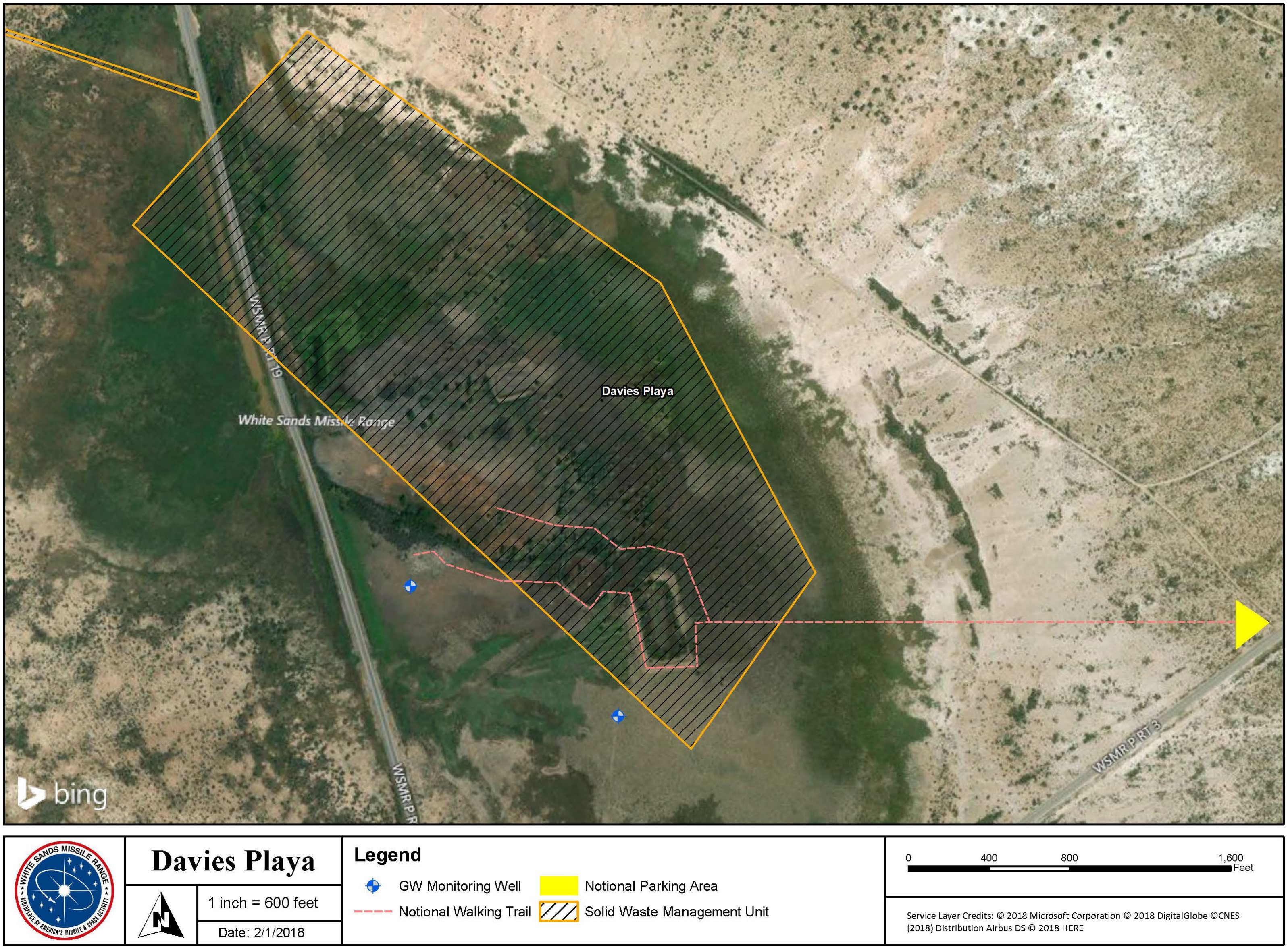
2.3.1 Project No. 4: Mobile Kitchen and Washing Facilities Water Recycling

Discharge from mobile kitchens and washing facilities (i.e., showers, hand wash stations, laundry, etc.), poses its own challenge. Periodic OTT events occur on WSMR that vary in size and tempo. Larger events occur over two- to four-week periods once or twice a year. The large events may have two to four mobile kitchens and wash facilities located at select Range Centers supporting up to a Brigade-sized unit. Small events occur more frequently, several times a year, requiring the use of an assault kitchen for three to five days serving a Company or smaller level unit. Military kitchen water requirements vary based on the troop unit size and duration of an event. Typically, portable water trailers such as an M-149 with a 400-gallon capacity would provide water for military kitchens. Assault kitchens might require several hand-carried containers holding 25 gallons each. Consideration of reuse options for discharges from mobile kitchens and washing facilities were eliminated from further consideration because WSMR follows an established BMP and the volume generated on an annual basis is small. The current practice to collect these discharges and dispose of into the sanitary sewer or septic tank would be continued.

No other alternatives have been identified for evaluation in the EA.

FIGURE 2-3: NOTIONAL WWTP BIOSOLIDS COMPOSTING LOCATIONS

FIGURE 2-4: DAVIES PLAYA NATURE TRAILS



3 AFFECTED ENVIRONMENT

This section describes the affected valued environmental components (VECs) or resources within and near the WSMR Main Post to account for proposed actions described under **Section 2**. These VECs are considered applicable to WSMR and can be impacted by combinations of past, present, and reasonably foreseeable future actions. Army Regulation 200-1, part 1-24, Environmental Protection and Enhancement (32 CFR 651), states (in part) that Garrison Commanders: *"Comply with applicable Federal, State, and local environmental laws, regulations, internal directives and goals, EOs [executive orders], and overseas Foreign Governing Standards."* It also states that Garrison Commanders are to: *"Ensure that actions subject to NEPA are coordinated with appropriate installation organizations responsible for such activities as master planning, natural and cultural resources management, or other installation activities and programs."* To that extent, this EA heavily relies on the WSMR Range-Wide Environmental Impact Statement and WSMR Integrated Natural and Cultural Resources Management Plan and Environmental Assessment as sources for the VEC descriptions presented. These documents were reviewed, along with other useful federal EISs and EAs prepared for WSMR, to establish regional issues, impacts, and their sources. In addition, they identified other useful references and potential BMPs to analyze proposed actions and associated impacts to VECs, if any. Review of three additional NEPA documents that reflected a variety of projects near the main cantonment area along with their relevant natural, cultural, social, and economic issues was conducted. Based on this approach, they identified the relationships between agency actions and their impacts on regionally important VECs.

The regionally important VECs at WSMR, as characterized from the EISs and EAs, were ranked as to the likelihood of impact from the proposed actions. A high rank indicates a direct, indirect or cumulative impact is predictable and would need to be mitigated, avoided, or monitored. A moderate rank indicates some direct, indirect or cumulative effects are foreseen. A low rank indicates that a negligible impact is anticipated and a None Applicable (N/A) signifies that the VEC will not be altered. A detailed effects analysis for relevant VECs is discussed in Chapter 4 under each proposed action project or alternative as appropriate. **Table 3-1** provides a review of the ranked VECs per proposed action projects and alternatives.

3.1 WSMR Location Description

WSMR's main cantonment area is located within Dona Ana County, New Mexico. Climate conditions in Dona Ana County are arid to semi-arid with relatively low humidity, with mild winters typical of southern, arid areas. The average monthly rainfall in 2017 ranged from below two inches in December and January to approximately eight inches in June, July and August.[10] In general, average relative humidity is lower in the valleys and higher in the mountains due to the lower mountain temperatures, and can range from 65 percent in the mornings to near 30 percent in the afternoon. Afternoon humidity in warmer months is typically as low as 20 percent be can be occasionally as low as 4 percent. As with the general climatic conditions in New Mexico, precipitation totals vary with highest amounts on or near mountains.[11]

Proposed actions under consideration for this EA are primarily located within the proximity of the WSMR Main Post area, which is in the far southwest part of WSMR within the built-up areas, at the eastern base of the Organ Mountains. The general locations of the facilities or areas addressed in the five proposed projects can be seen in **Figures 2-1, 2-2, 2-3,** and **2-4**, with the exception of OTT event locations, which are generally mobile and conducted at various sites across WSMR.

TABLE 3-1: VALUED ENVIRONMENTAL COMPONENTS ASSESSMENT

VEC	Proposed Actions				Alternatives to Proposed Actions			
	Project No. 1	Project No. 2	Project No. 3	Project No. 5	No Action	Alt. No. 1	Alt. No. 2	Alt. No. 3
Aesthetics and Visual Resources	Low	Low	Low	Low	N/A	N/A	Low	Low
Air Quality	Low	Low	Low	Low	N/A	Low	Low	Low
Airspace Resources	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Biological Resources	High	High	Moderate	Moderate	Low	High	Low	High
Cultural Resources	Moderate	Moderate	Low	Low	Low	Low	Low	Moderate
Energy	Moderate	Moderate	Low	Low	Low	Low	Moderate	Moderate
Facilities	High	High	Moderate	High	Low	High	High	High
Geology & Soils	Moderate	Moderate	High	Moderate	Low	Low	Moderate	Moderate
Hazardous Materials and Wastes	Low	Low	Low	Low	N/A	Low	Low	Low
Human Health & Safety	Low	Low	Low	Low	Low	Low	Low	Low
Land Use	High	Moderate	High	Low	Low	Moderate	Low	Moderate
Noise	Moderate	Moderate	Low	Low	N/A	Low	Low	Moderate
Socioeconomic Resources	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Utilities and Infrastructure:	Low	Low	High	High	Low	Low	Low	High
Water Resources	High	High	High	High	Moderate	High	High	High

Proposed Actions:
- Project No. 1: Wastewater Effluent Reuse
- Project No. 2: Well No. 16 Water Repurpose
- Project No. 3: Non-hazardous Solid Waste Water Disposal or Reuse
- Project No. 5: WWTP Biosolids Composting

Alternatives to Proposed Actions:
- No Action
- Alternative 1: Davies Playa Improvements
- Alternative 2: Drill a New Well (to replace Well No. 16)
- Alternative 3: Select aspects of Projects 1 –3 & 5.

3.2 Aesthetics and Visual Resources

The WSMR Main Post has visual resources that can be characterized by wide-ranging deserts and basins to the east and contrasting mountain geography to the west. The Organ mountain range that surrounds the west edge of the Main Post produces natural landscapes with visual appeal. The Desert Emerald Park is a green space on the Main Post that provides opportunities for people to walk among the trees and enjoy nature, a commodity that is in short supply on WSMR, and reported as a valued asset.[12] Employees, residents, and non-governmental organizations (NGOs) value the Desert Emerald Park for its diversity, accessibility, and solitude. However, the current limited watering at Desert Emerald Park has resulted in the grasses dying and the increase of tumbleweed growth, which is anticipated to be followed by increased bare ground and subsequent erosion. These green spaces have a positive impact on staff and residents by improving recreational opportunities, morale and welfare. Therefore, the aesthetics of these places are considered a high priority and retaining these spaces while reducing overall water consumption would greatly benefit the human welfare on the Post.

3.3 Air Quality

The air quality at WSMR is described in detail in the *Final EIS for Development and Implementation of Range-Wide Mission and Major Capabilities at WSMR*. Air quality in the Main Post area is affected by daily weather conditions and the influences of longer-term climate. Most emissions at WSMR are generated from vehicle exhaust and dust generated on dirt and gravel roads. Increased airborne particulate matter during times of high wind speeds, especially in the spring, can affect air quality on the Main Post.

Within proximity of WSMR, wind speeds are usually described as moderate (13-17 mph) according to the Beaufort Wind Force Scale; however, winds from the west, coupled with sparse vegetation and dry loose soil, can cause severe dust storms, most frequently in March and April.[13] In the general area of WSMR, spring is the windiest season, and winds generally blow from the southeast in summer and from the west in winter.[14] Average wind speed near WSMR is approximately 6 miles per hour (mph), but wind gusts of more than 30 mph have been recorded.[15]

The entire WSMR installation is in attainment for all the New Mexico and National Ambient Air Quality Standards (NAAQS); however, the New Mexico Air Quality Bureau (NMAQB) has recorded incidents where the standards for particulate matter (PM_{10} & $PM_{2.5}$) have been exceeded in Dona Ana County in the past. In response to these incidents, a Natural Events Action Plan (NEAP) was developed to address windblown dust in Dona Ana County. The only nonattainment area in New Mexico is located 17 miles south of WSMR's southernmost boundary at Anthony in Doña Ana County, which is classified as moderate nonattainment for PM_{10}.

3.4 Biological Resources

Biological resources include plants and animals and the habitats in which they occur. For purposes of this EA, Species of Concern (SOC) include the following:

- Endangered and threatened plant and animal species listed by the U.S. Fish and Wildlife Service (USFWS) under the federal Endangered Species Act (ESA, 16 USC § 1531 et seq.);
- Wildlife species under the New Mexico Wildlife Conservation Act by the New Mexico Department of Game and Fish (NMDGF);
- Species at Risk listed under the U.S. Department of Defense Natural Resource Program; and
- Those species protected under the Migratory Bird Treaty Act ([MBTA], 16 USC §§ 703-712).

Biological information contained in the 2015-2019 Integrated Natural and Cultural Resources Management Plan and Environmental Assessment (INCRMP), as well as *The Vegetation of White Sands Missile Range*, Volume 1 (2000), were used to describe vegetative communities and potential wildlife species in the proposed project areas.[16, 17] A Biological Evaluation (BE) within the proposed project areas was not performed as part of this EA. Further information regarding vegetative communities, wildlife species and SOC at the proposed project locations is discussed below.

3.4.1 Vegetation

The INCRMP used information collected by Muldavin et al[18] during a planning-level survey to develop a model that characterizes vegetative communities or cover types present at WSMR. The model organized vegetative communities into generalized categories, referred to as vegetation map units, and used collected distribution information of these communities to develop a vegetation map (refer to Figure 3.8.2 of the INCRMP). The vegetation map was used to determine vegetation communities present within the proposed project areas.

3.4.1.1 Mesquite Shrubland

Mesquite shrubland is common habitat on WSMR and adjoins the Main Post area to the west, north and to a large extent, east. Although the location of the proposed evaporation pond under Project No. 3 is unknown, it is anticipated this project would occur within this vegetative community.

Mesquite Shrubland occurs primarily on expansive dune fields of the Tularosa and southern Jornada del Muerto basins.[19] Mesquite Shrublands also occur on 27,000 acres of alluvial flats within the Tularosa Basin at elevations of 3,900-4,300 ft.[20] Evidence from soils, land surveys, and recorded data shows that honey mesquite (*Prosopis glandulosa*) has increased substantially since the 1880s as a consequence of a combination of overgrazing and severe droughts, both of which had a variety of effects, from increasing topsoil erosion to the spreading of honey mesquite seeds.[21, 22] In general, the land area covered by mesquite is monotypic and contains little structural heterogeneity, and low herbaceous diversity and production.[23] For these reasons, faunal use is likely to be considerably less than in surrounding areas.[24] Other noteworthy patches of vegetation present in this shrubland community type can include broom snakeweed (*Gutierrezia sarothrae*), fourwing saltbush (*Atriplex canescens*), and mesa dropseed (*Sporobolus flexuosus*).[25]

3.4.1.2 Lowland Basin Grasslands

Lowland basin grasslands are present east of the Main Post and contain the WWTP, as well as the proposed composting drying beds under Project No. 5. In addition, alternative disposal and beneficial reuse options being evaluated under Project No. 3 could potentially occur in this community type. This vegetative community is widespread in Tularosa and Jornada basins, occurring on heavy clay soils of alluvial flats, swales, and drainages between alluvial fans.[26] These are the lowest-elevation grasslands on WSMR, occurring at 3,800-5,800 feet. Alkali sacaton (*Sporobolus airoides*), tobosa grass (*Pleuraphis mutica*), and burrograss (*Scleropogon brevifolius*) are typical dominant flora; and sites with the best moisture conditions support inland saltgrass (*Distichlis spicata*). These grasslands can form extensive, nearly monotypic, and continuous stands with low overall diversity; they also intermix with Lowland Desert Scrub, Desert Plains Grasslands, and occasionally Pickleweed Shrublands.[27] Most prevalent shrubs are honey mesquite and fourwing saltbush that have become established in bare soil patches.

3.4.1.3 Creosotebush Shrubland

Creosotebush Shrublands habitat is located directly southeast of the Main Post. The proposed pipeline route under Project No. 1, and potentially the alternative disposal and beneficial reuse options being evaluated under Project No. 3, would occur in this vegetative community Creosotebush Shrublands are the most widespread vegetation community on WSMR, occurring across a broad range of environments.[28] In basin bottoms, creosotebush communities occur on alluvial flats with relatively deep clay soils and are diverse in character..[29] In basin bottom sites they are either barren or dominated by alkali sacaton on clay soils or mesa dropseed on sands; whereas, upper piedmonts and foothills have well-developed shrub layers that can include mariola (*Parthenium incanum*), ocotillo (*Foquieria splendens*), tarbush (*Flourensia cernua*), broom snakeweed, honey mesquite, and fourwing saltbush.[30]

3.4.1.4 Davies Playa

The Davies Playa is a naturally occurring ephemeral playa that is located in the southern portion of WSMR, southeast of the Main Post. The Playa would be affected under Project No. 1 or Alternative 1.

The Playa has been artificially watered with effluent from the WWTP since 1986,[31] which over the years has contributed to the growth of riparian species including willows (*Salix*), cottonwood trees (*Populus*), cattails (*Typha*), rushes (*Juncaceae* family), and sedges (*Cyperaceae* family), as well as other facultative and obligate wetland vegetation that would not otherwise persist within the playa.[32] Recently, however, water flow to the Davies Playa has been significantly reduced and has resulted in the deterioration of vegetation; subsequently, decreasing the quality of wetland and associated riparian habitats available to local or migratory fauna.[33]

A compilation of vegetative species present within the Davies Playa was performed in 2012 and included the identification of 89 species. The checklist of floral species present within the Playa is presented in **Appendix A**.

3.4.1.5 Military Disturbance

The Main Post, including the Desert Emerald Park, recreational fields, Well 16 and the proposed pipeline route under Alternative 2, is located in a human and military disturbed area that is classified in the INCRMP as *Military Disturbance*.[34] Human and Military Disturbance areas include buildings and cantonments, roads, fences, stock tanks, trash heaps, golf courses, and special military impact and research sites. Most human disturbance areas are in lowland basins near roads and most often affect desert grasslands and shrublands ecosystems.[35]

The Desert Emerald Park and recreational fields are currently characterized as artificial habitats (golf course and grass fields) that are maintained and comprised of non-native grasses, shrubs and trees. Currently, the Desert Emerald Park is watered on a limited basis and is not being used for recreational events.

3.4.1.6 Invasive Vegetation

A 2002 inventory of exotic plants estimated 115 vegetative species on WSMR are exotic; however, all are not considered invasive.[36] The inventory identified eight noxious or potentially noxious species that could threaten other WMSR habitats. According to the INCRMP (2015), three of these species have a moderate or low invasive potential: Johnson grass (*Sorghum halepense*), low; Russian knapweed (*Acroptilon ripens*), low; and Napa thistle (*Centaurea melitensis*), moderate. The six remaining exotic or invasive species include the Lehmann love grass (*Eragrostis lehmanniana*), African rue (*Peganum harmala*), saltcedar (genus *Tamarisk*), saltlover (*Halogeton glomeratus*), Russian olive (*Elaeagnus angustifolia*), and tree of heaven (*Ailanthus altissima*). Some of these species were also identified as noxious by WSMR.

3.4.1.7 Summary of Vegetation Communities per Proposed Project Area

Table 3-2 provides a summary of vegetation communities that are present within each proposed project area. A discussion of vegetation impacts associated with each proposed project are discussed in Chapter 4.

TABLE 3-2: SUMMARY OF VEGETATION COMMUNITIES PER PROPOSED PROJECT AREA

Proposed Project	Vegetation Community
Project No. 1: Wastewater Effluent Reuse	Creosotebush Shrublands and Davies Playa
Project No. 2: Well 16 Water Repurpose	Military Disturbance
Project No. 3: Non-hazardous Solid Waste Water Disposal or Reuse	Varying
Project No. 5: WWTP Biosolids Composting	Lowland Basin Grasslands
No Action Alternative	N/A
Alternative 1: Davies Playa Improvements	Davies Playa
Alternative 2: Drill a New Well	Military Disturbance

3.4.2 Wildlife

The borderlands region of New Mexico and Texas is a center of biodiversity in temperate North America for birds, mammals, and herpetofauna.[37, 38] The diversity of terrestrial vertebrates on WSMR is high, but few warm-blooded vertebrates are centered in or limited in their distribution to the Chihuahuan Desert.[39] Many vertebrates found on WSMR are those generally found in the Intermountain West and the Great Plains.[40, 41] Provided below is a summary of wildlife that may be present in the project areas based on the vegetation map units, as described under **Section 3.5.1**.

3.4.2.1 Herpetofauna

Herpetofauna occurring in shrubland and grassland habitats on WSMR include toads, snakes, and lizards. Couch's spadefoot (*Scaphiopus couchii*), New Mexico spadefoot (*Spea multiplicata*), Great Plains toad (*Bufo cognatus*), and green toads (*Bufo debilis*) may gather to breed in temporary ponds during the rainy season.[42] Reptiles in WSMR shrubland habitat may include the desert spiny lizard (*Sceloporus magister*), longnose leopard lizards (*Gambelia wislizenii*), and whiptail lizards (*Cnemidophorus*). Grassland reptiles include the New Mexico whiptail (*Cnemidophorus neomexicanus*), desert grassland whiptail (*Cnemidophorus uniparens*), little striped whiptail (*Cnemidophorus inornatus*), checkered whiptail (*Cnemidophorus tesselatus*), whipsnakes (*Masticophis sp.*), and the massasauga (*Sistrurus catenatus*). Herpetofauna diversity within Military Disturbance areas is likely low; many species present in these areas emerge only during the rainy season.

Herpetofauna pitfall surveys were conducted during the summer of 1997 at the Davies Playa as part of a broader survey effort of wetlands within WSMR.[43] Overall, seven species of amphibian and five species of reptiles were detected. Amphibian species detected during this effort represented all known species of toads that occur on WSMR. Additional surveys were conducted from 1999 through 2002 and included detection of 55 species, including five newly discovered for WSMR. Refer to Table 3.8.3(e) of the INCRMP for a listing of known herpetofauna by habitat present on WSMR.

3.4.2.2 Birds

Various habitats of WSMR support a diverse avifauna of 291 documented species[44] representing 17 orders and 55 families (refer to Table 3.8.3f of the INCRMP). Over half of the documented species (158) are residents during summer, winter, or year-round. This includes the golden eagle (*Aquila chrysaetos*), which is present year around and a resident at WSMR within multiple habitat types.

There are 99 transient species (including migrants), primarily in spring and fall. Migrants include 49 species of water birds and nine species of warblers; the rest are vagrants that occur only irregularly.

As noted in the INCRMP (2015-2019), creosotebush and mesquite shrubland habitats typically do not support a large diversity of birds relative to Montane scrub and chaparral habitats. Bird species on WSMR that prefer shrubland habitat include the crissal thrasher (*Toxostoma crissale*), black-chinned hummingbird (*Archilochus alexandri*), loggerhead shrike (*Lanius ludovicianus*), scaled quail (*Callipepla squamata*), and black-throated sparrow (*Amphisphiza bilineata*). In grassland habitats, species richness is slightly lower than in either shrublands or woodlands. Lowland basin grasslands are the most extensive grasslands on WSMR, but because of their more arid and harsher climate, they support fewer species than more mesic foothill and piedmont grassland habitats.[45] Species occurring in this habitat include the McCown's longspur (*Rhynchophanes mccownii*), prairie falcon (*Falco mexicanus*), scaled quail, and the Baird's sparrow (*Ammodramus bairdii*).

Within the Davies Playa, planning level surveys for migratory birds were conducted in 2015 and 2016.[46, 47] A total of 75 species were detected in 2015, but only 66 species were recorded in 2016. Some birds found in wetland and riparian habitats on WSMR include:

- Lucy's warbler (*Oreothlypis luciae*)
- Cordilleran flycatcher (*Empidonax occidentalis*)
- Snowy plover (*Charadrius nivosus*)
- Black-chinned hummingbird
- Red-naped sapsucker (*Sphyrapicus nuchalis*)
- Cassin's kingbird (*Tyrannus vociferans*)
- Plumbeous vireo (*Vireo plumbeus*)
- Warbling vireo (*Vireo gilvus*)
- Mississippi kite (*Ictinia mississippiensis*)
- Hammond's flycatcher (*Empidonax hammondii*)
- Little blue heron (*Egretta caerulea*)
- American avocet (*Recurvirostra americana*)
- White-faced ibis (*Plegadis chihi*)
- Marsh wren (*Cistothorus palustris*)

Birds found in areas of human disturbance tend to be underreported. From the INCRMP, the rock dove (*Columba livia*), European starling (*Sturnus vulgaris*), and house sparrow (*Passer domesticus*) are the only species reported from areas of human disturbance that would not be expected to be found elsewhere on WSMR. A comprehensive listing of birds known to occur on WSMR can be found in Table 3.8.3(f) of the INCRMP.

3.4.2.3 Mammals

A total of 73 species of mammals have been recorded on WSMR.[48] Three species are extirpated from the entire region: the gray wolf (*Canis lupus*), grizzly bear (*Ursus arctos horribilis*), and black-footed ferret (*Mustela nigripes*). In addition, WSMR includes six non-native species: the house mouse (*Mus musculus*), Norway or brown rat (*Rattus norvegicus*), feral cat (*Felis catus*), Barbary sheep (*Ammotragus lervia*), and oryx (genus *Oryx*).[49]

Small mammals typical of non-sandy shrubland habitats (i.e., creosotebush) on WSMR include the Texas antelope ground squirrel (*Ammospermophilus interpres*), Botta's pocket gopher (*Thomomys bottae*), rock pocket mouse (*Chaetodipus intermedius*), Merriam's kangaroo rat (*Dipodomys merriami*), silky pocket mouse (*Perognathus flavus*), white-throated woodrat (*Neotoma albigula*), Mearn's grasshopper mouse (*Onychomys arenicola*), and cactus mouse (*Peromyscus eremicus*). Conversely, small mammals typical of sandy soils on WSMR include the spotted ground squirrel (*Xerospermophilus spilosoma*), desert pocket gopher (*Geomys arenarius*), Chihuahuan pocket mouse (*Chaetodipus eremicus)*, Ord's kangaroo rat (*Dipodomys ordii*), plains pocket mouse (*Perognathus flavescens*), and the southern plains woodrat (*Neotoma micropus*).

Grassland habitats on WSMR are diverse and occur at nearly all elevations. Consequently, most mammal species utilize these important habitats to at least some degree, and a number of species occur only there.[50] Because grassland habitats generally lack three-dimensional structure, mammal species specializing in these habitats are typically large mammals or small burrowing forms.[51] Large mammals or carnivores associated with grassland habitat include the coyote (*Canis latrans*), kit fox (*Vulpes macrotis*), hog-nosed skunk (*Conepatus sp*.), and the badger (*Taxidea taxus*). Species associated with Playa habitat mainly include small mammals and bats, and include the Crawford's desert shrew (*Notiosorex crawfordi*), fringed myotis (*Myotis thysanodes*), black-tailed jackrabbit (*Lepus californicus*), Mearn's grasshopper mouse, and the long-tailed weasel (*Mustella frenata*). In general, small mammals and bats are also associated with disturbed areas on WSMR. Several species of bats are commonly reported in buildings, including the pallid bat (*Antrozous pallidus*), big brown bat (*Eptesicus fuscus*), silver-haired bat

(*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), California myotis (*Myotis californicus*), western small-footed myotis (*Myotis ciliolabrum*), and the little brown myotis (*Myotis lucifugus*).[52] A comprehensive listing of mammals by habitat known to occur on WSMR can be found in Table 3.8.3(g) of the INCRMP.

3.4.3 Threatened and Endangered Species, Species of Concern

Section 7 of the Endangered Species Act (ESA) requires Federal agencies to ensure that any action they authorize, fund, or carry out is not likely to adversely impact any federally listed threatened or endangered species or result in the destruction of critical habitat. The USFWS Information, Planning, and Conservation (iPaC) system tool was utilized to determine threatened and endangered species that may occur within the proposed action areas. Upon completion of the iPaC, an official USFWS species list was generated. Results of the iPaC review indicated the potential presence of five listed federal species:

- Least tern (*Sterna antillarum*) – Endangered
- Aplomado falcon (*Falco femoralis septentrionalis*) – Experimental Population
- Southwestern Willow Flycatcher (*Empidonax traillii extimus*) – Endangered
- Yellow-billed Cuckoo (*Coccyzus americanus*) – Threatened

Wildlife species or subspecies to New Mexico may be listed as threatened or endangered under the Wildlife Conservation Act (WCA-17-2-37 through 17-2-46 NMSA 1978). A species is categorized as endangered if it is in jeopardy of extinction or extirpation from the state; a species is considered threatened if it is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in New Mexico. A review of the State of New Mexico's Department of Fish and Game 2016 Biennial Review indicated the potential presence in Doña County of one mammal, nine birds, two reptiles and one mollusk (refer to **Table 3-3**).

TABLE 3-3: STATE-LISTED SPECIES THAT MAY OCCUR IN DOÑA ANA COUNTY

Species	Status
Mammals	
Spotted bat - *Euderma maculatum*	Endangered
Birds	
Aplomado Falcon - *Falco femoralis septentrionalis*	Endangered
Common Ground-Dove - *Columbina passerina*	Endangered
Buff-collared Nightjar - *Caprimulgus ridgway*	Endangered
Elegant Trogon - *Trogon elegans*	Endangered
Broad-billed Hummingbird - *Cynanthus latirostris*	Threatened
Violet-crowned Hummingbird - *Amazilia violiceps*	Threatened
Costa's Hummingbird - *Calypte costae*	Threatened
Gray Vireo - *Vireo vicinior*	Threatened
Varied Bunting - *Passerina versicolor*	Threatened
Reptiles	
Mottled Rock Rattle Snake - *Crotalus lepidus*	Threatened
Mollusk	
Doña Ana talussnail - *Sonorella todseni*	Threatened

3.4.3.1 Vegetation

The New Mexico Rare Plant Technical Council (NMRPTC) website and *Rare Plant Habitat and Locations* (INCRMP Table 3.8.4b) were reviewed to determine if suitable habitat is present for sensitive plant species within the proposed project areas. Based on habitat needs and known occurrences on WSMR, listed rare plants are unlikely to be present within the project areas.

The federally listed Sneed pincushion cactus (*Escobaria sneedii var. sneedii*), which is also classified as a New Mexico rare species according to the NMRPTC, prefers cracks in limestone in areas of broken terrain and steep slopes usually in Chihuahuan desert scrub. The limestones are generally hard, resistant to erosion, and support a sparse vegetation of low shrubs.[53]

3.4.3.2 Wildlife

Review of the INCRMP (2015-2019) and USFWS wildlife fact sheets indicate suitable habitat is not present for any of the identified federally listed species within the proposed project areas.

Surveys to identify suitable habitat within the Davies Playa for the southwestern willow flycatcher and yellow-billed cuckoo were conducted in 2003,[54] and in 2004 through 2005,[55] which concluded breeding habitat for these two species is marginal, limited in area, and widely dispersed. More recently (2016), two individual flycatchers were identified at the Davies Playa, although no cuckoos were observed. The survey report contributed low specie numbers in the playa due to a lack of suitable habitat and concluded yearly surveys for both species is not warranted due to the inadequate habitats that exist on WSMR.

A brief description of the federally listed wildlife species is provided below.

Aplomado falcon (*Falco femoralis septentrionalis*)

The aplomado falcon is classified as a federal experimental population and is state listed as endangered. In New Mexico the species is associated with Chihuahuan Desert grassland with a sparse canopy of woody vegetation consisting of scattered yucca (*Yucca sp.*), mesquite (*Prosopis*), and cacti (*Cactaceae*). Nesting is typically in a yucca and is early, from February through May.[56] The latest known occurrences of this species on WSMR was in 2005 and 2007 near the Stallion Range.[57]

Least tern (*Sterna antillarum*)

The least tern is the smallest member of the tern family at about 9 inches long (23 centimeters [cm]) with a wingspan of 20 inches (50 cm). They have a grayish back and wings and snowy white undersides. Least terns have a forked tail and narrow pointed wings. This species was formerly distributed along the major river systems of the Midwestern United States, including the Red, Rio Grande, Arkansas, Missouri, Ohio, and Mississippi river systems. Currently, they occur as small remnant colonies throughout their former range.

Southwestern willow flycatcher (*Empidonax traillii extimus*)

The southwestern willow flycatcher is a small bird, usually a little less than 6 inches in length, that has light-colored wingbars and lacks the pale eye-ring of many similar Empidonax species. Overall, the body is brownish-olive to gray-green above. The southwestern willow flycatcher was listed as a federally endangered species in 1995. The species is considered to be riparian obligates that typically nest in dense riparian vegetation where surface water is present, or soil moisture is high enough to maintain appropriate vegetation characteristics.[58] Timing of surveys is critical in determining which species is present at survey sites. Willow flycatchers (WIFL) are considered to be southwestern willow flycatchers if they are present on WSMR during the breeding period (June 24–July 17). Flycatchers detected prior to or after this period are considered migratory and may represent individuals from other subspecies of willow flycatcher.

Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)

The yellow-billed cuckoo is a fairly large, long, and slim bird with a yellow bill that is almost as long as the head. Wings of this species appears pointed and swept back in flight. Yellow-billed cuckoos are warm brown above and clean whitish below. Breeding western yellow-billed cuckoos are riparian obligates and currently nest almost exclusively in low- to moderate-elevation riparian woodlands with native broadleaf trees and shrubs that are 20 hectares (ha) (50 acres [ac]) or more in extent within arid to semiarid landscapes.[59] They are most commonly associated with cottonwood/willow dominated vegetation cover, but the composition of dominant riparian vegetation can vary across its range. This species is also considered to be migrants unless they are detected during their known breeding period (July 1–July 31).

3.5 Cultural Resources

WSMR manages cultural resources in accordance with the National Historic Preservation Act (NHPA) of 1966 (as amended) and is governed by the Programmatic Memorandum of Agreement executed in 1985 between WSMR, the Advisory Council on Historic Preservation and the New Mexico Historic Preservation Division. Section 106 of the NHPA requires Federal agencies to take into account the effects of their undertakings on historic properties. Cultural resources include historic districts, sites, buildings, structures, or objects considered important to a culture, subculture, or community for scientific, traditional, religious or other purposes. Cultural resources that are eligible for inclusion in the National Register of Historic Places (NRHP) under the established criteria in 36 CFR Part 60.4 (*Parks, Forests, and Public Property—National Register of Historic Places Criteria for Evaluation*) are known as "historic properties." Currently, Cultural Resources at WSMR are managed under the 2015-2019 Integrated Natural and Cultural Resources Management Plan (INCRMP).[60] A general discussion of the cultural resources found on WSMR is available in Section 3.5 of the WSMR EIS[61] as well as in Section 3.6 of the WSMR INCRMP and EA.[62]

Approximately 25 percent of WSMR's surface area has been surveyed for the presence of cultural resources.[63] These efforts have documented more than 7,100 archaeological sites. Determination for National Register of Historic Places (NRHP) eligibility has been made for approximately 10 percent of the recorded sites. Based on existing research, WSMR could encompass more than 50,000 archaeological sites.[64] Documented sites include Native American sites, historic mining sites, homesteads, ranches, trails, and sites related to the military presence in the area. The 25 percent surveyed encompasses the entirety of the Main Post and surrounding landscapes; see **Figure 3-1** for cultural surveyed area around the Main Post.

Currently, two WSMR properties are listed on the NRHP.[65] One of the listed properties is also a National Historic Landmark: The Trinity Site, where the world's first atomic bomb was detonated on July 16, 1945, and was listed on the NRHP in 1966. Launch Complex 33, where German V-2 rocket technology was tested after the close of World War II,[66] was listed in 1985. On the Main Post, the WSMR Historic District consists of over 52 Cold War facilities related to the development of testing and training programs conducted there.[67] Throughout WSMR, dozens of other architectural resources may be eligible for their Cold War-era significance or their technological and scientific importance, or both.

A review of Cultural Resource Geographic Information Systems (GIS) data, as provided by WSMR, indicates that the footprint of the proposed actions, including all proposed alternatives, would not be within identified cultural resource sites.

3.6 Energy

Energy sources for operational activities, support facilities, and residential housing within WSMR come from commercial natural gas and electricity providers as well as base-generated solar electricity.[68, 69] A

FIGURE 3-1: CULTURAL RESOURCE SURVEYS NEAR MAIN POST

complex utility network delivers electricity and natural gas to facilities throughout WSMR. The most concentration of energy use is located within the Main Post. The Main Post area has an accessible power line and substation that would allow for implementation of the proposed actions. No new facilities or other utilities are required. Any new poles will meet raptor safety protection requirements.

In an average year, the WSMR purchases approximately 110,000 megawatt-hours (MWh) of electricity.[70] Additionally, WSMR's solar panels produce an estimated 16,200 MWh of electricity or just under 15 percent of the total power used at the installation. The solar energy generated is sent to the Main Post, Small Arms Range, Emery Site and the Hazardous Test Area.[71, 72]

This network is used to power the pumps that supply the water for irrigation. The electricity required to pump the water from the fresh water treatment facility for irrigating Desert Emerald Park and the Main Post sports fields annually has been calculated to be 32.52 MWh (25.12 MWh for Desert Emerald Park and 7.40 MWh for the sports fields.[1]

3.7 Facilities

WSMR's population includes civilian and military employees and their dependents, as well as contractors. Over the years, total population at WSMR has fluctuated from lows less than 5,000 to highs just over 9,000. WSMR must maintain its water rights and be prepared for military reconsolidation or large fluctuation of soldiers, thus heightening the importance of preserving water quality of the aquifer.[73]

The Main Post accounts for the majority of the WSMR's water use. Water is supplied to the Main Post by a system of 15 wells. There are 11 water wells within the Main Post that draw water from the Tularosa Basin and supply potable water via the primary water delivery system. The other 4 water wells are in the Soledad Canyon area, 6-10 miles southeast of the Main Post, withdrawing water from the Hueco Basin.

According to the 40-year Water Development Plan (WDP), Desert Emerald Park required nearly 400,000 gallons per day (gpd) during the summer months (May thru August) for irrigation when it functioned as a golf course. The WDP also indicates 35.3 million gallons annually (MGA) are required to water the athletic fields based on the same irrigation rate per acre as the Desert Emerald Park; however, the report does not distinguish between monthly peak and non-peak water demands. To estimate the peak summer demands for the athletic fields, the same ratio of average daily usage versus summer daily usage (1.674) for the Desert Emerald Park (87.2 MGA/365 days = 238,904 gpd versus 400,000 gpd) was utilized. Based on this data from the 40-year WDP (2007-2014), it is estimated the athletic fields require approximately 162,000 gpd of water (35.3 MGA/365 x 1.674 =161,926 gpd). The WDP evaluated water use requirements of the Desert Emerald Park when it functioned as a golf course, however, the intent with the park is to reduce the irrigated acreage over time.

Well No. 16 is being considered for use to supply irrigation water for sports fields and the Desert Emerald Park under Project No. 2. Based on volume data from the WSMR 40-year WDP, Well No. 16 produced 3.5 MG during the month of November in 2009, or an average of 116,666 gpd (81 gallons per minute [gpm]). Also, as reported by WSMR, the Well's initial production rate in 1961 was 1,080,000 gpd (750 gpm).

3.8 Geology and Soils

3.8.1 Geology

Sediments washed from the mountains over time have filled the basin with a varied mix of sand, gravel, silt, and clay. Deposits formed in the bottom of ancient lakes made up of clay and gypsum occur within

[1] The required energy to pump the annual water amount for irrigation was calculated using the elevation difference between freshwater storage facility and Desert Emerald Park (55') or average elevation for five sports fields (40'), where the weight of 1-acre-foot of water (325,852 gallons or 2,719,226 lbs) lifted one foot requires 1,593,132 ft-lbs at 60 percent pump efficiency.

the loose, unconsolidated sediments in the center of the Tularosa Basin. The thickness of these sediments is reported to be as much as 8,000 feet.[74] The size and shape of the sediments (bolson fill) varies both horizontally and vertically across WSMR from West to East. Commonly, the sediments deposited near the mountain fronts are coarse-grained and poorly sorted, while the sediments deposited toward the center of the basin rank as fine-grained and well-sorted. The study illustrated this by identifying the percentage of sand between 500 and 1,000 feet below ground surface (bgs). Sediments in this lens along the mountains contain upwards of 80 percent sand, whereas sediments east of the Main Post contain <40 percent sand. Overall, the sediments contain a greater percentage of clay and gypsum as one moves east from the mountains.

In addition to the horizontal variation the bolson sediments differ vertically. A clay unit about 1,000 feet bgs was identified that is thought to be continuous and to be an actual barrier to ground-water flow. This clay layer is open to interpretation as others have considered it a series of discontinuous lenses. Furthermore, an increase in seismic velocity of sediments observed in test wells shows a substantial intensification in compaction and cementation of sediments at depth.[75]

3.8.2 Soils

In general, most soils on WSMR are well drained to excessively well drained with the depth to bedrock ranging from shallow (less than 10 feet) to very deep (greater than 50 feet). Thirty-one percent of the soils are rated as having moderate or severe susceptibility to water erosion, while 54 percent have moderate to severe susceptibility to wind erosion.[76]

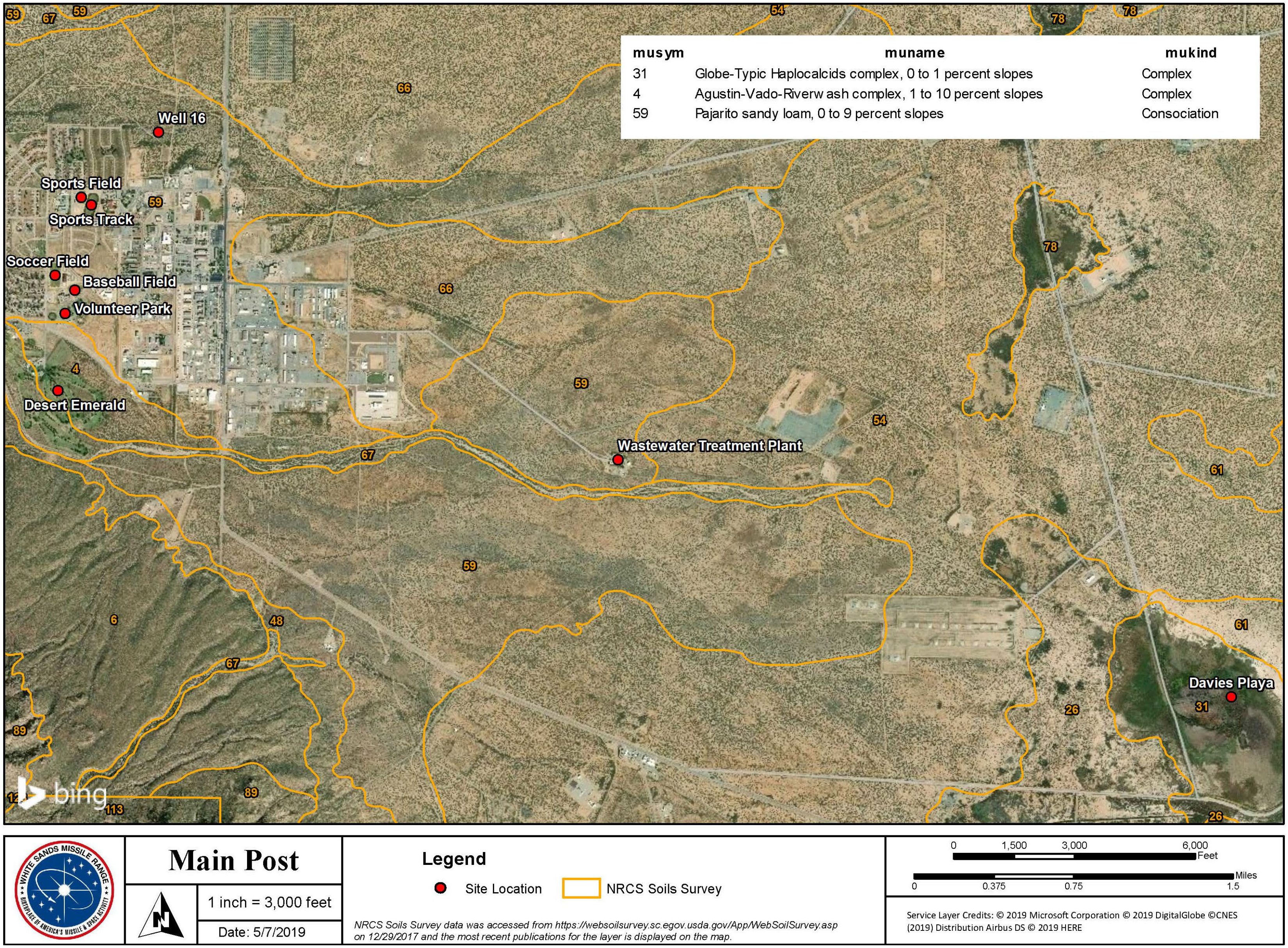
The Main Post area, to include the WWTP, consists of Pajarito sandy loam and Queencreek-Agustin-Stagecoach soil complexes that are considered piedmont alluvial deposits derived from exposed bedrock along the front of the Organ and San Augustin mountains to the west (refer to **Figure 3-2**). These piedmont alluvial deposits are mainly from upper and middle Quaternary period (2.58 ± 0.005 million years ago to the present), consisting of scattered sedimentary (gravel, sand, and slit) rock formations formed in the bottom of ancient lakes. The texture is coarse-loamy alluvium sand where coarse sand occupies the upper 30 inches of the soil profile with cobble-loamy coarse sand below. Soils from this source are susceptible to moderate wind erosion and severe water erosion. Vegetation within or near the Main Post area allows the near surface soil materials to be trapped by the roots and kept in mounded positions near plant stalks and roots.[77] Simply stated, without the vegetation to retain the soils near the plants, more erosion would be realized as a result of wind and water movement.

The Desert Emerald Park consist of the Agustin-Vado-Riverwash soil complex that is a somewhat excessively drained coarse loam soil type. Currently, this site is landscaped with many ornamental plant species associated with the previous golf course. Beyond human management, this soil type supports native vegetation such as honey mesquite (*Prosopis glandulosa*), soap tree yucca (*Yucca elata*), and broom snakeweed (*Gutierrezia sarothra*) (refer to **Figure 3-2**).[78]

3.9 Hazardous Materials and Waste

A hazardous material is any substance or agent (biological, chemical, radiological, and/or physical) that has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors. Hazardous materials are defined and regulated in the United States primarily by laws and regulations administered by the USEPA, the Occupational Safety and Health Administration (OSHA), the Department of Transportation (DOT), and the Nuclear Regulatory Commission (NRC). Each has its own definition of a "hazardous material." OSHA's definition can be found in 29 CFR 1910.1200.

FIGURE 3-2: SOIL TYPES



Hazardous waste is defined in 40 CFR 261.3 but essentially is any solid waste including wastewater not excluded from regulation under §261.4(b) that exhibits any of the characteristics of hazardous waste identified in Subpart C such as toxicity, corrosivity, ignitability, and/or reactivity.

Effluent from the WWTP is routinely analyzed to demonstrate that it contains no hazardous waste. Also, non-hazardous solid waste water, including salt water from tests and boiler blow-off water, is not discharged to the sewer system. Instead, it is containerized, analyzed to verify the water is non-hazardous, and disposed of off-site at an approved facility. Biosolids are dried throughout the year, containerized and disposed of at an approved special waste landfill generally once or twice a year. As with WWTP effluent and non-hazardous solid waste water, biosolids are not classified as hazardous waste.

No activities that generate hazardous material or waste are presently being conducted at the proposed action areas. As a result, no activities at or associated with these locations generate, treat, store, and/or dispose of hazardous materials or wastes.

3.10 Human Health and Safety

WSMR operates in compliance with numerous regulations and guidance documents and has implemented a comprehensive health and safety program to eliminate or reduce risks to workers and to the public.[79] The WSMR health and safety program includes the following components:

- Comply with all applicable Federal, State, Department of Defense (DoD), and Army instructions, laws, and regulations.
- Develop local regulations and detailed Standard Operating Procedures (SOPs) which further implement these laws and regulations and focus on unique risk factors and mission requirements at WSMR.
- Establish a local installation safety office with the proper resources and authority to effectively implement the WSMR health and safety program, and that is properly integrated with other WSMR and local civilian safety and emergency response organizations.
- Provide effective, mission-focused training and guidance to all WSMR personnel.
- Encourage proactive employee participation in safety and health programs, and charge leaders at all levels with the responsibility for planning and conducting mission activities in a safe manner.

Implementation and operation activities associated with the construction / implementation of the proposed actions would follow established WSMR Health and Safety Program, and New Mexico and federal regulations and protocols pertaining to same.

WSMR's safety policy is to plan for and implement every practical safety measure for all operations to prevent harm to people and property. This entails carrying out substantial risk mitigation procedures, as well as instituting control and oversite measures to ensure these practices are followed.

The White Sands Directorate of Public Works (WS-DPW) detected nitrate below the maximum contaminate level (MCL) of 10 mg/l in the water pumped from Well No. 16. There are no expected health effects.

3.11 Land Use

WSMR is a designated Major Range and Test Facility Base (MRTFB); most WSMR lands contribute to the facility's mission either directly or through operational support. In general, WSMR is more populated in the southern portion of the range (e.g., Main Post, NASA White Sands Test Facility [WSTF], Launch Complexes, etc.), while the northern (e.g., Stallion, Oscura, and North Oscura Range Centers) and central portions (e.g., Rhodes Range Centers) of the range contain fewer regularly inhabited facilities. **Figure 3-3** (Current Land Use Classifications), as presented in the Final EIS for *Development and Implementation of*

Range-Wide Mission and Major Capabilities at WSMR, provides the post-wide land use classifications, and is the basis for the description of the proposed action locations in and around the Main Post.

3.11.1 Main Post

The Main Post is classified as "Land Use B - Range Centers and Built-Up Areas" and is in the urbanized portion of WSMR, which occupies approximately 1,530 ac along the eastern slope of the Organ Mountains in the southwest corner of WSMR (refer to **Figure 2-1**).[80] In 2010, the Main Post contained approximately 820 structures with a combined size of 3.6 million square feet. Siting of new facilities on the Main Post is subject to approval by a Master Planning Review Board, which considers compatibility of adjacent land uses.[81] The Main Post's administrative and technical complex includes the base headquarters, an operations control center, administrative offices, technical laboratories, and work areas, warehouses, and service centers. The Main Post also serves as a self-contained community with military, shopping facilities, medical clinics, emergency and fire services, educational and recreational facilities, and churches.[82]

3.11.2 Range Centers and Test Facilities

WSMR's military weapons test and evaluation mission is supported by infrastructure that includes systems that service over 2,000 test facilities and sites. The Army, Navy, and Air Force use the range for evaluation and tests of missile systems, air-defense fire distribution systems, high-energy laser and directed-energy systems, surface-to-surface missile systems and space systems. Test infrastructure common to the range includes missile launch sites, missile impact areas, instrumentation sites, communication sites, and radar and laser test facilities. There are four distinct range centers (North Oscura, Oscura, Rhodes, and Stallion) tactically positioned in the central and northern regions that offer administrative, logistical, and technical support for ongoing remote operations.[83]

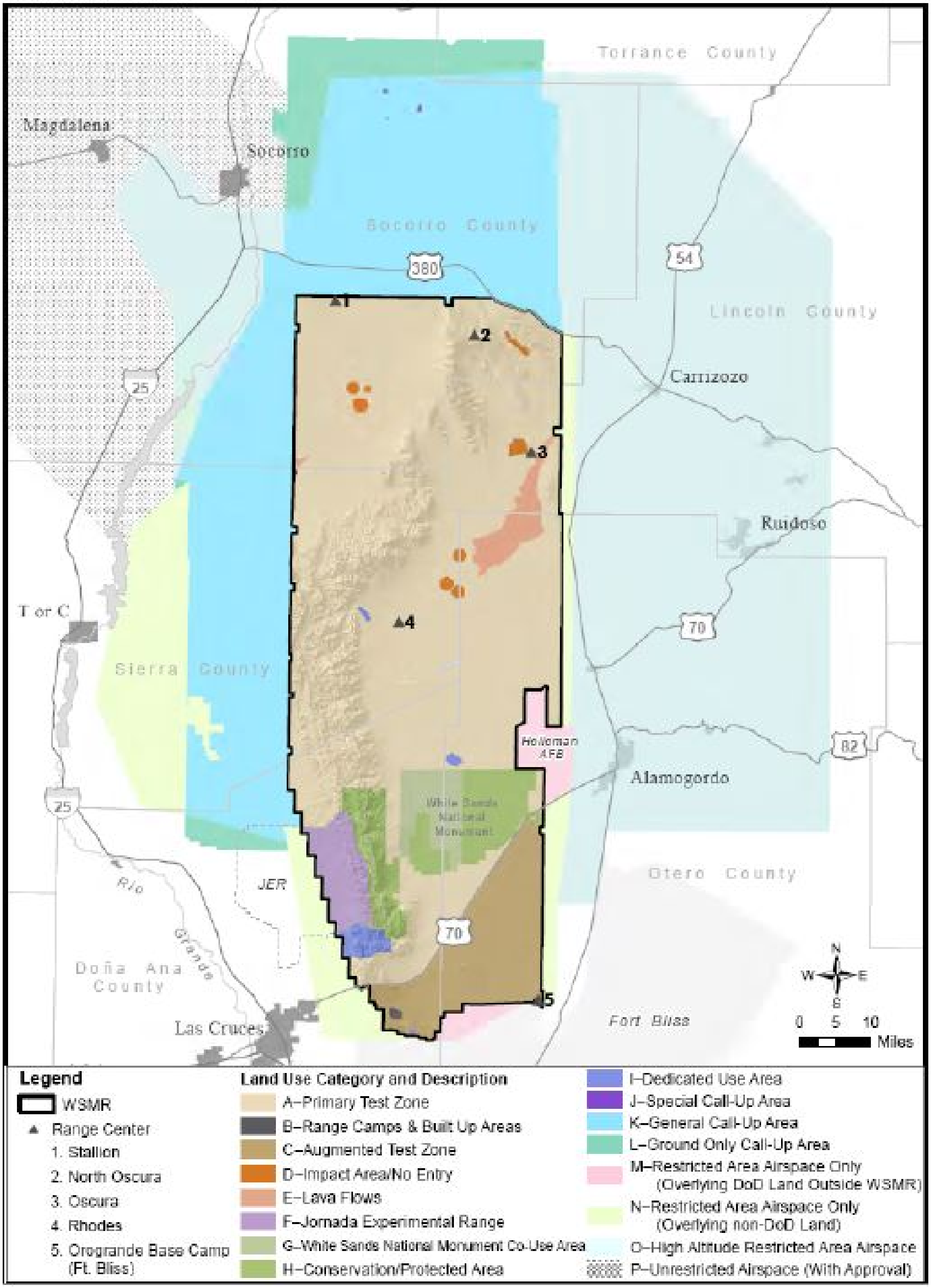
3.12 Noise

Noise is considered unwanted sound that interferes with normal activities or otherwise diminishes the quality of the environment. The measure of human response to sound is calculated as an A-weighted decibel (dBA) and used to characterize the compatibility of noise levels with different settings:

- 50 dBA reflects a relatively quiet environment like a suburban setting;
- Less than 62 dBA is normally acceptable for indoor and outdoor environments;
- Between 62 and 74 dBA is normally acceptable for sleeping quarters and active, outdoor recreation; and
- 70 dBA is typically consistent with an urban environment.[84, 85]

Low-level WSMR noise typically heard within the Main Post area includes short-term intervals of equipment transport, development activities, maintenance, and truck delivery. Other general WSMR activities that generate low-level noise within proximity of the Main Post may include ground maneuvers, off-road vehicle use, construction in proximity, and maintenance. A general discussion of the noises found on WSMR is available in the WSMR Installation Compatible Use Zone Study.[86]

FIGURE 3-3: CURRENT LAND USE CLASSIFICATIONS



3.13 Utilities and Infrastructure

3.13.1 Potable Water

WSMR obtains its potable water for the Main Post from a series of 15 deep supply wells: 11 within the Main Post and four located in the Soledad Canyon area. WSMR does not currently use water from Well No. 16 located on the Main Post. Water from these wells is pumped to the Main Post Water Treatment Plant (WTP) and from there it is stored in two 400,000-gallon aboveground storage tanks (ASTs) and two 1,000,000-gallon and one 200,000-gallon elevated storage tanks before being distributed as treated potable drinking water. The WTP provides potable water to the buildings and houses, the Desert Emerald Park, and launch complexes and down range to Oro Grande.

3.13.2 Wastewater Treatment

The original WWTP was built in 1958, was designed for 1 million gallons per day (MGD) inflow and included two trickling filters. The original trickling filter equipment was operated continuously until early 2017 when one of the original trickling filters, along with one primary and one secondary clarifier, were replaced with a Sequencing Batch Reactor (SBR) treatment system. The SBR is designed for 0.5 MGD inflow.

The current flow as based on historical effluent meter readings from 2010 to 2013 at the WSMR WWTP indicate an average of approximately 179,400 gpd.[87] However, interviews with WSMR WWTP staff in the fall of 2017 indicated that the average daily flow rate was closer to 200,000 gpd.[88]

3.13.3 Transportation

Transportation within the Main Post area is mostly conducted by motorized vehicle. The primary road within the Main Post is Headquarters Avenue; this road lies north to south from the Las Cruces gate to the El Paso gate. The only other primary road at the Main Post is Aberdeen Avenue, which supports east-west traffic flow.

Access to facilities and other areas outside the Main Post is available by a network of primary and secondary roads. The road network comprises over 1,900 miles of major range and secondary roads. Major range roads are two-lane with either paved or graded surfaces and all secondary roads are unpaved. Traffic levels on these roads is low and varies between 5 and 50 vehicles per day.[89]

With regards to waste transportation, WSMR currently hauls the non-hazardous solid waste water as well as the dried sludge from the WWTP off post for disposal at a permitted facility. Off-site disposal of non-hazardous waste water costs approximately 100k for 60,000 gallons.[90]

3.14 Water Resources

3.14.1 Surface Water

Surface water resources within WSMR are limited due to the arid region, high evaporation rates, and well to excessively drained local soils. None of the surface waters on WSMR are potable.[91] Most surface water, including lakes and ponds, within WSMR are ephemeral with low-flow regimes, where water flow is dependent on snowmelt and precipitation runoff.[92] The major perennial surface water on WSMR is Salt Creek.

The Main Post is situated within the southwestern portion of the Tularosa Watershed (HUC 13050003).[93] Surface water near the Main Post includes ephemeral washes and arroyos. Two minor arroyos are located within the area; the northern and southern arroyos convey a sizeable amount of runoff from the Organ Mountains.[94] The surface water in the Main Post area originates in the mountains and flows to the east. There are three artificial water bodies: Davies Playa, West Dry Lake Tank, and Hood Tank. **Figure 3-4** delineates the surface waters present within and near the Main Post area.

3.14.1.1 Davies Playa

Davies Playa is a natural playa that receives seasonal precipitation and treated wastewater effluent from the WSMR WWTP. Davies Playa has been receiving WWTP effluent since 1986. It is postulated that Benjamin Davies, who ran the San Augustin Ranch from 1874 to 1893, constructed the first large earthen berms in Davies Playa around the mid-1870s to hold water for livestock. There are three impoundments, that were dug by ranchers before the area was acquired by WSMR. The impoundments are bordered by raised earthen berms.[95] The playa is in the southeast section of WSMR and the southern section of the Tularosa Valley watershed (refer to **Figure 3-4**).

A recent data evaluation of natural resources and water quality within the Davies Playa was conducted in 2017.[96] No effluent water was observed discharging into the east side of Davies Playa during the 2017 field evaluation due to a deteriorated outfall pipeline from the WWTP. This pipeline was approved for repair/replacement under a separate action and is scheduled for FY 2020 which would restore effluent flow to Davies Playa.

3.14.2 Groundwater Resources

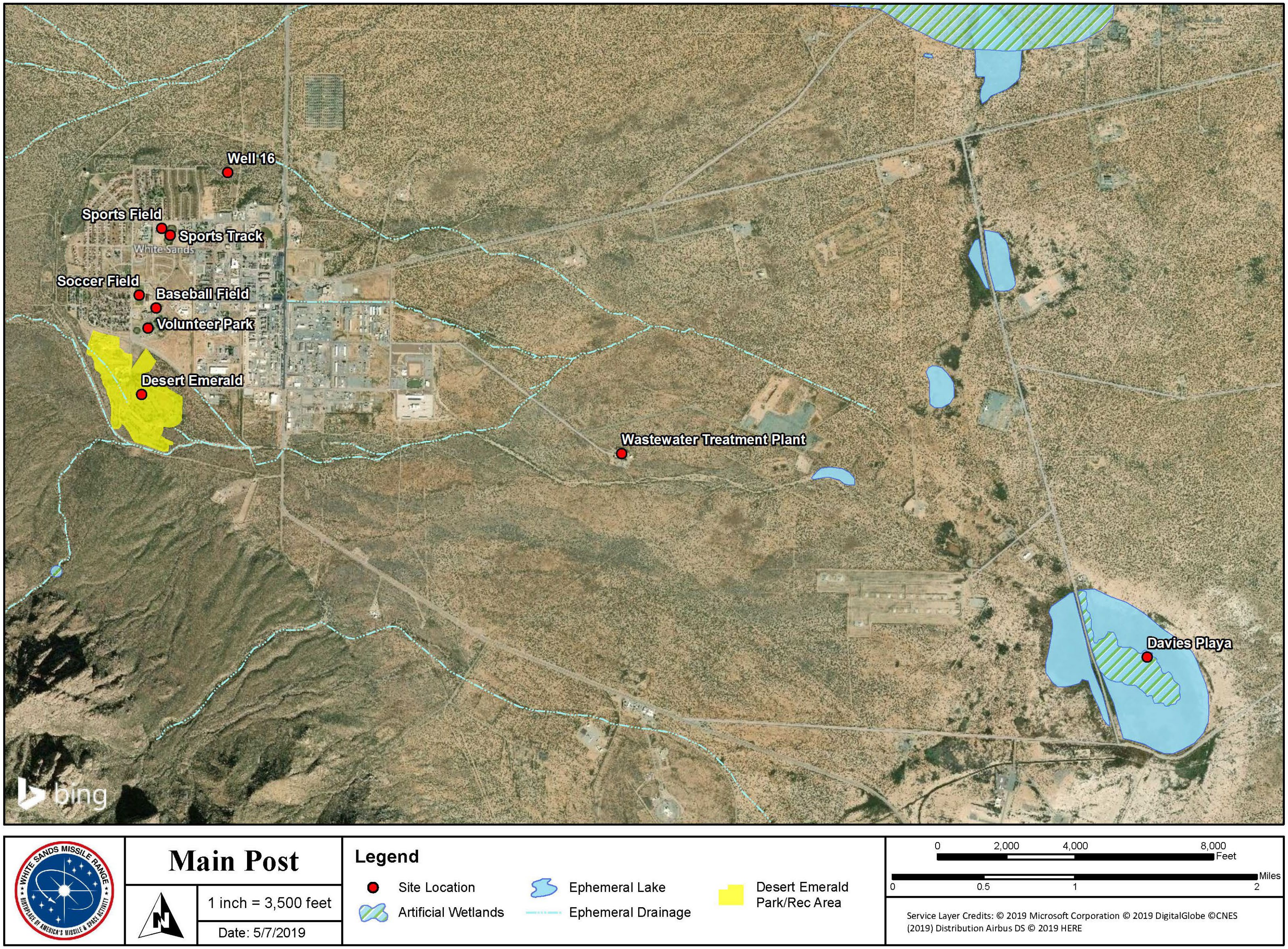
The main sources of groundwater for WSMR are regional aquifers located within the basin-fill aquifers.[97] The WSMR Main Post supply wells access fresh groundwater, defined as containing less than 1,000 mg/L of total dissolved solids (TDS), and there have not been any reported instances of saline intrusion within the WSMR wells that supply the Main Post.[98] The water use at WSMR exhibits a strong seasonal pattern with characteristic increases of water use during the summer months and a decline of water use in the winter months. Water withdrawals by calendar month vary from a high average of 60 MG in June to a low average of 13 MG in December.[99]

The combined withdrawal from the water wells serving WSMR averaged 446 million gallons per year (MGPY) from 2007 to 2014, with 2014’s withdrawal being just below 300 million gallons (MG).[100] This is considerably less than the previous 25-year average of 733 MGPY. Based on a calculated average withdrawal from several hydrogeological and groundwater assessments, the groundwater aquifers used by the WSMR Main Post water supply system have a safe long-term yield of 645 MGPY.[101] Of the recent annual withdrawn, nearly 96.7 percent comes from the Tularosa basin wells (431.3 MGPY) and 3.3 percent (14.5 MGPY) comes from the Soledad Canyon wells in the Hueco Basin.[102]

As summarized above, the quality of the groundwater varies, with TDS concentrations <1,000 mg/L occurring primarily in the merging alluvial-fan deposits along the basin edge. The deepest fresh groundwater is also located along the basin edge. Dissolved-solids concentrations in groundwater increases with distance in an easterly direction away from the Organ Mountains. For the projects in this EA, that means high-quality water (<1,000 mg/L TDS) is present in thick deposits (>1,000 feet) below the Main Post. Conversely, increases in TDS are present as the deposits thin out towards the Jarilla Mountains or the town of Orogrande, New Mexico. Generally, this west-to-east quality and thickness trend holds true in a northerly direction between the two mountain ranges.

Not all of the water in the ground is fresh water; much of the deeper groundwater is saturated with minerals. Under natural conditions the boundary between the freshwater and brine-water tends to be relatively stable, but pumping can cause brine-water to migrate upward and laterally, resulting in elevated minerals in the water supply. The fresh groundwater (<1,000 ppm TDS) beneath the well field is estimated at 1,500 to 2,000 feet according to a study done by the U.S. Geological Survey (USGS) and Army in 1988.[103] The large volume of withdrawals and proximity to saline water caused concern that the freshwater supply

FIGURE 3-4: SURFACE WATERS AT WSMR



might be threatened by saltwater intrusion and was the reason for conducting the study. The investigation was conducted by simulating water level declines and water-quality changes with groundwater flow models. The study's simulations indicated that mineral-laden waters would move laterally toward the well field rather than from beneath the well field. It was speculated that TDS could increase by as much as 500 ppm in the well field from 1983 to 2017 if individual sand lenses are connected to saline water in the eastern part of the modeled area. Recent water quality reports from 2011 state that base drinking water derived from groundwater are at or below the MCLs for drinking water; however, TDS was not reported.[104]

Natural groundwater recharge rates in the region are highly variable due to climate cycles. A range of aquifer recharge estimates exists from previous studies of the WSMR hydrogeology. An acceptable average estimate for supply wells used by the Main Post area is 625.63 MGPY.[105] The recharge for these wells enters the aquifer by infiltration of intermittent surface water flows into coarse sediment near the proximal end of alluvial fans and by seepage from arroyos from the Organ Mountains. Generally, these arroyos only contain water during and for a short time after storms.[106] In other words, the recharge is from precipitation in the Organ Mountains and not from rains on the Main Post. This is because the precipitation rate in the area of the Main Post is very low and the evaporation rate is very high.[107]

A simulation of the groundwater flow in the Basin-Fill aquifer of the Tularosa Basin was conducted by the USGS in cooperation with Holloman Air Force Base and the City of Alamogordo, in which they reported flow and recharge data. The Sub-basin (Sotol Creek) which feeds the WSMR supply wells is approximately 13 square miles and receives ~14.32 inches of precipitation annually of which only 4 percent is estimated to become groundwater. Estimates of hydraulic conductivity from this study indicate infiltration at just less than 10 feet per day. Additionally, frequent clay intervals in the aquifer cause a very small ratio of vertical to horizontal hydraulic conductivity between the deposits.[108] Furthermore, the study estimated a maximum evapotranspiration (ET)[1] rate of 4 feet per year and an ET extinction depth (maximum depth at which ET occurs) of 15 feet.

3.14.3 Wetlands

Wetlands are unique locations that are saturated at various times in the year and can support a distinct ecosystem of plants and animals based on their soil saturation. An estimated 5,000 ac of wetland habitat within WSMR would be protected under Executive Order 11990, Protection of Wetlands. Numerous small wetland and riverine systems are present in the Main Post area and include the Davies Playa (refer to **Figure 3-4**). Construction in these areas would be coordinated and minimized.

3.15 Applicable Regulatory Information

AR 200-1, *Environmental Protection and Enhancement*, addresses water resource protection and management, as well as watershed management. These regulations are in place to ensure that water resources are available, conserved, and protected, and that Army-provided drinking water meets the Safe Drinking Water Act (SDWA) standards and complies with applicable state and local regulations. AR 200-1 also establishes policies, procedures, and standards for the conservation, management, and restoration of land and natural resources. AR 420-1, *Army Facilities Management*, establishes policies and procedures addressing water supply and distribution, as well as wastewater and industrial water treatment, surveillance, and disposal.

---

[1]Evapotranspiration is the process of transferring moisture from the earth into the atmosphere. Simply put, evaporation occurs when water vapor leaves the soil or a plant's surface. Transpiration involves the passage of water through a plant, from its roots through its vascular system.

The applicable regulations include those promulgated under Title 42 of the United States Code Chapter 82 Solid Waste Disposal. An excerpt from definition 27 reads, "The term "solid waste" means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under section 1342 of title 33… (68 Stat. 923) [42 U.S.C. 2011 et seq.]."

Disposal of solid waste is regulated under RCRA Subtitle D (non-hazardous waste) unless it is regulated by an alternate permitting mechanism like the Clean Water Act (CWA). A National Pollutant Discharge Elimination System (NPDES) permit under the CWA is not required for WSMR's WWTP or other storm water discharges because there is no discharge to WOTUS.

3.15.1 Water Rights

The present water code in New Mexico was established before statehood and embraces tribal and community uses. In 1931 the state adopted groundwater laws and declared that the public owned the groundwater. The New Mexico law governing water use has five straightforward doctrines:

1. The public owns all the water in the state. Legal use of water requires a water right, and water rights are recognized as private property.
2. Senior (older), water rights have precedence. Senior rights holders receive their full allotment and junior owners' allotments are reduced during dry years, although this is rarely enforced.
3. To secure water rights, water must be put to "beneficial use." This commonly is accepted as domestic or irrigation, commercial and industrial uses.
4. Holders of water rights can modify the use or divert water, provided the State Engineer or a court finds the alterations won't harm other water rights, public welfare, or impact water conservation.
5. Water rights can be forfeited under certain conditions, for non-use or for wasting water.

The State Engineer's Office administers the state's water resources and enforces water law. The State Engineer has authority over the measurement, appropriation, and distribution of all surface and groundwater in New Mexico, including streams and rivers that cross state boundaries. The Federal government owns water rights to lands reserved by Congress or the President: National Parks and Forests, Wildlife Refuges, Wilderness Areas, and Military Bases are to be used for the original purpose of the land reserve. For example, WSMR was reserved for military purposes, and WSMR has federal water rights for all water put to this purpose. With the permanent closure of an existing well and subsequent drilling of a new well, current WSMR water rights would be retained, as filed with the New Mexico Water Rights Reporting System (NMWRRS).[109]

3.15.2 Regulatory Review Irrigation

Reclaimed water should be treated to a level that will be protective of human health when human exposure is anticipated.[110] Other considerations include preventing environmental degradation, avoiding public nuisance, and meeting necessary user requirements for a successful reuse program. These considerations all depend on the transfer and use of suitably treated reclaimed water. Where human exposure is anticipated in a reuse scenario, reclaimed water should be treated to a high degree (control of constituents of concern and pathogenic microorganisms) before it is applied.

3.15.2.1 Safe Drinking Water Act

Where reclaimed water may impact a source of drinking water, the SDWA would be applicable. The SDWA is the principal federal law that safeguards the quality of drinking water. Under the SDWA, the USEPA sets national health-based standards, or MCLs, for drinking water quality and oversees the states, municipalities and water suppliers that implement those standards. SDWA was initially passed by Congress in 1974 and amended in 1986 and 1996. While the original law focused mainly on treatment standards, the 1996 amendments significantly improved the law by creating requirements for source water protection. It is under this aspect of the law where the irrigation of Desert Emerald Park with reclaimed water may be scrutinized as the park is located above a source of fresh drinking water (<1,000 mg/L).[111] With regards to protection and prevention, water suppliers are mandated to conduct assessments of water sources to determine if there are any vulnerabilities to contamination.

3.15.2.2 USEPA Water Reuse Guidelines for Urban Reuse

Water reclamation and reuse standards in the United States are the responsibility of state and local agencies—there are no federal regulations for reuse. However, recognizing the need to provide national guidance on water reuse regulations and program planning, the USEPA has developed comprehensive, up-to-date water reuse guidelines. The most recent version of the USEPA's Guidelines for Water Reuse (2012)[112] addresses topics applicable to WSMR's proposed irrigation projects.

The Unrestricted Urban Reuse category applies to the proposed irrigation of Desert Emerald Park using WWTP effluent. Unrestricted Urban Reuse is defined as:

> "*The use of reclaimed water for non-potable applications in municipal settings where public access is not restricted.*"

3.15.3 Regulatory Review Non-hazardous Solid Waste Water Reuse

Non-hazardous solid waste water resulting from military tests with saline water and boiler blowdown water are regulated under RCRA Subtitle D at WSMR. Disposal of this non-hazardous solid waste water directly onto the ground surface or by spreading on roads or construction sites for dust suppression is prohibited by the statutes set under Subtitle D. Disposal of the non-hazardous solid waste water into the WSMR sewer system is not allowed because it is not domestic sewage.

3.15.4 Regulatory Review Biosolids

RCRA Subpart D also applies to the WWTP biosolids, and WSMR periodically disposes of approximately 50,000 pounds of dried biosolids annually at an offsite special waste landfill permitted by New Mexico Environment Department (NMED) Solid Waste Bureau (SWB). WSMR also has a Sludge Management Plan approved by the SWB that describes how the sludge is managed and disposed. Any changes to biosolids treatment or disposal will require a change to the Sludge Management Plan and subsequent approval by SWB.

In accordance with 20.0.2-20.9.10 NMAC, compost, by definition, includes biosolids that meet the requirements of 40 CFR 503. WSMR would be required to follow the 40 CFR 503 regulations to implement Project No. 5, WWTP Biosolids Composting. The proposal is to compost biosolids to achieve a product that meets Class A pathogen reduction, vector attraction reduction standards, and the most stringent metals limits (40 CFR 503). This high-quality composted biosolids product may be used as a fertilizer without site restrictions.[113]

4 RESOURCE IMPACTS

The following sections discuss the impacts of the proposed action projects and the alternatives to the proposed actions for each of the applicable VECs. The no action alternative would not include construction activities for any of the proposed actions or alternatives to the proposed actions, and therefore would result in no change to the VECs at the project areas or the surrounding area.

4.1 Project No. 1: Wastewater Effluent Reuse

A summary of Project No. 1's forecasted effects and projected outcomes are provided at the end of this section in **Table 4-2**.

4.1.1 Biological Resources

The criteria for evaluating potential impacts to biological resources resulting from the implementation of proposed actions, as well as alternatives to the proposed actions, include the potential:

- To degrade critical or protected habitat for wildlife and the ecosystem to the extent that biodiversity is impaired;
- To destroy habitat and prevent biological communities in the area from reestablishing themselves after the habitat is disturbed;
- To create habitat fragmentation and interfere with the movement of any native resident or migratory wildlife species;
- To adversely impact threatened, endangered, or sensitive species or destroy or adversely modify Critical Habitat;
- To cause substantial mortality or displacement of species and promote the spread of invasive, non-native species; and
- To cause substantial damage to vegetation communities.

4.1.1.1 Vegetation

Implementation of the proposed actions to construct the pipeline and pumping station under Project No. 1 are anticipated, in general, to have temporary and minor impacts to local vegetation. Vegetative community diversity within the Main Post area and along the proposed pipeline route is considered low and is primarily composed of creosotebush shrublands. The proposed actions and alternatives would not result in extensive surface disturbance; significant degradation, fragmentation, or habitat loss; therefore, physical changes to the creosotebush shrubland composition is not expected. However, BMPs would be employed when necessary to minimize impacts to this vegetation community that may include the revegetation of disturbed areas and/or the utilization of construction practices to reduce erosion hazards and the spread of invasive plants. Efforts to reduce the chance of invasive plants affecting project areas would be coordinated with the WSMR Integrated Pest Management Coordinator.

The proposed pipeline route would not be constructed in unique or sensitive vegetative habitats or communities, and when feasible, would be constructed along existing ROWs. Coupled with low vegetative diversity within the proposed action area(s), impacts associated with construction of the pipeline are not anticipated to adversely affect vegetative resources. Other construction activities (e.g., pipe stand, storage tank, solar-powered pumping stations, etc.) associated with the proposed action would have nominal effects on vegetation.

The use of reclaimed wastewater for irrigation of Desert Emerald Park may affect the non-native vegetation and man-made habitat(s) present within this recreational use area since the reclaimed wastewater, as reported by WSMR,[114] contains elevated levels of nitrates (measured as total nitrogen 19 mg/L), one of the three common chemicals in fertilizers. Nitrogen, phosphorus and potassium, or NPK, are the three primary nutrients in commercial fertilizers. Nitrogen is the most important nutrient, and plants absorb more nitrogen than any other element. Nitrogen is essential to making sure plants are healthy as they develop.[115] Nitrate (NO_3) is the principal source of nitrogen for plants; it is a nutrient they cannot live without.

A long-term (4.5 years) monitoring program of nine golf courses in southern Nevada was conducted to observe the effects of irrigating with fresh water, reuse water, and the transition to reuse water during the monitoring program.[116] Water reused on the golf courses originated from municipal tertiary treated wastewater facilities. The study's observations indicated that the long-term use of reclaimed water high in nitrates resulted in increased soil salinity at several depths on fairways and greens; however, this increased salinity did not lead to a systematic decline in leaf health. Furthermore, when the data were analyzed as fresh, transition, or reuse irrigated, soil salinity on reuse courses were statistically higher than fresh and transitional courses, yet plant response on reuse courses was not statistically different than that observed on fresh courses. The researchers concluded that proper irrigation management was able to maintain favorable salt balances and plant response if irrigation volumes were not restricted to where deficit irrigation occurred.[117] These results emphasize the need for soil salinity monitoring to adjust irrigation management to control salinity and avoid or minimize plant stress. Appropriate BMPs would need to be implemented to avoid the negative impact of salt accumulation in the soil associated with using reuse water for irrigation.

Deficit irrigation volume (an optimization strategy in which irrigation is applied during drought-sensitive growth stages of a crop) could be an issue as the WWTP may not produce enough reclaimed water to irrigate Desert Emerald Park adequately during the high-demand summer months. A decision as to how to augment the Desert Emerald Park irrigation water would need to be made. Available sources would consist of either the existing WSMR drinking water or water from Well No. 16; either source would work. The impacts of using well No. 16 water are discussed in Project No. 2.

Currently, the primary water source for the Davies Playa is wastewater effluent. The pipeline to Davies Playa would remain in place for continuous or periodic use. A reduction of wastewater effluent received by the Playa would have little impact on the current vegetative community within the Playa since the quality of existing wetland and riparian habitat is considered marginal. As such, the implementation of Project No. 1 would be anticipated to have low to no adverse impacts on the vegetative communities within the Playa.

4.1.1.2 Wildlife

A further reduction of wastewater effluent received by the Davies Playa would have little to no adverse impact on the functional habitat available to wildlife species since the quality of existing wetland and riparian habitat within the Playa is considered marginal. Conversely, the habitat at Desert Emerald Park currently provides diverse habitat for species of interest such as Monarch butterflies (*Danaus plexippus*), Vermillion fly-catchers (*Pyrocephalus rubinus*), etc. Additional water received at the Desert Emerald Park would enhance existing habitat for these species and others, as well as enhance the present vegetation so it can be maintained as a green area year-round. Additionally, employees, residents, and NGOs value the Desert Emerald Park for its diversity, accessibility, and solitude.

The enhancement of existing habitat at the Desert Emerald Park would attract more wildlife and increase the potential for negative human-wildlife interactions (*e.g.,* rattlesnakes, coyotes, bobcats, cougars, insect pests such mosquitoes, ticks, bees, wasps, etc.). Information/warning signs would be installed and brochures available to educate people of the potential interactions with wildlife, as well as how to mitigate negative human-wildlife interactions when visiting the Park.

Construction of the pipeline to route effluent water from the WWTP for beneficial uses (refer to **Figure 2-2**) would not be expected to cause permanent displacement or have any other adverse effects to wildlife resources. In response to construction activities or in situations when human activity is high, small mammals, rodents, and reptiles would likely withdrawal to burrows, or, given the widespread plant community, may move into adjacent habitats. More mobile species such as birds would temporally vacate the proposed actions areas until activities ceased. In some rare cases, incidental mortality from construction activities and increased vehicular traffic would be expected. To minimize impacts to birds during the installation of the pipeline, construction activities would take place during the non-nesting season (September through February), however migratory bird nest surveys would take place prior to any ground-disturbing activities during nesting season. Other construction activities (e.g., pipe stand, storage tank, solar-powered pumping stations, etc.) associated with the proposed action would have nominal effects on wildlife.

4.1.1.3 Species of Concern

The USFWS in New Mexico utilizes a Project Review process to satisfy informal Section 7 requirements and project approval once it has been determined a project is unlikely to affect Endangered and Threatened Species. The first step of the process is to obtain an official species list by using the USFWS iPaC tool (refer to **Chapter 3**, **Section 3.4.3**) and then develop a species conclusion table (refer to **Table 4-1**). The Table is used to list federal SOC that may be present within the Area of Potential Effect (APE) (including critical habitats), to identify suitable habitats, and lastly, to develop an ESA Determination specific to each identified SOC. For SOC, the level of impact expected to be incurred was determined based on the activities to be performed per each project or alternative, species ecology, and the likelihood that the species would occur within an area based on habitat needs.

TABLE 4-1: SPECIES OF CONCERN HABITAT SUITABILITY AND ESA DETERMINATION SUMMARY

Species	Habitat Determination	Comments	ESA Determination
Vegetation			
Sneed Pincushion Cactus (*Escobaria sneedii var. sneedii*)	Suitable habitat is *not* present in Project Areas.	• No critical habitat in APE. • Suitable habitat is not present in Project Areas • Considered a NMRPTC rare species.	No effect from proposed actions or from alternatives to proposed actions.
Wildlife			
Aplomado falcon (*Falco femoralis septentrionalis*)	Suitable habitat may be present in Project Areas.	• Federal experimental population. • Species is mobile. • Critical habitat not designated for species.	No effect from proposed actions or from alternatives to proposed actions.
Least tern (*Sterna antillarum*)	Suitable habitat is *not* present in Project Areas.	• No critical habitat in APE. • Habitat suitability based on 2018 field survey.	No effect from proposed actions or from alternatives to proposed actions.
Southwestern Willow Flycatcher (*Empidonax traillii extimus*)	Suitable habitat is marginal and limited within Davies Playa.	• No critical habitat in APE. • Habitat suitability based on 2016 field survey.	No effect from proposed actions or from alternatives to proposed actions.
Western Yellow-Billed Cuckoo (*Coccyzus americanus occidentalis*)	Suitable habitat is marginal and limited within Davies Playa.	• No critical habitat in APE. • Habitat suitability based on 2016 field survey.	No effect from proposed actions or from alternatives to proposed actions.

Results of the project review process indicate implementation of the proposed actions or alternatives would not have adverse effects on the identified SOC due to a lack of suitable habitat within the project areas (refer to **Table 4-1**). In addition, there are no designated critical habitats in the proposed action areas. The ESA Determination for each species is "no effect"; therefore, further consultation with the USFWS is not required.

Ground disturbance associated with construction of the pipeline to reroute effluent water from the WWTP (refer to **Figure 2-2**) or other associated construction activities (e.g., pipe stand, storage tank, solar-powered pumping stations, etc.) are not anticipated to have adverse effects on identified SOC.

Based on findings from the 2003 habitat delineation study, breeding habitat within the Playa for the southwestern willow flycatcher (*Empidonax traillii extimus*) and the western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) is marginal, limited in areas, and widely dispersed.[118] In a more recent study (2016) it was reported low numbers for these species within the playa are due to a lack of suitable habitat. Because habitat within the Playa is artificial and is already limited for both species, implementing Project No. 1 would have no effect on either species. However, water delivered to the Desert Emerald Park would have a benefit for vegetation growth that could provide habitat for yellow-billed cuckoo or western willow fly catcher. There would be no impacts to these species from the implementation of Project No. 1.

4.1.2 Cultural Resources

Impacts resulting from the proposed action would be considered significant if they were to:

- Detrimentally distress known cultural resources considered eligible for inclusion into the NRHP.
- Adversely affect the importance and the integrity of the WSMR Historic District.
- Harm or affect previously unidentified and recorded archaeological and historical resources.
- Result in extensive unauthorized artifact collection by personnel.
- Negatively disturb known Traditional Cultural Places (TCPs) on WSMR.

Construction or surface disturbances required under Project No. 1 lie within an area that has been fully surveyed for cultural resources, including TCPs. Currently, no eligible historic properties or cultural resource sites have been identified in the planned APE for Project No. 1; therefore, no adverse effects are anticipated to historic properties or cultural resources as a result of implementing this Project. However, if cultural resources are discovered during the construction phase of this Project, they would be avoided by repositioning project boundaries, altering pipeline routes or moving sites altogether.

In addition to avoidance measures, construction crews would receive briefings regarding limitations on artifact collection, non-restricted and restricted area identification, and procedures to be followed if unintentional encounters of cultural resources, including human remains, prior to construction actions. Should such an occasion take place during Project No. 1, program personnel would apply the appropriate SOP from the WSMR Integrated Natural and Cultural Resource Management Plan (INCRMP); ground disturbing activity(s) would stop; and WSMR archaeologists would be alerted immediately. WSMR archaeologists would then assess the Project individually to determine if further evaluation under Section 106 would be required by following practices and procedures outlined in the INCRMP.

4.1.3 Energy

Operation of the proposed WWTP pipeline to Desert Emerald Park using solar-powered pumps to convey an average of 200,000 gpd is achievable with commercially available solar pumps. Depending on the volume needed for daytime or evening irrigation, the solar-powered pumps can be selected from several vendors. The solar-powered pump station(s) would require backup power from the existing electrical grid, but neither the tie-in activity nor the occasional operation on base power would result in more than an inconsequential impact to the electrical system. The operation of new solar pumps would not impact the current WSMR energy electrical demand nor would it affect the current solar energy array. Additionally, by replacing the water currently being used for Desert Emerald Park irrigation that is pumped via the use of the existing electrical grid with effluent pumped via solar power, the overall consumption of commercially supplied electricity would be reduced and help WSMR achieve their Net Zero energy goal.

4.1.4 Facilities

Construction of new facilities would be localized to less than 6 acres adjacent to the Desert Emerald Park. A siting process through master plans would be used to identify a suitable location for this infrastructure which may preclude other land uses. The former golf course use would change.

The use of ~200,000 gpd on average of non-potable water to irrigate Desert Emerald Park would reduce the demand on the Main Post water supply wells by ~73 MGPY. This would decrease the annual average amount (446 MG, 2007-2014).[119] of fresh groundwater produced by 16.4 percent making that unused groundwater capacity available. The reduced production also moves WSMR closer to achieving their Net Zero water balance reduction goal.

4.1.5 Geology and Soils

4.1.5.1 Geology

Construction activities associated with the implementation of Project No. 1 would include trenching to a maximum depth of approximately 4 feet bgs, approximately 2 feet in width, and approximately 15,000 feet in length. Total affected volume would be approximately 4,500 cubic yards of soil. Minor construction activities would also include installing a pipe stand, storage tank, and solar-powered pumping station(s). The construction activities associated with Project No. 1 would be expected to have no impact on the geology at the proposed locations.

4.1.5.2 Soils

During the construction phase of Project No. 1, trenching and construction access would be required. Additionally, some minor soil grading, soil stockpiling, and compaction may be required and would increase the potential for soil erosion. Stockpiled soil, if required, would be covered to reduce dust. Construction ROWs would be approximately 25 feet in width for the length of the pipeline and would be placed in areas of existing ROWs when feasible. Pipeline trenching, installation, filling and revegetation activities are conservatively estimated at 2 weeks per mile. Total affected area of soil would be approximately 375,000 sq. ft. (8.6 ac). Removed soil could be spread in areas to help support the growth of vegetative cover, replace eroded soils, fill in depressions, etc. Although some grading, removal, and compaction of soils would be necessary, these activities would be in localized locations for short durations. Therefore, no long-term impacts on soils are anticipated from the construction activities.

The use of reclaimed wastewater to irrigate Desert Emerald Park would result in the application of excess nitrate concentrations (N 19 mg/L) and sodium being applied. When plants are irrigated in arid areas, the salts from the irrigation water become concentrated in the soil, which can cause soil to become "saline" and no longer fertile.[120] In addition to its direct effect on plants, sodium in irrigation water may alter soil structure, reducing the rate at which water can move into the soil as well as soil aeration capacity. If the infiltration rate is critically decreased, it may be impossible for plants to receive enough water for good growth.

High sodium or very low calcium content in the soil or applied water would result in a permeability problem in the surface layer. When the sodium adsorption ratio (SAR) reaches a certain level, the infiltration rate would decrease, or increase based on the level of salinity. Therefore, a combination of the SAR and electrical conductivity (EC) of the applied water can be used to assess the permeability. Reclaimed wastewaters are typically high in both salt and calcium, so any concern that the water might dissolve and leach too much calcium from the soil surface would not be valid. Reclaimed wastewaters with high sodium concentrations and therefore elevated SAR, is the major concern for wastewater irrigation projects.

Once nitrogen fertilizers are applied to ground surfaces, the fertilizers are absorbed directly by plants or converted into other forms via the oxidation process. Extra nitrogen is rerouted in ionic or gaseous form by leaching, volatilization, and denitrification.[121] Nitrate not taken up by plant roots is carried away by runoff or leaches into the soil along with water.

A study of nine golf courses irrigating with reclaimed water in arid and semiarid regions determined it was important to maintain positive leaching fractions[1] to minimize salt build up in the root zone.[122] However, with the consistent nitrate being applied via the reclaimed water, implementing positive leaching fractions can lead to increased downward movement of nitrate. It is therefore vital that below surface movement of nitrate be measured comparative to nitrogen loading under such conditions.

4.1.6 Land Use

Proposed locations for the storage facility and pipeline placement were based upon post-wide land classifications within the Main Post area. Activities associated with the proposed project would be consistent with WSMR's designated land use plan. Implementation of the proposed project would have no impact on the land use plan currently in effect.

Water reuse would benefit current land use at the Desert Emerald Park to enhance recreational opportunity, as well as improve forested or mature tree habitat for valued wildlife species. The proposed action would create internal land use benefits to mission objectives.

4.1.7 Noise

Minor short-term localized noise would be generated during pipeline placement and storage facility construction activities (~<10-weeks). Noise levels during construction are anticipated to be above that of normal daily operations when near occupied structures but would not be expected to exceed the OSHA-established maximum noise level of 90 decibels for a continuous 8-hour exposure during a working day.[123] Implementation of Project No. 1 is anticipated to have no impact on regional long-term noise levels.

There are residential areas within proximity of the Desert Emerald Park. In the past, residents have complained about construction noise associated with the storm water retention berm project on the west side. The magnitude of the impact the construction noise may have on the residences is typically unknown early in the project development stages; however, measures can be implemented during the design phase that can help to reduce the anticipated noise impacts at sensitive receptors. Nevertheless, design changes and modification to the pipeline route may not always be practical or feasible. Also, the magnitude of the noise reduction attained from the chosen BMPs is difficult to determine prior to and even possibly during construction. BMPs to consider include:

- **Storage Areas:** During the planning and design stages of the pipeline, storage area locations may be identified that are removed from sensitive receptors. If this is not possible, storage of materials, earth, or other supplies may be able to be positioned in a manner that would function as a noise barrier.
- **Detours:** Elevated noise generated by temporarily routing of traffic during construction is usually considered part of the construction noise. It is possible to reduce the impact from such changes during the design phases of the pipeline.

[1] The salts that make the water saline will accumulate within the root zone unless extra water is applied. The amount of water needed to flush the salts beyond the root zone is called the 'leaching fraction.'

- **Concurrent Operations**: It may be possible to schedule multiple noisy operations concurrently to take advantage of the combined noise levels not being significantly greater than the level that any one operation may produce if performed separately.
- **Early Construction of Noise Barriers:** Noise barriers that would be installed as part of the project to abate traffic or construction noise can be installed during the initial stages to reduce the noise impacts of the construction.
- **Compressors:** While most compressors are powered by diesel or gasoline engines, many have baffles to help abate noise levels. Electric compressors are significantly quieter than diesel or gasoline engine-powered compressors.
- **Contract Specifications and Special Provisions**: These are typically produced during the design stages and may be included in the project plans and contract documents. Ideally, use of these documents is considered in conjunction with other control methods to achieve an overall construction noise strategy. For example, noise-sensitive locations such as residences, institutions, hospitals, etc., would be held to a noise compliance levels as follows:
    - Daytime hours (7 AM – 6 PM): 75 dBA or baseline + 5 dBA with a max loud impact noise level of 85-90 dBA
    - Evening hours (6 PM – 10 PM): Baseline + 5 dBA with a max loud impact noise level of 85 dBA
    - Nighttime hours (10 PM – 7 AM): Baseline + 5 dBA > (if Baseline <70 dBA) >Baseline + 3 dBA (if Baseline 70 dBA)

For conventional pipeline laying (land clearing, trench digging and pipe placement), each crew works at the rate of between 0.75 mile and 2.5 miles per day depending on the terrain and size of pipe to be installed (e.g., if there are more trees, or the ground is very rocky, progress may be slower than otherwise). To enable the crews to work safely and efficiently there is often a delay between the arrival dates of each crew. Typically, it takes up to 6 weeks for all the crews to pass through an area and complete their tasks. Predicted noise emissions for typical pipeline construction is anticipated at 65 dBA or less at 825 feet from the construction activity.[124] If construction noise associated with the WWTP pipeline or Desert Emerald Park storage facility were to become a nuisance, migration measures such as these would be implemented so that the overall impact would be short term and at acceptable decibel levels considering the surroundings.

As activity levels increase at Desert Emerald Park, it is conceivable that increased recreation would elevate noise levels and potentially affect wildlife and nearby residents. These anticipated levels would comply with the suggested land use compatibility noise zones for the area.[125] Furthermore, because these noise levels could be mitigated with the use of park hours to regulate activities during traditionally more quiet hours or other means of control, there really is no concern that the noise would escalate to a level that would have a significate impact on wildlife or nearby residents.

4.1.8 Utilities and Infrastructure

The candidate pipeline routes and storage tank and pump station locations for wastewater effluent reuse would encounter some infrastructure and existing utilities during installation. A limited amount of traffic disruption on the Main Post would be required for pipeline placement and construction of storage facilities. Placement of the pipeline would occur in existing ROWs when feasible. Also, there would be some limited requirements for utilities once the system is completed: 1) the solar-powered pump station(s) would require backup systems tied into the electrical grid and flow monitoring, and 2) a dedicated domestic wastewater irrigation system separate from the existing potable water irrigation system would need to be established. Utility and infrastructure impacts from construction associated with

Project No. 1 would be similar to other construction activities, such as repairs to existing water lines, on Main Post and anticipated to be low.

Construction and operation of the proposed wastewater effluent reuse system components such as storage tanks and pump stations would exclude any other development at those proposed locations.

4.1.9 Water Resources

4.1.9.1 Surface Water

Reuse of WWTP effluent for irrigation, construction, or dust control is possible provided that the EPA water reuse guidelines for unrestricted urban reuse are followed.[126]

The pipeline routes identified from the WWTP to the proposed storage tank location at Desert Emerald Park (**Figure 2-2**) are located on the southern end of the Main Post. Surface water resources in this area are limited to ephemeral washes and arroyos. No surface water bodies are located near the proposed pipeline routes. Implementation of Project No. 1 would have no effect on the ephemeral washes or water bodies located within WSMR.

4.1.9.2 Groundwater

This proposed project involves routing treated domestic wastewater effluent from the WWTP to use as a source for landscape irrigation and construction activities. Currently, the WWTP discharges an average of approximately 200,000 gpd. The former golf course average summer usage was approximately 400,000 gpd, whereas in the winter months the usage drops down to approximately 60,000 gpd.[127] The Desert Emerald Park is anticipated to require less water.

It is assumed the irrigation needs of the Desert Emerald Park may need to be augmented during the summer months with water from the WSMR groundwater supply wells. Domestic wastewater irrigation systems cannot have any direct or indirect connections to potable water systems; therefore, the installation of a separate redundant domestic wastewater irrigation system would be needed at Desert Emerald Park if the summer make-up water were to be supplied from the potable system. If an alternative source of non-potable water can be used to augment irrigation during the summer high demand season, the redundant irrigation system would not be needed.

Development and use of reclaimed wastewater for Desert Emerald Park irrigation would reduce potable water use by as much as 73 MGPY. Currently, the irrigation needs for Desert Emerald Park constitute the single largest consumer of potable water on the base.[128] If this demand is replaced with reclaimed domestic wastewater, the potable water capacity produced from WSMR groundwater wells is increased and available for other uses, including possible population increase. The current average annual withdrawal from the 15 groundwater supply wells is 446 MG as compared to the average annual natural groundwater recharge rate of 626 MG.[129] The difference between current average withdrawal and average recharge is 180 MG. The reduction of potable water demand by using treated domestic wastewater for irrigation alone would increase the difference or current surplus capacity between withdrawal and recharge rate by 44 percent to an annual average of 266.5 MG. The long-term safe yield of 645 MGPY represents the pumping amount, which balances the expected natural recharge of the aquifer and considers the prevention of saline intrusion.

The use of treated domestic wastewater that meets the EPA water reuse guidelines for unrestricted urban reuse can be used for irrigation of sports fields, parks and golf courses and is considered suitable for uses in which public exposure is likely. To meet this standard, monitoring is required for pH, BOD_5, turbidity, Fecal Coliform, chlorine, and Total Residual Chlorine (TRC) or UV Transmissivity. This testing would not increase or result in a burden, as the WWTP effluent is currently sampled and tested on a regular basis. By meeting the EPA water reuse guideline criteria for unrestricted urban reuse, the water is recognized as safe for the intended uses and protective of the groundwater aquifer. Although the WWTP effluent generally meets these water reuse guidelines, it also contains nitrates at 19 mg/L, above the safe drinking water standard of 10 mg/L. Using reclaimed wastewater with elevated nitrate levels to irrigate parks is recognized as an acceptable and beneficial use; however, it can pose an environmental risk to the groundwater

WSMR, therefore, must determine the quality of the reclaimed wastewater for use in irrigation considering the potential vulnerability to the underlying known fresh groundwater. Once the reclaimed water quality is determined, the potential for impacts to the groundwater can be evaluated based upon site-specific conditions. An evaluation of effluent quality for irrigation would assess the anticipated vegetation mineral uptake, soil types, depth to fresh water, and alluvial fan composition to determine the water quality reaching the groundwater and thus, the potential impact, if any.

Results published from both conventional agricultural studies and turfgrass studies (golf course) indicate that the main driving force behind nitrate leaching losses is directly related to the specific characteristics of the soil-plant system and the fertilizer and irrigation timing and amounts.[130] As discussed in the golf course study, solution extraction cups were inserted at depths of 15, 45, 75, and 105 cm on fairways and sampled and analyzed for nitrate on a monthly basis. Distribution patterns of nitrate varied from site to site. Concentrations exceeding 100 mg/L were observed at the 105-cm depth on all three long-term reuse courses. The results of this study indicate a need for a more scientific approach to nitrogen management on reuse-irrigated courses. As mentioned, agencies have set nitrate standards for drinking water at 10 mg/L; concentrations above this level do not by themselves indicate that a compelling environmental risk is inevitable. Instead, the environmental threat needs to be weighed based on mass loading, which means concentrations should be assessed with appropriate drainage fluctuations. Although nitrate concentrations were measured as high under the golf course fairways in the referenced study, leaching fractions estimated at the monitoring sites were relatively low with an inverse relationship between yearly average nitrate concentrations and leaching fractions. Still, the fact that nitrate concentrations in the 105-cm deep cups were considerably higher under reuse-irrigated fairways verses transitional fairways remains troubling. The study results seem to suggest that movement of nitrate into deep soils might be related to excess nitrogen loading per year. Without monitoring and measuring the nitrogen loading and leaching fractions at Desert Emerald Park, it is impossible to predict the nitrate downward movement and potential impact to the potable groundwater in the Tularosa basin beneath the irrigated area.

On the other hand, a USGS study conducted in cooperation with Holloman Air Force Base and the City of Alamogordo to simulate the flow of groundwater in the basin-fill aquifer of the Tularosa Basin indicates that the WSMR potable water supply is recharged from an area in the Organ Mountains and not from the irrigation water used on the Post.[131] It further indicates that the majority of the precipitation is lost to evaporation, and that the hydraulic conductivity is about 10 feet/day and decreases to the east. Based on this information, groundwater from Desert Emerald Park to the WSMR potable water supply wells would take approximately 528 days and from the nearest sports field would be 198 days.

Based on this information, nitrate infiltration from irrigating the Desert Emerald Park with WWTP reclaimed water is not anticipated to alter the current nitrate levels in the groundwater wells within the Main Post. However, mitigation measures to eliminate or reduce nitrates from reaching the groundwater would be appropriate to implement. It is recommended that WSMR use the potable water to augment the irrigation water supply of the Desert Emerald Park during high demand spring and summer months. This will provide a positive leaching factor and diluting the nitrates delivered by the use of the reclaimed wastewater during heavy use months. Furthermore, it is suggested that WSMR, install a monitoring well so that water quality can be evaluated after percolation through the vadose zone or unsaturated part of the earth between the groundwater and the land surface. Analyzing the water quality from the monitoring well on a quarterly basis annually for the first couple of years should provide suffice data to correlate with the WWTP effluent quality. This should provide sufficient data to indicate the source of potable groundwater under the Main Post is not receiving elevated levels of nitrates or other constituents of concern.

TABLE 4-2: PROJECT NO. 1 – SUMMARY OF IMPACTS

VEC	Rank	Forecasted Effects	Projected Outcomes
Biological Resources	High	**Vegetation:** Physical changes in vegetative community composition is not expected, however, long-term use of reclaimed water, high in nitrates, would result in increased soil salinity.	Proper irrigation management, based on a multitiered feedback system (soil–plant–atmospheric monitoring), would maintain favorable salt balances and plant responses.
		Deficit irrigation volume could be an issue as the WWTP would not produce enough reclaimed water at its current rate to irrigate Desert Emerald during the high-demand summer months.	The Desert Emerald irrigation water supply would be augmented with available sources from either the existing WSMR drinking water or water from Well No. 16.
		A further reduction of wastewater effluent received by the Playa would result in the continued degradation of available wetland and associated riparian habitat.	WWTP effluent volume sent to the Playa could be monitored and adjusted to avoid degradation, if deemed appropriate.
		Wildlife: Minor-to-negligible impacts to wildlife species that inhabit or utilize the Playa since existing wetland and riparian habitat is considered marginal. Additional water received at the Desert Emerald Park would enhance existing habitat for Monarch butterflies, Vermillion fly-catchers and others, as well as enhance the present vegetation. There would be no impacts to these species from the implementation of Project No. 1.	Beneficial outcome projected for Desert Emerald Park and potential preservation of certain obligate and facultative wet vegetative species may enhance marginal wildlife habitat in the Playa.
		The enhancement of existing habitat at the Desert Emerald Park would attract more wildlife and increase the potential for negative human-wildlife interactions (*e.g.,* rattlesnakes, coyotes, bobcats, cougars, insect pests such mosquitoes, ticks, bees, wasps, etc.).	Information/warning signs would be installed and brochures available to educate people of the potential interactions with wildlife, as well as how to mitigate negative human-wildlife interactions when visiting the Park.
		Construction of the pipeline would not be expected to cause permanent displacement or have any other adverse effects to wildlife resources.	To minimize impacts to birds, construction or ground disturbing activities would take place during the non-nesting season.
		Species of Concern: The ESA determination for each species is “no effect.”	Consultation with the USFWS is not required.
		Additional water delivered to the Desert Emerald Park would benefit vegetation growth that could provide habitat for yellow-billed cuckoo or western willow fly catcher. There would be no impacts to these species from the implementation of Project No. 1.	Beneficial outcome projected.
		Artificial habitat within the Davies Playa would continue to be marginal for the yellow-billed cuckoo and western willow fly catcher.	Water levels within the Playa would be maintained at existing levels to support habitat for the yellow-billed cuckoo and western willow fly catcher.
Cultural Resources	Moderate	All surface-disturbing activities would be conducted in areas surveyed for cultural resources with no known cultural properties.	Cultural resources would be avoided.
		Potential unintentional encounters of cultural resources.	Construction crews would be educated on artifact collection and how to report a finding of an unknown historic cultural resource.

Table 4-2: Project No. 1 – Summary of Impacts

VEC	Rank	Forecasted Effects	Projected Outcomes
Energy	Moderate	The solar-powered pump station(s) would supply most of the energy required to move WWTP effluent, but occasional backup power from the existing electrical grid would be needed.	Use of solar-powered energy would reduce overall commercially supplied electricity and help WSMR achieve their Net Zero energy goal.
Facilities	High	The annual average fresh groundwater produced would be decreased by 16.4 percent.	The unused fresh groundwater would be available for WSMR to use elsewhere.
Geology & Soils	Moderate	**Geology:** There would be no impacts to the geology.	Beneficial outcome.
		Soils: Construction impacts and compaction of soils would increase potential for erosion from wind and rain in localized locations for short durations.	Removed soil could be spread in areas to help support the growth of vegetative cover, replace eroded soils, and fill in depressions.
		Increased watering of Desert Emerald Park would decrease bare ground surface and help prevent conditions that would cause erosion.	The grass and tumbleweeds would grow, providing increased ground cover subsequently reducing erosion potential. .
		Watering with elevated nitrates would potentially increase saline concentrations, causing structural alterations to soils, reducing the rate at which water can move into the soil, as well as, soil aeration capacity.	Monitor the SAR and EC values of the applied water to assess the permeability and maintain positive leaching fractions with augmented fresh water supply would minimize salt build up.
Land Use	High	Proposed actions would not affect the land use designation.	Activities would be consistent with WSMR's land use plan.
Noise	Moderate	Minor, temporary construction noise is anticipated during pipeline placement.	Various BMPs would be employed to maintain normal Main Post background noise levels.
		With increased activity at Desert Emerald Park it is conceivable that noise levels would be elevated and temporarily affect wildlife and nearby residents.	These noise levels would be mitigated with the use of restricted park hours or other means of control.
Utilities and Infrastructure	Low	A limited amount of traffic disruption on the Main Post would be required for pipeline placement and construction of storage facilities.	Work with traffic issues would be addressed as they arise to limit impacts to normal base roads, etc.
Water Resources	High	**Surface Water:** Diverting WWTP effluent for irrigation use would likely result in longer and more frequent periods of reduced water flow to Davies Playa.	Cutting off complete flow to Davies Playa is not planned even during high demand summer months.
		Groundwater: The reduction of potable water demand by using treated domestic wastewater for irrigation would increase the difference or current surplus capacity between withdrawal and recharge rate by 44 percent.	The potable water consumption from WSMR groundwater wells would be decreased, resulting in more freshwater available for other base uses without having to modify existing infrastructure.
		If unused water rights were taken from WSMR and used by others, the groundwater aquifer could be negatively impacted by withdrawals exceeding the recharge rate and allowing saline intrusion from surrounding aquifers.	WSMR would maintain its unused water rights to preserve the water quality of the aquifer and to be prepared for possible military personnel influx.
		There is a potential for increased downward movement of nitrate into deep soils and possibly affecting the groundwater by elevating the nitrate concentration above drinking water standards of 10 mg/L.	Consistent monitoring of the nitrogen loading and leaching fractions at Desert Emerald Park along with the installation of a monitoring well to evaluate water quality reaching the aquifer would allow mitigation measures to be taken to prevent below-surface movement of nitrate during normal irrigating conditions.

4.2 Project No. 2: Well No. 16 Water Repurpose

Raw water supplied from Well No. 16 is a viable source that can be used for dust control or to irrigate several sport fields and the Desert Emerald Park during summer and non-summer months, effectively reducing the potable water demand at WSMR. Pumping raw water from Well No. 16 for landscape irrigation or construction use may have a positive effect of preventing nitrate concentration increases in nearby wells by withdrawing groundwater containing elevated nitrates.[132]

A summary of Project No. 2's forecasted effects and projected outcomes are provided at the end of this section in **Table 4-4**.

4.2.1 Biological Resources

4.2.1.1 Vegetation

The use of water from a repaired Well No. 16 as an additional beneficial use would require installation of a water pipeline. As with Project No. 1, the proposed pipeline route (refer to **Figure 2-2**) would primarily be constructed in Military disturbance areas, and when feasible, would be placed within existing ROWs. Impacts associated with construction of the pipeline (and associated construction activities) are not anticipated to adversely affect vegetative resources on the Main Post or along the pipeline route.

Impacts from the use of repurposed water with nitrate levels at 9 mg/L would be similar but less dramatic and delayed when compared to the impacts described under Project No. 1 with elevated nitrate levels (19 mg/L). As previously reported, the long-term use of water high in nitrates would likely result in increased soil salinity at various depths; however, this increased salinity may not lead to a subsequent systematic decline in plant health. Furthermore, data showed soil salinity on lands was statistically higher than if fresh water was used, although plant responses were not statistically different on lands where fresh water was used. It was concluded that proper irrigation management, based on multitiered feedback, could maintain favorable salt balances and plant response if irrigation volumes were not restricted to where deficit irrigation occurred. As with Project No. 1, appropriate BMPs would need to be implemented to avoid the negative impact of salt accumulation in the soils that would result by using repurposed water with elevated nitrate concentrations.

Deficit irrigation volumes should not be an issue as Well No. 16 can produce sufficient quantities for year-round irrigation of both Desert Emerald Park and the sports fields.

The existing flow of wastewater effluent to the Davies Playa would maintain the current wetland and associated riparian vegetation, and possibly preserve existing population sizes of obligate and Facultative Wet (FACW) vegetative species (e.g., duckweed [*Lemna minor*], pale spikerush [*Eleocharis palustris*], common reed [*Phragmites australis*], etc.). Therefore, impacts associated with the implementation of this Project would be similar to Project No. 1.

4.2.1.2 Wildlife

The use of water from Well No. 16 as an additional beneficial use would require installation of pipeline within the Main Post area. As with Project No. 1, the proposed pipeline route (refer to **Figure 2-2**) may cause temporary displacement or avoidance impacts to small mammals, but overall, would not be expected to cause adverse effects to wildlife resources. Other construction activities (e.g., pipe stand, storage tank, solar-powered pumping stations, etc.) associated with the proposed action would have nominal effects on wildlife.

Benefits to wildlife at the Desert Emerald Park and associated BMPs would be similar to those described for Project No. 1.

4.2.1.3 Species of Concern

As with Project No. 1, ground disturbance associated with installation of the Well No. 16 pipeline to route beneficial use water (refer to **Figure 2-2**), or other construction activities (e.g., pipe stand, storage tank, solar-powered pumping stations, etc.), are not anticipated to have adverse effects on identified SOC.

As noted under Project No. 1, breeding habitat within the Playa for the southwestern willow flycatcher and the western yellow-billed cuckoo is marginal, limited in areas, and is widely dispersed. Therefore, implementing Project No. 2, and maintaining the current wastewater effluent discharge to the Playa, would retain the status quo for these species. Water delivered to the Desert Emerald Park would have a benefit for vegetation growth that could provide habitat for yellow-billed cuckoo or western willow fly catcher. There would be no impacts to these species from the implementation of Project No. 2.

4.2.2 Cultural Resources

Foreseen impacts would be the same as describe for Project No. 1, as a result there are no adverse impacts anticipated to the cultural resources from the implementation of Project No. 2.

4.2.3 Energy

Operation of the proposed Well No. 16 pipeline to Desert Emerald Park using solar-powered pumps to convey the needed water at nearly 550,000 gpd during peak demand months is achievable with commercially available solar pumps. The solar-powered pump station(s) would require backup power from the existing electrical grid, but neither the tie-in activity nor the occasional operation on base power would result in more than an inconsequential impact to the electrical system. As with Project No. 1, the operation of new solar pumps would not impact the current WSMR energy electrical demand nor would it affect the current solar energy array. Additionally, the use of solar-powered energy would reduce overall commercially supplied electricity and help WSMR achieve their Net Zero energy goal.

4.2.4 Facilities

The Desert Emerald Park should require less than 400,000 gpd on average (~335,000 gpd) of non-potable water during the summer months to irrigate. Also, reusing water to irrigate the various recreational areas would reduce the demand on the Main Post water supply wells by ~122.5 MGPY. This would decrease the annual average (446 MG, 2007-2014) amount of potable fresh groundwater produced by ~27.5 percent making that unused capacity available for WSMR uses. The reduced production also moves WSMR closer to achieving their Net Zero water balance reduction goal for potable water use.

Table 4-3 summarizes the available water supplies and estimated, or necessary water needs to implement the proposed actions under Project No. 2.

TABLE 4-3: SUMMARY OF AVAILABLE WATER SUPPLY AND WATER NEEDS FOR RECREATIONAL USES

Water Source and Available Water Supply Volumes	
Source	**Available Water Supply**
Wastewater Treatment Plant	≈200,000 gpd (refer to **Section 3.15.4**)
Well 16	≈116,666 GPD to 1,080,000 gpd (refer to **Section 3.8**)
Water Needs per Recreational Use	
Desert Emerald Park	87 MGA or 400,000 gpd (peak demand)
Sport Fields	35.5 MGA or ≈162,000 gpd (peak demand)
Total Required Volumes	≈122.5 MGA or ≈562,000 gpd (peak demand)

4.2.5 Geology and Soils

4.2.5.1 Geology

Foreseen impacts would be the same as described for Project No. 1. As a result, there are no adverse impacts anticipated to the geology from the implementation of Project No. 2.

4.2.5.2 Soils

Foreseen impacts for the pipeline construction and pump / tank installation activities would be the same as described for Project No. 1, resulting in ~330,000 sq. feet (7.6 ac) of affected soil (2.5 miles long x 25 feet wide). There are no adverse impacts anticipated to the soils from the construction of Project No. 2.

The use of repurposed water to irrigate Desert Emerald Park, sports fields and green spaces would result in the application of elevated nitrate concentrations (N 9 mg/L) being applied that could potentially lead to nitrate infiltration via leaching. Therefore, as described under Project No. 1, similar BMPs and monitoring would be appropriate to maintain positive leaching fractions; in addition, measuring the below-surface movement of nitrate would be suitable.

Again, limited watering at Desert Emerald Park has resulted in the reduction of grasses and the increase of tumbleweed growth, which is anticipated to be followed by increased bare ground, and subsequent erosion. The use of the repurposed water for irrigation at Desert Emerald Park would stay these impacts and eventually reverse their effects on the soils and vegetation in the short term.

4.2.6 Land Use

Impacts to Land Use under Project No. 2 would be the same as described for Project No. 1.

4.2.7 Noise

Impacts from noise generation under Project No. 2 would be the same or similar to those described for Project No. 1. However, construction noise would be elevated somewhat for residential dwellings, schools, and some offices, as the pipeline route would necessitate activities in closer proximity to these structures and the need for BMPs, albeit short term, may be required more frequently.

4.2.8 Utilities and Infrastructure

Impacts to utilities and infrastructure under Project No. 2 would be the same as described for Project No. 1 apart from the installation of an irrigation system for reclaimed water. The irrigation system could be fitted with higher pressure and longer trajectory spray nozzles.

4.2.9 Water Resources

4.2.9.1 Surface Water

The pipeline route from Well No. 16 to the Desert Emerald Park would have no effect on the ephemeral washes or water bodies located within WSMR as the setting is like that described for Project No. 1. No impact to surface water would be anticipated with the implementation of Project No. 2.

4.2.9.2 Groundwater

Water provided for irrigation and dust suppression by implementation of Project No. 2 would not affect groundwater quality, as raw water from the Well No. 16 has been previously used for drinking water and currently meets the Federal and State Drinking Water Standards. Monitoring of water from Well No. 16 to comply with EPA Water Reuse Guidelines may be necessary for use as landscape irrigation and construction activities if the nitrate levels were to exceed 10 mg/L.

Groundwater depletion, recognized as long-term water-level declines, would not be anticipated from the sustained groundwater pumping of Well No. 16. This water would be withdrawn from Well No. 16 to replace potable water being withdrawn from other wells in the Tularosa Basin that currently serve the base, thus making the gross volume withdrawn from Tularosa Basin unchanged. The average Tularosa Basin annual withdrawal is 431.3 MGA or 54 percent (507.7 MGA) below the maximum beneficial use by WSMR as recorded in 1971, and 33.1 percent (213.7 MGA) below the safe long-term yield of 645 MGA.[133]

During peak summer demand it is estimated that the volume of water from Well No. 16 required to adequately sustain the athletic fields (~162,000 gpd) and the Desert Emerald Park (~400,000 gpd) would be approximately 562,000 gpd (392 gpm) (refer to **Table 4-3**). This level of production would likely drawdown[1] Well No. 16 but, given that the annual withdrawal would not be excessive, there would be ample time to replenish the groundwater over the non-peak months. Also, it is conceivable that during the peak demand months the water table would be lowered around Well No. 16, but it is not anticipated that the well would need to be deepened, the pump lowered, or the rate of water yield declined.

Another threat to fresh groundwater supplies during drawdown is contamination from possible mineral intrusion. It is anticipated that impacts on surrounding groundwater quality from large withdrawals of water from Well No. 16 would be limited to the volume of groundwater removed from the aquifer. Moreover, since the total withdrawal would be the same or relatively similar and the peak demand would be limited to a typical three-month period annually, it is not foreseen that the implementation of Project No. 2 would result in elevated mineral content above the federal or state safe drinking water standards. In fact, pumping raw water from Well No. 16 for landscape irrigation or construction use may have a positive effect of preventing nitrate concentration increases in nearby wells by withdrawing groundwater containing elevated nitrates.[134]

TABLE 4-4: PROJECT NO. 2 – SUMMARY OF IMPACTS

VEC	Rank	Forecasted Effects	Projected Outcomes
Biological Resources	High	**Vegetation:**	
		Physical changes in vegetative community composition is not expected; however, long-term use of reclaimed water, high in nitrates, would result in increased soil salinity.	Proper irrigation management, based on a multitiered feedback system (soil–plant–atmospheric monitoring), would maintain favorable salt balances and plant responses.
		Irrigating during plant growth seasons would ensure maximum plant uptake of nitrate.	This would aid in maintaining favorable salt balances and plant responses.
		The existing flow of effluent water to Davies Playa is expected to be maintained.	The current function and size of the hydrophytic vegetative communities would be unchanged.
		Wildlife:	
		Additional water received at the Desert Emerald Park would enhance existing habitat for Monarch butterflies, Vermillion fly-catchers and others, as well as enhance the present vegetation.	Enhance habitat would add to employees, residents, and NGO organizations enjoyment and increase the value the Desert Emerald Park has for its diversity, accessibility, and solitude.
		The enhancement of existing habitat at the Desert Emerald Park would attract more wildlife and increase the potential for negative human-wildlife interactions (*e.g.,* rattlesnakes, coyotes, bobcats, cougars, insect pests such mosquitoes, ticks, bees, wasps, etc.).	Information/warning signs would be installed and brochures available to educate people of the potential interactions with wildlife, as well as how to mitigate negative human-wildlife interactions when visiting the Park.
		Minor to negligible impacts to wildlife species that inhabit or utilize the Playa since existing wetland and riparian habitat is considered marginal.	The use and number of wildlife species inhabiting the playa would largely go unchanged.
		Construction of the pipeline would not be expected to cause permanent displacement or have any other adverse effects to wildlife resources.	To minimize impacts to migratory birds, construction or ground disturbing activities would not take place during the nesting season (March through August) without performance of a nest survey.

[1] To estimate drawdown, it would need to be determine if the well has had a "pumping test." This test measures pumping and recovery rates over time. If not, one would need to be performed.

TABLE 4-4: PROJECT NO. 2 – SUMMARY OF IMPACTS

VEC	Rank	Forecasted Effects	Projected Outcomes
		Species of Concern: Preserving wastewater effluent discharge to the Playa, would retain the status quo for SOC.	
		Additional water delivered to the Desert Emerald Park would have a benefit for vegetation growth that could provide habitat for yellow-billed cuckoo or western willow fly catcher.	
Cultural Resources	Moderate	All surface-disturbing activities would be conducted in areas surveyed for cultural resources with no known cultural properties.	Cultural resources would be avoided.
		Potential unintentional encounters of cultural resources.	Construction crews would be educated on artifact collection and how to report a finding of an unknown historic cultural resource.
Energy	Moderate	The solar-powered pump station(s) would require backup power from the existing electrical grid.	Use of solar-powered energy would reduce overall commercially supplied electricity and help WSMR achieve their Net Zero energy goal.
Facilities	High	The annual average fresh groundwater produced would be decreased by 27.5 percent.	The reduced production moves WSMR closer to achieving their Net Zero water balance reduction goal for potable water use.
Geology & Soils	Moderate	**Geology:** There would be no impacts to geology.	
		Soils: Construction impacts and compaction of soils would increase potential for erosion from wind and rain in localized locations for short durations.	Removed soil could be spread in areas to help support the growth of vegetative cover, replace eroded soils, and fill in depressions.
		Increased watering of Desert Emerald Park would decrease bare ground surface and help prevent conditions that would cause erosion.	The grass and tumbleweeds would grow, providing increased ground cover subsequently reducing erosion potential. .
		Watering with elevated nitrates would potentially increase saline concentrations, causing structural alterations to soils, reducing the rate at which water can move into the soil, as well as, soil aeration capacity.	Monitor the SAR and EC of the applied water to assess the permeability and maintain positive leaching fractions to minimize salt build up in the rhizosphere.
Land Use	Moderate	Proposed activities would be consistent with WSMR's land use plan.	
Noise	Moderate	Minor, temporary construction noise is anticipated during pipeline placement.	Various BMPs would be employed to maintain normal Main Post background noise levels.
		With increased activity at Desert Emerald Park it is conceivable that noise levels would be elevated and potentially affect wildlife and nearby residents.	These noise level could be mitigated with the use of restricted park hours or other means of control.
Utilities and Infrastructure	Low	A limited amount of traffic disruption on the Main Post would be required for pipeline placement and construction of storage facilities.	Work with traffic issues would be addressed as they arise to limit impacts to normal base roads, etc.
Water Resources	High	**Surface Water:** No effect on the ephemeral washes or reservoirs located within WSMR.	
		Groundwater: The reduction of potable water demand by using water from Well No. 16 for irrigation would leave the gross volume withdrawn from Tularosa Basin largely unchanged.	
		Pumping raw water from Well No. 16 may have a positive effect of preventing nitrate concentration increases in nearby wells by withdrawing groundwater containing elevated nitrates.	Beneficial Outcome.
		Pumping raw water from Well No. 16 may result in encroachment of minerals laterally into the fresh groundwater resulting in elevated TDS.	Tracking of the total withdrawal so that the amount would not exceed the current levels and limiting peak demand to a three-month period annually would mitigate mineral encroachment.

4.3 Project No. 3: Non-hazardous Solid Waste Water Disposal or Reuse

Discharge water generated at WSMR from military RDT&E operations, boiler blow-off, and HVAC maintenance, etc., has been determined to be non-hazardous solid waste,[135] and is currently containerized and trucked off site for disposal under a contract. As part of RDT&E operations, WSMR customers expect to conduct annual assessments at their test facility using salt water that mimics ocean conditions. To date, one test has been conducted, and analysis of the waste stream (29,000 mg/L salt) indicated the generated water is not a hazardous waste.[136]

The current off-site disposal method is not cost effective.[137] Exploring additional disposal methods for this solid waste water to include beneficial uses could help WSMR reduce disposal costs and potable water demand.

Boiler water blow-off, HVAC water discharged, and any other non-hazardous solid waste created from WSMR activities would also be considered for reuse options. However, because the discharged water from these activities is anticipated to have limited availability (every 5-10 years) and relatively low discharge volumes, these water sources are not considered critical to the implementation of any of the reuse or disposal options defined within this EA. When available, the disposition of these waters would be discerned, and if appropriate, reused or disposed via the selected reuse and/or disposal option(s) described under Alternative 3.

Based on the options analyzed below, only options 3, 7, and 8 are viable. A summary of Project No. 3's forecasted effects and projected outcomes are provided at the end of this section in **Table 4-5**. Note: Proposed Outcomes are not summarized in **Table 4-5** if the proposed action or project option is anticipated to have "No Impact" on the associated resource.

Disposal or Reuse Project 3, Options 1 & 2: Surface Land Application or Dust Suppression on Roadways

Use of the non-hazardous solid waste water for surface application or dust control is not a viable option as the application is not allowed by regulation (RCRA Subpart D). See **Section 3.15.3**.

Disposal or Reuse Project 3, Option 3: Various Off-Site Disposal Options

An additional off-site disposal option for the non-hazardous solid waste water could include injecting the salt water waste stream into a non-hazardous Class I well permitted under the SDWA. According to the USEPA, there are approximately 800 Class I wells in the United States. However, according to the NMED, no Class I Wells are in New Mexico. In addition, no Class I wells are in the State of Arizona. There are three non-hazardous permitted Class I wells in Texas, the closest being in Perryton, Texas, approximately 500 miles from WSMR. In addition, assuming a 4,000-gallon water truck capacity and an average speed of 60 mph, a total of 285 trips or approximately 4,560 labor-hours would be required on an annual basis to dispose the non-hazardous solid waste water via Class I disposal.

Disposal or Reuse Project 3, Option 4: Dust Control in Weapon Test Impact Areas

Using non-hazardous solid waste water, such as salt water from testing activities, for dust control in weapon test impact areas would not be appropriate as the discharge water is classified as a solid waste, and the application onto land is not allowed by regulation (RCRA Subpart D). See **Section 3.15.3**.

Disposal or Reuse Project 3, Option 5: Discharge into an Existing Wastewater Treatment System at the High-Energy Laser Systems Test Facility (HELSTF)

Under this option, the non-hazardous solid waste water would be transported to the HELSTF for disposal within an existing lined unpermitted wastewater treatment system.

The wastewater evaporation ponds at HELSTF are unpermitted and cannot accept non-hazardous solid waste water without a RCRA subtitle D permit. Disposal into the wastewater pond at HELSTF may render the system ineffective for its designed wastewater treatment.

Disposal or Reuse Project 3, Option 6: Discharge into the Existing Brine Pond at the Stallion Range Center

The existing unlined brine pond is part of the Stallion Water Supply System. It was formed by the discharge of reverse osmosis backwash water. The Stallion brine pond is not permitted and cannot accept non-hazardous solid waste without a RCRC subtitle D permit.

Disposal or Reuse Project 3, Option 7: Evaporation Lined Pond (*to be constructed*)

Under Project 3, Option 7, WSMR would construct a lined evaporation pond to receive non-hazardous solid waste water ranging from a minimum amount of 60,000 gallons and a maximum amount of 450,000 gallons multiple times a year. However, a double-lined pond with a leak detection system may be required. The liners must be impervious to any seepage of water. Several types of liners are available, including polyvinyl chloride, high-density polyethylene (HDPE), butyl rubber, and Hypalon. It would be a BMP for the evaporation pond(s) to be lined with a material that is chemically compatible with the waste, resistant to deterioration by sunlight, and have a minimum thickness of 40 millimeters.

Example dimensions of an impoundment capable of holding 510,000 to 900,000 gallons of water would be approximately 200 feet by 200 feet, and six feet in depth (to include at least two feet of freeboard). The impoundment would hold ~1,196,500 gallons when filled. The evaporation rate as measured at the Jornada Experimental Range by the National Oceanic and Atmospheric Administration is 90 inches annually or 60 inches between the months of May and October and 31.4 inches between November and April.[138] This level of evaporation would be enough to vaporize the 570,000 gallons (~23 inches height in impoundment) expected to be discharged into the impoundment every six months.

Water received by the pond would evaporate through natural processes and would leave a non-hazardous concentrated solid waste that would be regulated under 40 CFR 239 – 259 and as such, require disposal at a permitted landfill. The generated solid waste would require disposal at a permitted landfill approximately every five years.

Disposal or Reuse Project 3, Option 8: Treatment at a Water Reclamation Plant (*to be constructed*)

A mobile pre-engineered water treatment system (skid mounted) can be fitted with a desalination reverse osmosis system (DROS). This system would only need to initially treat ~1,140,000 gallons annually but could be scalable to treat larger volumes if tenant testing were to increase; that makes this option worth investigating. The pre-engineered DROS is typically skid mounted or built inside metal shipping containers and delivered fully-functional with no need for on-site system assembly, pipe work, electrical wiring or mounting of components. A new DROS could be co-located at the WWTP as it would only need a small footprint. The DROSs are capable of producing drinking water quality water (salt content less than 500 ppm) from a source with salinity up to 37,500 ppm at a rate of 5,000 to 25,000 gpd. Energy consumption is often a big concern in managing a DROS plant; however, it could be operated with solar power. Another option may be renting a DROS to cover periodic treatment needs. There are DROSs that are deployed as stand-alone units or in combination to form complete systems.

The impacts of operating such a unit would be minimal as the location would be at the existing WWTP, and the effluent would-be high-quality water that could be released to Davies Playa or used for irrigation. It is envisioned that the non-hazardous solid waste water would be delivered to the DROS unit at the WWTP via water truck as the operation of the unit would be periodic and would not require a permanent connection. Furthermore, a small storage tank capable of holding the daily volume (10,000 gallons) could be installed adjacent to the unit.

4.3.1 Biological Resources

4.3.1.1 Vegetation

The construction of a lined evaporation pond (Project 3, Option 7) or the reclamation plant (Project 3, Option 8, reclamation treatment facility) would require ground disturbance activities that would have minor, temporary impacts on vegetative resources.

4.3.1.2 Wildlife

Low to moderate wildlife impacts would be anticipated from the implementation of Project 3, Option 7, (lined evaporation ponds) without the use of BMPs. High-saline waters in the ponds could present potential hazards to wildlife in situations when the ponds are used for drinking, feeding, or resting.[139] Wildlife hazards associated with the saline water could include the toxic effects from ingestion of the salts, osmotic imbalances from consuming or resting on the water, and entrapment or mortality due to salt encrustation.[140] In addition, high salinity levels may harm the reproductive health of certain waterfowl.[141]

There is also the potential for the non-hazardous solid waste water to contain trace concentrations of selenium. Elevated concentrations of selenium have been shown to increase the risk of adverse impacts to the health and reproductive success of waterfowl and shorebird species[142] due to accumulation in the aquatic food chain. Based on a review of field and laboratory data, concentrations of selenium greater than (0.002 mg/L) in water can undergo bioaccumulation[143]. Although the effects of selenium on birds has been shown to vary by species, the commonly cited effect threshold for reproductive impairment for water bird eggs (or embryotoxicity) is 10 mg/L, or 3 mg/L.[144] Specific to waterfowl, 10 – 25 mg/L of selenium caused significantly more deformed embryos, and exposure to 100 mg/L or greater was lethal.[145]

Wildlife protective measures around lined evaporation ponds could include active or passive methods such as fencing around the pond or netting above the pond. In addition, as a best management practices, the non-hazardous solid waste water would be sampled and characterized prior to discharge into the evaporation pond to ensure selenium levels are below the threshold for reproductive impairment or embryotoxicity.

If selected, disposal and/or reuse options that would require ground disturbance activities (e.g., evaporation pond or water reclamation plant construction) may cause temporary displacement or avoidance impacts to small mammals during construction activities.

4.3.1.3 Species of Concern

The evaluation of alternative disposal and/or beneficial reuse options for non-hazardous solid waste water is not anticipated to adversely affect identified SOC in the area. In addition, if selected, disposal and/or reuse options that would require ground disturbance activities (e.g., evaporation pond or water reclamation plant construction) would have no effect on SOC.

4.3.2 Cultural Resources

The disposal or beneficial reuse of non-hazardous solid waste water, including the placement and construction of a lined evaporation pond or a water reclamation plant, would not be conducted or constructed in areas that would affect historic properties or cultural resources. Environmental coordination through the sitting process will help avoid impacts to cultural resources or historic properties.

4.3.3 Energy

Project 3, Options 3, 7, and 8, are considered passive in terms of disposal or reuse and would not require additional energy use. Project 3, Option 3 (off-site disposal) is conducted off WSMR and would not require the use of additional energy resources. Project 3, Option 8 (reclamation treatment facility) would likely require some use of energy resources to implement daily treatment operations. However, energy consumption for this option is considered low. The implementation of any viable option under Project No. 3 is not anticipated to have any impact on energy resources.

4.3.4 Facilities

The implementation of Project 3, Options 7 or 8 (lined evaporation pond or reclamation treatment facility) would augment the base water treatment capabilities and provide added infrastructure that could be beneficial for future tenants that would conduct testing requiring water disposal. Having the treatment infrastructure would provide capacity and capability for growth although the initial cost would be an added financial expense.

4.3.5 Geology and Soils

4.3.5.1 Geology

Only two options (lined evaporation pond, reclamation plant) for Project No. 3 would require geotechnical evaluation and minor construction activities. Project 3, Option 3 (off-site disposal) requires disposal off site and would have no impacts on Geologic resources. Geotechnical testing and construction associated with the construction of new evaporation ponds or a reclamation plant / DROS unit would be limited to surface and near surface (<10 feet) depths. No impacts to geology would be anticipated from these construction activities.

4.3.5.2 Soils

From a geotechnical or construction perspective, the disturbance to soils would occur in a limited area for Project 3, Option 7 (lined evaporation ponds). Soil would be removed and stockpiled during construction. Soils would also be disturbed during geotechnical drilling activities. Removed soil would be used to spread on areas to help support the growth of vegetative cover, replace eroded soils, fill in depressions, etc. Although some grading, removal, and compaction of soils may be necessary, no long-term impacts would be anticipated to the site soils.

4.3.6 Land Use

Impacts to Land Use under Project No. 3 would be similar as described for Project No. 1. Project 3, Option 7 (lined evaporation pond) may change the current land use designation, depending on the selected location of the pond; however, siting criteria to minimize land use changes would be implemented to include compliance with any facility Area Development Plan (ADP) or Master Plan. In addition, the use of an evaporation pond to dispose of the non-hazardous solid waste water is considered beneficial as the option would help WSMR meet Net Zero mission objectives. Impacts associated with this option are considered low/moderate. No additional land use impacts or changes are anticipated for the remaining Project Options.

4.3.7 Noise

Impacts from noise would be limited to construction activities for Project 3, Options 7 and 8 (lined evaporation pond and reclamation treatment facility). They would be similar to those described for Project No. 1. Off-site disposal would have no impacts as the anticipated noise to be generated would not exceed normal levels for activates associated with loading and unloading and hauling water via trucks.

4.3.8 Utilities and Infrastructure

Utility and infrastructure impacts would be limited to construction locations and result in similar minor traffic disruptions, along with some additions to electric and wastewater discharge systems for these new facilities. The disposal option under this project involves hauling non-hazardous solid waste water to various locations off-post, and the expected impacts to utilities and infrastructure would be trivial.

4.3.9 Water Resources

4.3.9.1 Surface Water

Hauling the non-hazardous solid waste water to off-site locations for disposal would not affect surface water resources on the Range nor would the construction of a dedicated evaporation pond or reclamation facility. No impacts to surface water resources under any viable option are anticipated with the implementation of Project No. 3.

4.3.9.2 Groundwater

Some options included in Project No. 3 call for placing non-hazardous solid waste water in existing or newly constructed surface impoundments. The potential for impounded water to migrate to groundwater can be mitigated through the use of liners, proper impoundment placement based on geotechnical analysis, and monitored using monitoring wells. Construction of the reclamation facility to treat non-hazardous solid waste water would render the effluent appropriate for discharge to the surface without potential impacts to groundwater.

TABLE 4-5: PROJECT NO. 3 – SUMMARY OF IMPACTS

<table>
<tr><th>VEC</th><th>Rank</th><th>Forecasted Effects</th><th>Projected Outcomes</th></tr>
<tr><td rowspan="3">Biological Resources</td><td rowspan="3">Moderate</td><td>**Vegetation:**
Project 3, Options 7 & 8: Construction activities would have minor, temporary impacts.</td><td>The location of the impoundment and/or reclamation plant would be selected in areas with sparsely populated vegetation. The construction footprint of each proposed option would be minimized to the extent feasible.</td></tr>
<tr><td>**Wildlife:**
Project 3, Options 7: Potential impacts associated with the ingestion of salts and selenium.</td><td>Protective measures such as fencing, netting or hazing would be installed or implemented. In addition, water would be tested to ensure appropriate selenium levels.</td></tr>
<tr><td>Project 3, Options 7 & 8: Ground disturbing actives may cause temporary displacement to small mammals.</td><td>The location of the impoundment and/or reclamation plant would be selected in areas with little available wildlife habitat. The construction footprint of each proposed option would be minimized to the extent feasible.</td></tr>
<tr><td>Cultural Resources</td><td>Low</td><td>All surface-disturbing activities would be conducted in areas surveyed for cultural resources with no known cultural properties.</td><td>Cultural resources would be avoided and if discovered, the project boundaries would be repositioned.</td></tr>
<tr><td>Energy</td><td>Low</td><td colspan="2">Would require additional use of resources, although consumption would be low.</td></tr>
<tr><td>Facilities</td><td>Moderate</td><td colspan="2">Would augment the base water treatment capabilities by adding disposal infrastructure.</td></tr>
<tr><td rowspan="3">Geology & Soils</td><td rowspan="3">High</td><td colspan="2">**Geology:**
Project 3, Options 7 & 8 would require geotechnical evaluations, but no impacts would be realized.</td></tr>
<tr><td>**Soils:**
Project 3, Option 7: Impact limited to the area of construction of a collection pond.</td><td>Line pond and install a leak detection system.</td></tr>
<tr><td>Project 3, Options 8: Low impacts to soils limited to the area of construction of a water reclamation plant.</td><td>Removed soil would be used to spread on areas to help support the growth of vegetative cover, replace eroded soils, fill in depressions, etc.</td></tr>
</table>

TABLE 4-5: PROJECT NO. 3 – SUMMARY OF IMPACTS

VEC	Rank	Forecasted Effects	Projected Outcomes
Land Use	High	Either option may change the current land use designation, depending on the selected location.	Siting criteria to minimize land use changes would be implemented to include compliance with any facility ADP or Master Plan.
Noise	Low	Minor short-term localized noise would be generated during pipeline placement and other construction activities associated with Project 3, Options 7 and 8.	Construction activities are not expected to exceed the OSHA-established maximum noise level of 90 decibels for a continuous 8-hour exposure during a working day.
Utilities and Infrastructure	Low	Minor traffic disruptions, along with some additions to electric and wastewater discharge systems for new facilities.	Work with traffic issues would be addressed as they arise to limit impacts to normal base roads, etc.
Water Resources	High	**Surface Water:** No waters of the U.S. (WOUS) are present within any of the project areas.	
		Groundwater: Project 3, Options 7: Potential migration of saline water, and subsequent impacts to groundwater without appropriate BMPs may occur.	BMPs would be accomplished with liners, leak detection system, geotechnical analysis, and monitoring wells to minimize impacts to the groundwater.

4.4 Project No. 5: WWTP Biosolids Composting

WSMR proposes to compost dried biosolids produced by the WWTP. The compost would be applied to parks, dirt roads and other landscape areas as a fertilizer product. The compost would meet USEPA's definition of Exceptional Quality (EQ), which is:

- Meets Class A pathogen reduction requirements,
- Meets the most stringent metals limits in 40 CFR 503, and
- Meets the vector attraction reduction standards specified in 40 CFR 503.

An EQ biosolids product may be used without site restrictions.[146]

WSMR would dispose of the biosolids at a permitted landfill, as is current practice, if the compost does not meet the EQ product standards. A summary of Project No. 5's forecasted effects and projected outcomes are provided at the end of this section in **Table 4-6**.

4.4.1 Biological Resources

4.4.1.1 Vegetation

EQ product is anticipated to have a positive impact on vegetation in terms of increased plant biomass and cover.[147] EQ product returns nutrients to the soil, which enhances conditions for vegetative growth.[148]

Implementing this project would require minor localized ground disturbance activities to construct additional drying beds and possibly a building in which to house them. The additional drying beds would not be constructed in unique or sensitive vegetative habitats as the proposed location would be adjoining the existing WWTP. Adverse impacts to vegetative resources due to surface disturbances are not anticipated.

Turfgrass plants require nitrogen for growth and upkeep. This inorganic nitrogen is characteristically located in soil as either nitrate (NO_3^-) or ammonium (NH_4^+) and originates from normal earth processes. Composted biosolids can provide nitrogen to the soil, and most of that nitrogen is organic. WSMR intends to apply the EQ product as a fertilizer or soil binder for landscaping at Desert Emerald Park, at the various recreational/sports fields and around buildings on the Main Post during routine landscape projects.

4.4.1.2 Wildlife

Implementing this project would require minor localized ground disturbance activities to construct additional drying beds and possibly a building in which to house them. Ground disturbance activities associated with this project may cause temporary displacement or avoidance impacts to small mammals.

Ground disturbing activities would be conducted outside of the nesting season for migratory birds (September through February) without the performance of a nest survey. Also, fencing or an enclosed area and proper maintenance would be utilized to keep wildlife out of the drying beds.

4.4.1.3 Species of Concern

Construction of additional drying beds would require minor localized ground disturbance activities. Adverse effects on identified SOC are not anticipated. There are no restrictions for the use of EQ product as a fertilizer or soil binder

4.4.2 Cultural Resources

There would be no anticipated impacts to Cultural Resources as a result of applying EQ product as a fertilizer or soil binder. Furthermore, no historic properties or cultural resource sites have been identified in the project area where the additional drying beds are to be constructed/installed.

4.4.3 Energy

The application of EQ product as a fertilizer or soil binder would not require additional energy use. Some additional energy may be needed during cooler months to maintain the minimum temperature required during the composting process. Impacts to energy resources associated with Project No. 5 are considered low.

4.4.4 Facilities

Additional drying beds and possibly a structure or new facility to compost the biosolids would enhance the base's capabilities. This asset would also reduce off-site disposal fees, for hauling solids to landfills.

4.4.5 Geology and Soils

4.4.5.1 Geology

Geotechnical testing would be conducted to determine the suitability for additional drying bed locations as well as a building to house them if desired. Equipment access, near-surface (<10 feet) soil removal, and compaction would be required during construction activities. The construction activities associated with Project No. 5 would be expected to have no impact on the geology at the proposed project location.

4.4.5.2 Soils

As stated under **Section 4.4.1.1** (Vegetation), the use of EQ product is anticipated to improve soil fertility, as well as facilitate increases to plant biomass and cover.[149] Negative Impacts associated with the use of EQ product is considered low.

If additional drying beds are constructed, some minor soil grading, soil stockpiling, and compaction may be required that would increase the potential for soil erosion. Stockpiled soil, if required, would be covered to reduce dust emissions. Water would also be used to mitigate wind erosion in construction access zones. Furthermore, removed soil would be spread in areas to help support the growth of vegetative cover, replace eroded soils, fill in depressions, etc. Although some grading, removal, and compaction of soils may be necessary if additional drying beds are installed, associated impacts to soils in the project area would be anticipated to be low.

4.4.6 Land Use

Land Use under Project No. 5 would not be affected as the land where the biosolid compost facility would be constructed is currently part of the existing WSMR WWTP. Under this project, EQ product would be used as a fertilizer to landscape areas. Land use designations would remain unchanged. Land use impacts associated with implementing this project are anticipated to be low.

4.4.7 Noise

Impacts from noise generation under Project No. 5 would be the same or similar to those described for the construction activities in Project No. 1, and similar BMPs could be implemented if necessary. The noise associated with operating the biosolids composting operation is not anticipated to be above the current level at the WWTP.

4.4.8 Utilities and Infrastructure

There would be no construction traffic delays and required electrical and water utility connections would be similar to those described under Project No. 1 but limited to the location adjoining the WWTP. A new temperature-controlled facility may need to be constructed to ensure the resulting compost would meet EQ product standards for use without restrictions.

A noticeable permanent increase in traffic would not occur directly due to construction of the project. The only increase in traffic resulting directly from the project would be due to EQ product hauling.

4.4.9 Water Resources

4.4.9.1 Surface Water

Project No. 5 involves the composting of biosolids and the construction of drying beds and possibly a holding facility. No surface waters are located near the proposed composting facility location and, as such, impacts to surface waters are not anticipated during Project No. 5 construction activities. Care would be taken during the biosolids composting operation to control runoff during inclement weather.

Adverse impacts caused by the land application of composted biosolids to surface waters are considered low.

4.4.9.2 Groundwater

The composting facility and drying beds would be constructed in a manner that would contain liquids until dry, preventing the liquid from migrating to groundwater sources. No impacts to groundwater are anticipated during the biosolids compost operation.

TABLE 4-6: PROJECT NO. 5 – SUMMARY OF IMPACTS

VEC	Rank	Forecasted Effects	Projected Outcomes
Biological Resources	Moderate	**Vegetation:** Positive impact on vegetation in terms of increased plant biomass and cover.	The additional drying beds would not be constructed in unique or sensitive vegetative habitats.
		Minor, localized ground disturbance activities to construct additional drying beds.	Use of EQ composted biosolids.
		Wildlife: There are no restrictions for the use of EQ product as a fertilizer or soil binder	Increased habitat quality from improved soil fertility and increased plant biomass.
		Construction of additional drying beds would require minor, localized ground disturbance activities.	Ground disturbing activities would be conducted outside of the nesting season for migratory birds (September through February). Also, fencing or an enclosed area would be utilized to keep wildlife out of the drying beds.

TABLE 4-6: PROJECT NO. 5 – SUMMARY OF IMPACTS

VEC	Rank	Forecasted Effects	Projected Outcomes
		Species of Concern: Adverse effects on identified SOC are not anticipated.	
Cultural Resources	Low	All surface-disturbing activities would be conducted in areas surveyed for cultural resources with no known cultural properties.	Cultural resources would be avoided.
Energy	Low	EQ product as a fertilizer or soil binder would not require additional energy use.	
Facilities	High	Much needed room in landfills would be freed-up and considerable cost savings would be realized when compared to current disposal methods of solid waste.	
Geology & Soils	Mod	Improvement of soil fertility, increases to plant biomass and cover.	
		If additional drying beds are constructed, some minor soil grading, soil stockpiling, and compaction may be required that would increase the potential for soil erosion.	Removed soil would be stockpiled and covered to reduce dust emissions. Water would also be used to mitigate wind erosion in construction access zones. Furthermore, removed soil would be spread in areas to help support the growth of vegetative cover, replace eroded soils, and fill in depressions.
Land Use	Low	Proposed activities would be consistent with WSMR's land use plan.	
Noise	Low	Minor, temporary construction noise is anticipated during construction.	Various BMPs would be employed to maintain normal Main Post background noise levels.
Utilities and Infrastructure	Not Ranked	Minor increase total traffic due to biosolid compost hauling	Work with traffic issues would be addressed as they arise to limit impacts to normal base roads, etc.
Water Resources	High	**Surface Water:** Impacts to surface waters are not anticipated during Project No. 5 construction activities	
		Groundwater: No impacts to groundwater are anticipated during the biosolids compost operation.	

4.5 No Action Alternative

Under the No Action Alternative, there would be no beneficial reuse of treated wastewater effluent for landscape irrigation use at the Desert Emerald Park and/or for construction activities. Furthermore, Well No. 16 would not be repaired for irrigation use at the Desert Emerald Park or sport fields. In addition, non-hazardous solid waste water would continue to be hauled and disposed of off-site. Also, WWTP dried biosolids would continue to be disposed of at an approved landfill. This alternative would not meet the Army objectives of Net Zero,[150] and high costs associated with the current disposal of non-hazardous solid waste water and dried biosolids would remain unchanged. There would be no costs associated with construction of new facilities and infrastructure.

4.6 Alternative 1: Davies Playa Improvements

The repair of the outfall pipeline to Davies Playa should be completed in 2020. This alternative would be to enhance the functionality of the wetland, improve public access and allow for the potential construction of public nature trails and/or bird watching stations. Under this alternative the WWTP effluent would not be used for landscape irrigation. See **Figure 2-4** for potential nature trails at Davies Playa.

A summary of Alternative 1's forecasted effects and projected outcomes are provided at the end of this section in **Table 4-7**.

4.6.1 Biological Resources

4.6.1.1 Vegetation

It is anticipated that overall wetland quality and function would be improved with the presence of more abundant riparian habitat and hydrophilic vegetative populations. Adverse impacts to vegetation are not anticipated upon implementation of this Alternative.

4.6.1.2 Wildlife

Although the playa is already associated with both avian and small mammal species, moderate increases to wildlife composition and diversity within the area would be expected. The enhancement of existing habitat would attract more wildlife and increase the potential for negative human-wildlife interactions (*e.g.,* rattlesnakes, coyotes, bobcats, cougars, insect pests such mosquitoes, ticks, bees, wasps, etc.). Information/warning signs would be installed and brochures available to educate people of the potential interactions with wildlife, as well as how to mitigate negative human-wildlife interactions when visiting the playa. Adverse impacts to wildlife would not be anticipated upon implementation of this Alternative.

4.6.1.3 Species of Concern

The primary focus of the proposed Alternative is not to specifically enhance the quality of suitable habitat (e.g., riparian). within the playa for the. Implementation of this alternative may potentially improve the quality water by meeting EPA water reuse guidelines for unrestricted urban reuse. There would be no impacts to the southwestern willow flycatcher (*Empidonax traillii extimus*) or the western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) from the implementation of this Alternative.

4.6.2 Cultural Resources

The formation of public nature trails and/or bird watching stations would cause minor surface disturbances with limited ground compaction for foundation stabilization. As a result, the implementation of Alternative 1 is not anticipated to cause adverse impacts to the cultural resources.

4.6.3 Energy

Under Alternative 1, construction or other activities requiring the additional consumption of energy would not be implemented. Adverse impacts to natural gas, electricity, and solar panel are not anticipated.

4.6.4 Facilities

Under Alternative 1, the development of nature trails and bird observation spots at Davies Playa would enhance the base's recreational opportunities and expand WSMR's capacity to accommodate a large fluctuation of soldiers or reconsolidation.

4.6.5 Geology and Soils

Implementing Alternative 1, formation of public nature trails and/or bird-watching stations would cause minor soil disturbances. As a result, the implementation of Alternative 1 is not anticipated to cause impacts to the geology or soils of the Davies Playa or along the existing pipeline ROW.

4.6.6 Land Use

Activities associated with the proposed Alternative 1 would be consistent with WSMR's designated land use plan. Constructing walking trails and bird watching stations in the Davies Playa is possible provided that the EPA water reuse guidelines for unrestricted urban reuse are followed.[151] Implementation of the proposed alternative would have no impact on the land use plan currently in effect.

4.6.7 Noise

Minor short-term localized noise would be generated during trail construction activities (~<10-weeks). Noise levels during construction are not expected to exceed the OSHA-established maximum noise levels of 90 dBA for continuous 8-hour exposure during a working day. Implementation of Alternative 1 is anticipated to have no impact on regional long-term noise levels.

4.6.8 Utilities and Infrastructure

Traffic and utility impacts associated with this alternative would be limited to conducting wetland enhancements, improving public access and constructing public nature trails and/or bird watching stations. Construction related impact would be minimal compared to those described for Project No. 1.

4.6.9 Water Resources

4.6.9.1 Surface Water

Implementation of this alternative would result in all the wastewater continuing to flow to Davies Playa. No impact would be anticipated for surface water.

4.6.9.2 Groundwater

This alternative would <u>not</u> result in a reduced demand for potable water as the continued irrigation of the Desert Emerald Park would need to rely on water supplied from the WSMR groundwater supply wells. As with the No Action Alternative, WSMR needs to preserve its potable water supply, to reduce the potential of saline intrusion from adjacent aquifers and to be prepared for a large fluctuation of soldiers or reconsolidation. Under this alternative, potable groundwater use would not decrease withdrawal levels and the groundwater quality could be adversely impacted in the long term.

TABLE 4-7: ALTERNATIVE 1 – SUMMARY OF IMPACTS

VEC	Rank	Forecasted Effects	Projected outcomes
Biological Resources	High	**Vegetation:** Continued effluent flow to the Davies Playa would promote vegetative diversity.	Increased vegetation diversity would likely facilitate a sustainable increase to wetland and riparian community structure and composition.
		Wildlife: Effluent continuing to be received within the playa would likely enhance and increase wetland and vegetative habitats available to wildlife species.	The enhancement of existing habitat would attract more wildlife.
		Increased wildlife would lead to potential for negative human-wildlife interactions (*e.g.,* rattlesnakes, coyotes, insect, etc.).	Information/warning signs would be installed and brochures available to educate people of the potential interactions with wildlife, as well as how to mitigate negative human-wildlife interactions when visiting the playa.
		Species of Concern: Wastewater effluent continuing to the Playa may potentially enhance the quality and availability of preferred habitat for the southwestern willow flycatcher and the western yellow-billed cuckoo.	
Cultural Resources	Low	All surface-disturbing activities would be conducted in areas surveyed for cultural resources with no known cultural properties.	Cultural resources would be avoided.
		Potential unintentional encounters of cultural resources.	Construction crews would be educated on artifact collection and how to report a finding of an unknown historic cultural resource.
Energy	Low	Additional consumption of energy would not occur.	
Facilities	High	Development of nature trails and bird-observation spots at Davies Playa would enhance the base's recreational opportunities and expand WSMR's capacity to accommodate reconsolidation.	
Geology & Soils	Moderate	Construction of public nature trails and/or bird watching stations would cause minor soil disturbances in limited localized areas.	

TABLE 4-7: ALTERNATIVE 1 – SUMMARY OF IMPACTS

VEC	Rank	Forecasted Effects	Projected outcomes
Land Use	Moderate	Development of bird-watching stations and nature trails would add to existing land uses within the Playa.	Activities would be consistent with WSMR's designated land use plan. The EPA water reuse guidelines for unrestricted urban reuse would need to be followed.
Noise	Low	Minor short-term localized noise would be generated during trail-construction activities.	Various BMPs would be employed to maintain normal or acceptable noise levels.
Utilities and Infrastructure	Low	There would be no impact on the potable water supply at WSMR as no reclaimed wastewater would be used to offset potable demand.	
Water Resources	High	**Surface Water:** Wastewater effluent continuing to be delivered to Davies Playa would result in the water quality remaining unchanged.	Continued effluent flow would promote wetland vegetation and stabilization of wildlife habitat.
		Groundwater: Demand for potable water would remain unchanged as the continued irrigation of the Desert Emerald Park would need to rely on water supplied from the WSMR groundwater supply wells.	Potable groundwater use would not decrease withdrawal levels and the groundwater quality could be adversely impacted in the long term.
		No impact to groundwater quality beneath the playa would be anticipated.	

4.7 Alternative 2: Drill a New Well

Drilling a new well would be a replacement for Well No. 16. This new well would supply potable water for drinking and landscape irrigation.

A summary of Alternative 2's forecasted effects and projected outcomes are provided at the end of this section in **Table 4-8**.

4.7.1 Biological Resources

4.7.1.1 Vegetation

Implementing Alternative 2 would only require minor (<1 acre) localized ground-disturbing activities within a Military Disturbance area; therefore, adverse impacts to vegetative resources are not anticipated. Positive impacts to vegetation would be anticipated if the new water well was used for irrigation purposes, to include irrigation of recreational use areas, such as the Desert Emerald Park or sport fields.

4.7.1.2 Wildlife

Implementing Alternative 2 would only require minor ground-disturbing activities; therefore, adverse impacts to wildlife resources are not anticipated. Furthermore, the use of a new well's water supply for landscape irrigation within the Desert Emerald Park may provide some wildlife habitat benefits. Benefits to wildlife at the Desert Emerald Park and associated BMPs would be similar to those described for Project No. 1.

4.7.1.3 Species of Concern

Implementing Alternative 2 would require minor ground-disturbing activities to drill a new well; adverse impacts to SOC are not anticipated. Similar to Project No. 2, the use of a new well's water supply for drinking, landscape irrigation or construction activities would have no additional effects on SOC.

Additional water delivered to the Desert Emerald Park would have a benefit for vegetation growth that could provide habitat for yellow-billed cuckoo or western willow fly catcher. There would be no impacts to these species from the implementation of Project No. 2.

4.7.2 Cultural Resources

The proposed well location lies within areas that have been fully surveyed for cultural resources, including TCPs. As such, foreseen impacts from the implementation of Alternative 2 would be the same as described for Project No. 1, which would not result in adverse impacts to cultural resources. Furthermore, identified cultural resources, if present, would be avoided successfully through siting practices to include repositioning project boundaries or routes.

4.7.3 Energy

Short-term uses of energy resources would be required to drill a new well. Similar to Project No. 2, energy consumption for this component of the Alternative would rely on new solar power, and therefore have no long-term effect on the existing electrical system, other than to secure a source for backup power. Neither the tie-in activity nor the occasion operation on base power would result in more than an inconsequential impact to the electrical system. As with Project No. 1, the operation of new solar pumps would not impact the current WSMR energy electrical demand nor would it affect the current solar energy array.

4.7.4 Facilities

Drilling a new well would not achieve Net Zero balance but would just replace an existing well that has been out of service.

4.7.5 Geology and Soils

4.7.5.1 Geology

Drilling a new well would involve boring through various formations to obtain the desired depth to produce usable water from the target aquifer. The new well would be drilled on a 1-acre site that adjoins Well No. 16, with the well itself being approximately 250 feet away. Due to this proximity, it is expected the new well would be completed at a similar depth (~≤ 4,000 feet bgs) and it would take less than two weeks to drill and install the 5-inch casing with a typical truck-mounted rig. No oil-based muds or other petroleum-based liquid products would be used to circulate the drill bit or flush the wellbore and no fracturing of the wellbore would be conducted. The impacts to the geology from drilling this depth, installing the casing, and operating the well on a long-term basis would be inconsequential, as the well would not increase geologic susceptibility to induced local seismicity or subsidence. No impacts to the regional or localized geology are anticipated from constructing a new water well.

4.7.5.2 Soils

Impacts to the soils from drilling the new well would also be like the construction impacts for the storage tank and pumping station(s) installation, as described under Project No. 1, since construction of a 1-acre staging area would be necessary. Stockpiled soil, if required, would be covered to reduce dust during construction activities and bare soils would be mulched or revegetated to reduce susceptibility associated with erosion. As such, there are no anticipated adverse impacts to the soils from the implementation of Alternative 2.

4.7.6 Land Use

Impacts to land use under Alternative 2 would be low but similar to those as described for Project No. 2. Activities associated with the proposed project would be consistent with WSMR's designated land use plan and implementation of the proposed project would have no impact on the land use plan currently in effect.

4.7.7 Noise

Impacts from noise generation under Alternative 2 would be the same or like those described for Project No. 1. Minor, short-term localized noise would be generated during pipeline placement, storage facility construction activities, and well drilling. Noise levels would not be expected to exceed the OSHA-established maximum noise level of 90 dBA for continuous 8-hour exposure during a working day.[152] BMPs like the one described for Project No. 1 would be implemented for the pipeline construction activities, and additional measures would be used during drilling activities. Specially designed pre-engineered environmental noise control systems for drilling rigs would be provided on a temporary basis to control sound. Drilling rig noise control systems include:

- Temporary Perimeter Sound Walls,
- Temporary Drilling Rig Generator Sound Control Systems,
- Drilling Rig Floor, Derrick and Sub-structure Sound Blanket Barrier Panels, and
- Draw Works Brake Shroud Sound Control System.

The use of these BMPs would reduce the noise level during drill so that nearby residential properties would not be subjected to sounds above normally acceptable decibels for daytime hours. It is assumed that no evening or nighttime drilling would be permitted. The implementation of these BMPs would ensure noise levels are reasonable and not intrusive to residents and working staff near the construction activities.

4.7.8 Utilities and Infrastructure

The impacts of drilling a new well and using the potable water for drinking as well as irrigation or construction uses would be like those described for Project No. 1. The impacts to traffic flow from the well drilling equipment being mobilized and demobilized would be short-lived and inconsequence.

4.7.9 Water Resources

4.7.9.1 Surface Water

No impact to surface water would be anticipated with the drilling of a new well. No impact to surface water would be anticipated with the implementation of Alternative 2, as the water from the new well is not expected to reach surface waters.

4.7.9.2 Groundwater

Although implementation of Alternative 2 would require drilling a new well in a different location, the same impacts as implementation of Project 2 would be anticipated. WSMR has multiple ongoing water conservation efforts which have decreased the recent water usage and this trend is expected to continue for the short-term future. Because the proposed new well would be replacing an existing, currently unused water well, annual aquifer withdrawal rates and/or ground water usages are expected to remain the same.

Drilling a new well and capping Well No. 16 would eliminate the opportunity to potentially draw nitrates from vulnerable wells near Well No. 16.

Table 4-8: Alternative 2 – Summary of Impacts

VEC	Rank	Forecasted Effects	Projected Outcomes
Biological Resources	Low	**Vegetation:** Positive impacts to turf grasses and ornamental shrubs/trees would be anticipated if the new water well was used for irrigation purposes, including irrigation of recreational-use areas.	Reduction in grasses dying and tumbleweed growth, repair of bare ground, and reduced erosion potential.
		Wildlife: Landscape irrigation within the Desert Emerald Park may benefit some wildlife.	Enhanced existing habitat for species of interest such as Monarch butterflies, and Vermillion flycatchers.
		Continued watering of the Desert Emerald Park could attract wildlife, resulting in an increased potential for negative human-wildlife interactions (*e.g.,* rattlesnakes, coyotes, bobcats, cougars, insect pests such mosquitoes, ticks, bees, wasps, etc.).	Use environmental education in the form of installed warning signs and brochures to mitigate negative human-wildlife interactions when visiting the Park.
		Species of Concern: Water delivered to the Desert Emerald Park would help sustain established vegetation that in turn could provide habitat for yellow-billed cuckoo or western willow fly catcher.	
Cultural Resources	Moderate	All surface-disturbing activities would be conducted in areas surveyed for cultural resources with no known cultural properties.	Cultural resources would be avoided.
		Potential unintentional encounters of cultural resources.	Construction crews would be educated on artifact collection and how to report a finding of an unknown historic cultural resource.
Energy	Moderate	The solar-powered pump station(s) would require backup power from the existing electrical grid.	Use of solar-powered energy would reduce overall commercially supplied electricity and help WSMR achieve their Net Zero energy goal.
Facilities	High	Drilling a new well would not achieve Net Zero balance but would just replace an existing well that has been out of service.	
Geology & Soils	Moderate	**Geology:** The impacts to the geology from drilling this well, installing the casing, and operating the well on a long-term basis would be inconsequential.	The well would not increase geologic susceptibility to induced local seismicity or subsidence.
		Soils: Construction impacts and compaction of soils would increase potential for erosion from wind and rain in localized locations for short durations.	Removed soil could be spread in areas to help support the growth of vegetative cover, replace eroded soils, and fill in depressions.
		The current reduced or lack of watering is allowing the grass to die and tumbleweeds to grow, potentially followed by increased bare ground and subsequent increase to conditions that may facilitate erosion.	The use of the repurposed water for irrigation at Desert Emerald Park would stay these impacts and eventually reverse their effects on the soils and vegetation in the short-term.
Land Use	Low	Proposed actions would not affect the land use designation.	Activities would be consistent with WSMR's land use plan.
Noise	Low	Minor, temporary construction noise is anticipated during drilling of the new well.	Various BMPs would be evaluated and implemented to reduce noise levels.
		With an increased activity at Desert Emerald Park it is conceivable that noise levels would be elevated and potentially affect wildlife and nearby residents.	These noise level could be mitigated with the use of restricted park hours or other means of control.
Utilities and Infrastructure	Low	A limited amount of traffic disruption on the Main Post would be required for construction of storage facilities and drilling of the new well.	Work with traffic issues as they arise to limit impacts to normal base roads, etc.

TABLE 4-8: ALTERNATIVE 2 – SUMMARY OF IMPACTS

VEC	Rank	Forecasted Effects	Projected Outcomes
Water Resources	High	**Surface Water:** No effect on the ephemeral washes or water bodies located within WSMR, as the water from the new well is not expected to reach these surface waters.	
		Groundwater: Potential encroachment of minerals laterally into the fresh groundwater resulting in elevated TDS.	Tracking of the total withdraw so that the amount would not exceed the current levels and limiting peak demand to a three-month period annually.
		Replacing Well 16 would eliminate the possibility of withdrawing nitrates from the groundwater in that location.	Nitrate free irrigation water eliminates need to follow EPA Water Reuse Guidelines and removed monitoring requirements.

4.8 Alternative 3: Implement Viable and Legally Supported Aspects of Projects 1 thru 5

The Net Zero Initiative launched by the Army in October 2010 focused on strategies that support sustainable management of energy, water, and solid waste at Army installations. The implementation of Alternative 3 would involve employing various aspects of Projects 1 2, 3, and 5 to ensure feasible steps are utilized to reduce the overall consumption of water resources, as well as costs associated with the disposal of non-hazardous solid waste water and solid waste. This management approach would provide the maximum benefit for the reuse of water and WWTP biosolids, while concurrently supporting Net Zero mission objectives. *Note*: Analysis of each individual Project or Alternative is provided in this Chapter; additional analysis specific to this Alternative was not performed as part of this EA.

Under this Alternative, a portion of the effluent from the WSMR WWTP could be utilized to provide irrigation water to the Desert Emerald Park and/or sport fields (**Project No. 1**). However, because all of the wastewater effluent is currently discharged to the Davies Playa, this Project would reduce the amount available for sustaining the riparian area and wetland habitat. It is possible that a reduction in current volumes may lead to some degradation of riparian and wetland habitat in the Davies Playa. As an alternative to this approach, water to irrigate the Desert Emerald Park and sport fields could be sourced by Well No. 16 (**Project No. 2**) or by a newly drilled well (**Alternative 2**). Pumping raw water from Well No. 16 for landscape irrigation or construction use may have a positive effect of preventing nitrate concentration increases in nearby wells by withdrawing groundwater containing elevated nitrates.[153]

Lastly, **Project No. 1** and either **Project No. 2** or **Alternative 2** could be implemented concurrently to provide water to the Desert Emerald Park and sport fields. With this management approach, water sourced from Well No. 16, for instance, could be used to supply water during the summer months to the sport fields while augmenting the WWTF effluent water supply being used to irrigate the Desert Emerald Park. Under this scenario, withdrawal rates from Well No. 16 may be less, reducing potential impacts to groundwater quality and, as noted above, routing WWTP effluent water from the Davies Playa for irrigation would lead to the continued degradation of wetland and riparian habitat within the Playa.

Project No. 3: Waste water generated at WSMR from military RDT&E operations, boiler blow-off, HVAC maintenance, and other operations has been determined to be non-hazardous solid waste water,[154] and is currently containerized and trucked off site for legal disposal through a contract. WSMR anticipates disposing 60,000 to 450,000 gallons of non-hazardous solid waste water four times a year. Current disposal methods are not cost effective (water truck capacity ≈ 4000 gallons).[155] Exploring alternative disposal methods for this non-hazardous solid waste water could help WSMR reduce disposal costs.

Under Option 6, WSMR would construct a lined evaporation pond (location to be determined) that would receive 450,000 gallons of non-hazardous solid waste water twice a year. The size of the pit required to hold this volume of water would be approximately 1 acre at 16.6 inches deep or an area 210 feet x 210 feet.

Water received by the pond would evaporate through natural processes and as with Disposal Options 5 and 6, would leave a non-hazardous concentrated residue or solid waste that would require disposal at a permitted landfill approximately every five years.

Project No. 5: Biosolids generated during the treatment of domestic wastewater at the WWTP are dried in drying beds prior to disposal as a special waste at an approved landfill. Beneficial use of the WWTP biosolids compost may include application to parks, dirt roads and other land areas needing soil or vegetation improvement. EQ product biosolids have no restrictions on use and application.[156]

4.9 Cumulative Impacts

Cumulative impacts are those environmental impacts that result from the incremental effects of the proposed actions when compounded by other past, present, or reasonably foreseeable future actions (40 CFR 1508.7). Each resource within the ecosystem and human environment should be analyzed in terms of its ability to accommodate additional effects, both temporally and spatially. The Army uses a process identified by the CEQ for analyzing cumulative effects.[157]

This environmental assessment evaluates potential environmental impacts from seven actions and the methods for implementation of those actions. For the purposes of this cumulative impact's analysis, the region of influence includes areas within and near the main cantonment area shown in **Figure 2.1**, General Site Locations. The specifics of any proposed action implemented would go through a siting and environmental review processes with the intent to avoid conflicts or identify applicable best management practices.[158, 159]

Project No. 1, Wastewater Effluent Reuse, considers the reuse of treated wastewater effluent from the WSMR WWTP for construction activities on the Main Post or landscape watering of the Desert Emerald Park, following USEPA water reuse guidelines. Project No. 2, Well No. 16 Water Repurpose, considers repurposing of the water for construction projects near the main cantonment, or watering recreation fields as well as the Desert Emerald Park. Projects 1 and 2 will require construction of new infrastructure in order to support proposed reuse. Construction tends to be noisy and generate dust, however, this would be localized and temporary. There are future plans to enhance recreational opportunities at the Desert Emerald Park, which would include construction of new RV slips, tent camping locations, and outdoor meeting arenas. Solar panels may be installed to power wells.

Currently, treated wastewater effluent flows into Davies Playa. Wastewater treatment function, seasonable weather patterns and fluctuations in Main Post demographics will influence the amount of available water to reuse. Improvements were made to the water conveyance system from the WWTP to Davies Playa in 2019. Even if water is diverted for watering the Desert Emerald Park, a portion would always go towards the playa.

Project No. 3, Non-hazardous Solid Waste Water Disposal or Reuse, considers various methods for handling this type of water generated from military operations, and facility maintenance. Waste water generated from these activities are classified as solid waste and are regulated under RCRA Subtitle D. This classification prohibits the use of this waste water as a dust suppressant, disposal into the WSMR sewer system, into the HELSTF treatment pond or the Stallion brine ponds. Hauling this non-hazardous solid waste water to an injection well or construction of a water reclamation plant are options, but both are not practical due to the cost of hauling and construction. Construction of a lined evaporation pond could be a feasible option. The impacts would be localized with little impact regionally. Any new evaporation pond would need to go through a siting and an environmental review process.

Project No. 5, WWTP Biosolid Composting would occur at a specific location near the WWTP. Drying beds already exist but may need to be eventually eliminated and replaced with new composting beds that meet higher standards. Construction would be required that avoids impacts to hydrological drainage patterns, cultural resources and nesting migratory birds, as well as incorporate wildlife exclusion measures. Biosolids would be composted to meet USEPA Guidelines.

Alternative 1, Davies Playa Improvements, would enhance the wetland functionality and improve public access. Public access is dependent on wastewater being treated to meet USEPA guidelines, and non-environmental factors such as physical security. Selection of this alternative would not allow for reused of treated waste water to be used for watering vegetation at Desert Emerald Park, nor provide construction water. Drinking water would continue to be used for landscape irrigation. Additional infrastructure would not be constructed, thus avoiding additional ground disturbance.

Alternative 2, considers the need to drill another well to replace Well No. 16. This might be needed if Well No. 16 needs to provide drinking water. At the time of this environmental analysis, there was plenty of available drinking water for the current population. Drilling another well isn’t necessary but could be considered if future growth of Main Post occurs or if there are changes to the water quality of Well No. 16. It would not make sense to drill another well for watering recreational fields or construction projects at this time, however, reuse of Well No. 16 would be practical. A siting and environmental review process would be required.

Alternative 3 is to select aspects of Projects 1 through 3 and/or Project 5. Potential cumulative impacts associated with implementation in combination have already been discussed in this section. Davies Playa Improvements involving public access is not a preferred decision, not is the drilling of another well to replace Well No. 16.

4.10 Impact Conclusions

This EA contains the results of an impact analysis of the proposed projects and alternatives on the environment. The environmental resources evaluated in this analysis include biological resources, cultural resources, geology and soils, energy, facilities, land use, noise, utilities and infrastructure, and water resources. No significant impacts on the environment have been identified for the preferred wastewater and biosolids projects or their alternatives and no cumulative impacts are expected.

From a legal or regulatory approach Projects 1, 2, and 5 are viable and the various components of each of these construction efforts have no regulatory impediments (Project No. 1: Wastewater Effluent Reuse, Project No. 2: Well No. 16 Water Repurpose, and Project No. 5: WWTP Biosolids Composting). The implementation of Projects 1 and 2 will require WSMR to meet certain water quality standards for specific uses and conduct routine monitoring to dial in the appropriate irrigation volumes. Project 5 will require WSMR to construct an enclosure around the existing drying beds or build new drying beds to compost the biosolids so that a consistent temperature can be maintained to achieve a product that meets Class A pathogen reduction on a regular basis.

Project No. 3: Non-hazardous Solid Waste Water Disposal or Reuse, contains eight options of which only three (Options 3, 7, & 8) were determined to be legally viable. Options 1 & 2: *Surface Land Application* *or Dust Suppression on Roadways*; Option 4: *Dust Control in Weapon Test Impact Areas*; Option 5: *Discharge into an Existing Wastewater Treatment System at the High-Energy Laser Systems Test Facility (HELSTF),* and Option 6: *Discharge into the Existing Brine Pond at the Stallion Range Center;* were all found to be legally non-viable under RCRA Subpart D. Using non-hazardous solid waste water, such as salt water from testing activities, for dust control is not appropriate as the discharge water is classified as a solid waste, and the application onto land is not allowed. Discharging the non-hazardous solid waste water into either the HELSTF wastewater evaporation ponds or the Stallion brine pond without a RCRA subtitle D permit is not allowed and may render either system ineffective for their intended treatment purpose. Also, disposal of the non-hazardous solid waste water into the WSMR sewer system is not allowed because it is not domestic sewage.

Various off-site disposal possibilities (injection, treatment, etc.) as discussed under Project 3, Option 3 (off-site disposal) are legally viable, however each possibility was a considerable distance (>500 miles) away from WSMR and require excessive hauling to transport the non-hazardous solid waste water for disposal.

Options 7 & 8 each require the construction of a new facility, evaporation pond or a water reclamation facility respectively to implement, but both options are legally feasible. The evaporation pond would result in a non-hazardous concentrated solid waste that would require periodic disposal at a permitted landfill approximately every five years. The water reclamation plant basically a pre-engineered, skid-mounted desalination reverse osmosis system would be co-located at the WWTP and the resulting effluent would be of sufficient quality to be used as an additional irrigation source or released to Davis Playa with no implications. The only complication would be the added energy consumption needed to periodically operate the system; however, it could be operated with solar power.

As for the Alternatives considered, none have any legal considerations that would render them non-viable.

5 CONTRIBUTING AGENCIES AND PERSONS

Name, Title	Affiliation	Role / Resource Area Contribution
Debbie Hartell	WSMR – Environmental	Project Manager
Debbie Nethers	WSMR – Environmental	NEPA Point of Contact
Benito Avalos	WSMR – Environmental	RCRA
Susan Harrington	WSMR – Environmental	Env. Office, Compliance Division Chief
Greg Silsby	WSMR – Environmental	NEPA
Kelly Norwood	WSMR Environmental	Water Quality Manager/Geologist
Charlene Brown	WSMR Directorate of Public Works	Master Plans
Craig Collins	WSMR Directorate of Public Works	Energy Manager
Rachel A. Cano	WSMR Directorate of Public Works	Water Utilities
Samuel E. Morris, Jr.	WSMR Directorate of Public Works	Engineer
Kevin M. Dent	WSMR Staff Judge Advocate	Legal
Jim Thompson	ATEC/G3	Engineer
Grady D. Greene	USACE - Tulsa District	Technical Manager
Rick Smith	USACE - Tulsa District	Project Manager

5.1 List of Preparers

Name	Title	Education	EA Responsibility	Experience
David Epperly, Ph.D., P.E.	Program Manager	Ph.D., Agricultural Eng. M.S., Agricultural Eng., B.S., Agricultural Eng.	Program Manager	30 years of NEPA, EIS, EA, & ESA experience
Jon W. Seekins	Project Manager Sr. Env. Scientist	B.S., Environmental Science	Project Manager	34 years of NEPA, EIS, EA, Land Use Planning, and Environmental remediation experience
David Winter	Sr. Biologist	M.S., Biology B.S., Biology	Lead Biological Resources	24 years of environmental biological experience, Certified Wetland Biologist
Doug Cooper	Sr. Geologist	M.S. Hydrogeology B.S., Geology,	Lead/Physical Resources	25 years of various RCRA, UIC, & CERCLA experience
Charles McComas, P.E.	Sr. Chemical Engineer	M.S., Chemical Eng. B.S., Chemistry B.S., Chemical Eng.	Lead Regulatory Specialist	27 years of RCRA & NEPA experience
Nathan Alleman	Biologist	M.A.S., Environmental Policy and Management BSc Biology	Biological Resources	12 years of NEPA, Biological Assessment, Environmental Planning experience
Ben Bockelmann	GIS Manager	BSc Geography	GIS/Graphics Manager	10 years of GIS, CADD, and Graphics

Citations

[1] U.S. Dept of Defense. 2019. DOD Recognizes Importance of Environment to Readiness. 22 Apr. By David Vergun. https://www.defense.gov/explore/story/Article/1817776/dod-recognizes-importance-of-environment-to-readiness/

[2] U.S. Army Corps of Engineers. 2019. Net Zero Planner - An integrated Modeling Tool. https://www.rti.org/impact/net-zero-planner-integrated-modeling-tool

[3] White Sands Missile Range (WSMR), *Final Environmental Impact Statement for Development and Implementation of Range-Wide Mission and Major Capabilities at White Sands Missile Range, New Mexico* (November 2009).

[4] White Sands Missile Range (WSMR), *Integrated Natural and Cultural Resources Management Plan and Environmental Assessment (INCRMP), White Sands Missile Range, New Mexico*, prepared by Environmental Stewardship Branch and Gene Stout and Associates (June 2015).

[5] White Sands Missile Range (WSMR), *Final Environmental Assessment of Alternative Energy Facility Projects* (June 2014).

[6] U.S. Army, *Programmatic Environmental Assessment Army Net Zero Installations*, Final (July 2012), https://www.army.mil/e2/c/downloads/259794.pdf (accessed March 5, 2019).

[7] Eco Inc., "Davies Playa Natural Resources and Water Quality Data Evaluation" (January 2017).

[8] CB&I Federal Services LLC, *Wastewater Treatment Plant Evaluation Report, White Sands Missile Range, New Mexico* (May 2014).

[9] U.S. Army, *Programmatic Environmental Assessment Army Net Zero Installations*.

[10] World Weather Online, White Sands Weather Forecast (2018), https://www.worldweatheronline.com/v2/weather-averages.aspx?q=88002 (accessed on February 19, 2018).

[11] WSMR, *Final Environmental Impact Statement*.

[12] WSMR, *Final Environmental Impact Statement*.

[13] WSMR, *Final Environmental Impact Statement*.

[14] WSMR, *Final Environmental Impact Statement*.

[15] WSMR, *Final Environmental Impact Statement*.

[16] White Sands Missile Range (WSMR), *Integrated Natural and Cultural Resources Management Plan and Environmental Assessment (INCRMP), White Sands Missile Range, New Mexico*, prepared by Environmental Stewardship Branch and Gene Stout and Associates (June 2015).

[17] E. Muldavin, Y. Chauvin, G. Harper, and P. Neville, *The Vegetation of White Sands Missile Range, New Mexico*, Vol. 1, Handbook of Vegetation Communities; vol. 2, Vegetation Map, Final report for Cooperative Agreement no. 14-16-002-91-233, WSMR, USFWS, The Nature Conservancy, and the University of New Mexico. New Mexico Natural Heritage Program, Albuquerque, NM (2000).

[18] E. Muldavin, Y. Chauvin, G. Harper, and P. Neville, *The Vegetation of White Sands Missile Range, New Mexico*, Vol. 1, Handbook of Vegetation Communities; vol. 2, Vegetation Map, Final report for Cooperative Agreement no. 14-16-002-91-233, WSMR, USFWS, The Nature Conservancy, and the University of New Mexico. New Mexico Natural Heritage Program, Albuquerque, NM (2000).

[19] WSMR, INCRMP.

[20] WSMR, INCRMP.

[21] Lee C. Buffington and Carlton H. Herbel, "Vegetational Changes on a Semidesert Grassland Range from 1858 to 1963," *Ecological Monographs* 35, no. 2 (Spring 1965): 139–64.

[22] J. York and W. Dick-Peddie, "Vegetation Changes in Southern New Mexico during the Past Hundred Years," in *Arid Lands in Perspective*, edited by W.G. McGinnies and B.J. Goldman (Tucson, AZ: University of Arizona Press, 1969), 157–66.

[23] WSMR, INCRMP.

[24] WSMR, INCRMP.

[25] WSMR, INCRMP.

[26] WSMR, INCRMP.

[27] WSMR, INCRMP.

[28] WSMR, INCRMP.

[29] WSMR, INCRMP.

[30] WSMR, INCRMP.

[31] MEVATEC Corporation LLC, *Site Characterization Report for the Former Sewage Treatment Plant (STP) Percolation Ditches, White Sands Missile Range, New Mexico* (April 1999).

[32] Eco Inc., "Davies Playa Natural Resources and Water Quality Data Evaluation."

[33] Eco Inc., "Davies Playa Natural Resources and Water Quality Data Evaluation."

[34] WSMR, INCRMP.

[35] WSMR, INCRMP.

[36] WSMR, *White Sands Missile Range inventory of aggressive exotic plants management report.* WSMR, NM. 20 pp. + appendices. 2002.

[37] Robert R. Parmenter, Sandra L. Brantley, James H. Brown, Clifford S Crawford, David C. Lightfoot, and Terry L. Yates, "Diversity of Animal Communities on Southwestern Rangelands: Species Patterns, Habitat Relationships, and Land Management," *Natural Resources and Environmental Issues* 4 (1995).

[38] Robert R. Parmenter and Thomas R. Van Devender, "Diversity, Spatial Variability, and Functional Roles of Vertebrates in the Desert Grassland," in *The Desert Grassland*, edited by Mitchel P. McClaran and Thomas R. Van Devender (Tucson, AZ: University of Arizona Press, 1995): 194–233.

[39] David E. Brown, *Biotic Communities of the Southwestern United States and Northwestern Mexico* (Salt Lake City, UT: University of Utah Press, 1994).

[40] Parmenter et al, "Diversity of Animal Communities on Southwestern Rangelands."

[41] Parmenter and Van Devender, "Diversity, Spatial Variability, and Functional Roles of Vertebrates in the Desert Grassland."

[42] WSMR, INCRMP.

[43] D.W. Burkett, *Pitfall Surveys of Selected Waters of the U.S. and Wetlands within White Sands Missile Range*, Project for U.S. Army Waterways Experimental Station (1997).

[44] White Sands Missile Range (WSMR), "Bird Checklist of White Sands Missile Range New Mexico," Environmental Stewardship Branch, Directorate of Public Works, WSMR, NM (updated September 2007).

[45] WSMR, INCRMP.

[46] M. Hartsough, D. Burkett, R. Wu, C. Britt, G. Villegas, and J. Hobert, *Draft 2015 Migratory Bird Survey Summary*, ECO Inc. (2015).

[47] Hartsough et al, *Draft 2015 Migratory Bird Survey Summary*.

[48] White Sands Missile Range (WSMR), "Mammal Checklist of White Sands Missile Range," Directorate of Environment and Safety, WSMR, NM (September 2007).

[49] WSMR, "Mammal Checklist of White Sands Missile Range."

[50] WSMR, INCRMP.

[51] WSMR, INCRMP.

[52] WSMR, INCRMP.

[53] U.S. Fish and Wildlife Service (USFWS), *Sneed and Lee Pincushion Cacti (Coryphantha sneedii var. sneedii and Coryphantha sneedii var. leei) Recovery Plan* (1986).

[54] Natural Heritage New Mexico, Biology Department, *Delineation of Southwestern Willow Flycatcher and Yellow–billed Cuckoo Habitat on White Sands Missile Range* (2003).

[55] Ecological Consultants, "Davies Playa Natural Resources and Water Quality Data Evaluation" (September 2017).

[56] Kendal E. Young and Quinn H. Young, "Aplomado falcon (Falco femoralis)," In *Raptors of New Mexico*, edited by Jean-Luc E. Cartron (Albuquerque, NM: University of New Mexico Press, 2010), 429–443.

[57] White Sands Missile Range (WSMR), *Final Environmental Assessment for Implementation of the Endangered Species Management Plan for the Northern Aplomado Falcon at White Sands Missile Range*, Directorate of Public Works-Environmental Division, WSMR, NM (2007).

[58] M.K. Sogge and R.M. Marshall, "A Survey of Current Breeding Habitats," in *Status, Ecology, and Conservation of the Southwestern Willow Flycatcher*, ed. by Deborah M. finch and Scott H. Stoleson (Fort Collins, CO: U.S. Department of Agriculture Forest Service, 2000), 43-56.

[59] J.M. Hughes, "Yellow-billed Cuckoo (*Coccyzus americanus*)," in *The Birds of North America*, No. 148, ed. by A. Poole and F. Gill (Philadelphia, PA: The Birds of North America, Inc., 1999).

[60] WSMR, INCRMP.

[61] WSMR, *Final Environmental Impact Statement*.

[62] WSMR, INCRMP.

[63] WSMR, INCRMP.

[64] WSMR, INCRMP.

[65] WSMR, INCRMP.

[66] WSMR, INCRMP.

[67] WSMR, INCRMP.

[68] WSMR, *Final Environmental Impact Statement*.

[69] WSMR Public Affairs, "White Sands Home to Army's Largest Solar Power System," U.S. Army website (January 17, 2013), https://www.army.mil/article/94412/white_sands_home_to_armys_largest_solar_power_system (accessed October 3, 2018).

[70] WSMR, *Final Environmental Impact Statement*.

[71] WSMR Public Affairs, "White Sands Home to Army's Largest Solar Power System."

[72] Adriana Salas De Santiago, "White Sands Missile Range Solar Array Saving Dollars," WSMR Public Featured News (updated October 26, 2018), http://www.wsmr.army.mil/fn/Pages/WhiteSandsMissileRangeSolarArraysavingdollars.aspx (accessed March 5, 2019).

[73] James W. Lewis, *White Sands Missile Range 40-year Water Development Plan*, ERDC/Coastal and Hydraulics Laboratory, ERDC/CHL LR-16-13 (2016).

[74] Dennis Risser, *Simulated Water-Level and Water-Quality Changes in the Bolson-Fill Aquifer, Post headquarters Area, White Sands Missile Range, New Mexico*, U.S. Geological Survey Water-Resources Investigation Report 87-4152, US Department of the Army (1988), https://pubs.usgs.gov/wri/1987/4152/report.pdf (accessed October 17, 2018).

[75] Risser, *Simulated Water-Level and Water-Quality Changes in the Bolson-Fill Aquifer, Post headquarters Area, White Sands Missile Range, New Mexico*.

[76] NRCS, 2004. "Soil Survey Geographic (SSURGO) Database for White Sands Missile Range, New Mexico." Texas.

[77] WSMR, *Final Environmental Impact Statement*.

[78] United States Department of Agriculture, Natural Resources Conservation Service, and United States Department of the Interior, National Park Service. 2017. Soil Survey of White Sands National Monument, New Mexico. (Accessible online at: https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/new_mexico/whitesandsNM2017/WhiteSands781.pdf).

[79] WSMR, *Final Environmental Impact Statement*.

[80] WSMR, *Final Environmental Impact Statement*.

[81] WSMR, *Final Environmental Impact Statement*.

[82] WSMR, *Final Environmental Impact Statement*.

[83] WSMR, *Final Environmental Impact Statement*.

[84] David Kelso and Al Perez, "Noise Control Terms Made Somewhat Easier," Noise Pollution Clearinghouse (1983), http://www.trpa.org/wp-content/uploads/1983-NPC_Kelso-Noise-Control.pdf (accessed on March 15, 2018).

[85] American National Standards Institute, *Quantities and Procedures for Description and Measurement of Environmental Sound –Part 4: Noise Assessment and Prediction of Long-term Community Response*, Revision ANSI S12.9-1996/Part 4 (ANSI S12.9-2005/Part 4) (1996, revised 2005), https://www.leg.state.mn.us/docs/2015/other/150681/PFEISref_1/ANSI%202005.pdf (accessed March 15, 2018).

[86] Environmental Noise Branch, Environmental Health Sciences Division, Army Public Health Center, 2019. WSMR Installation Compatible Use Zone Study, 200-1 WS VAR INT 2019.

[87] Ecological Consultants, "Davies Playa Natural Resources and Water Quality Data Evaluation," Appendix A – "Historical Water Quality Monitoring for the Main Post Sewage Treatment Plant Effluent."

[88] Personal Interview with Charlene Brown, DPW-MP (November 6, 2017).

[89] WSMR, *Final Environmental Impact Statement*.

[90] White Sands Missile Range (WSMR), "Salt Water Management COAs," G-3 / DPW Presentation (2017).

[91] WSMR, *Final Environmental Impact Statement*.

[92] WSMR, *Final Environmental Impact Statement*.

[93] WSMR, *Final Environmental Impact Statement*.

[94] Directorate of Public Works, *Environmental Assessment for the Development of a Pilot Solar Energy Project at White Sands Missile Range, NM*, Environmental Division, Customer Support Branch, WSMR (November 2011).

[95] Ecological Consultants, "Davies Playa Natural Resources and Water Quality Data Evaluation."

[96] Ecological Consultants, "Davies Playa Natural Resources and Water Quality Data Evaluation."

[97] WSMR, *Final Environmental Impact Statement*.

[98] Lewis, *White Sands Missile Range 40-year Water Development Plan*.

[99] Lewis, *White Sands Missile Range 40-year Water Development Plan*.

[100] Lewis, *White Sands Missile Range 40-year Water Development Plan*.

[101] Lewis, *White Sands Missile Range 40-year Water Development Plan*.

[102] Lewis, *White Sands Missile Range 40-year Water Development Plan*.

[103] Risser, *Simulated Water-Level and Water-Quality Changes in the Bolson-Fill Aquifer, Post headquarters Area, White Sands Missile Range, New Mexic*o.

[104] White Sands Missile Range (WSMR), "White Sands Missile Range 2011 Drinking Water Quality Report," Main Post (2012), http://www.dtic.mil/dtic/tr/fulltext/u2/a573746.pdf (accessed October 17, 2018).

[105] Jacobs/Huitt-Zollars, "Draft 2009 Infrastructure Report: Potable Water System Analysis BCT (Heavy), WSMR," White Sands Missile Range (May 22, 2009).

[106] Risser, *Simulated Water-Level and Water-Quality Changes in the Bolson-Fill Aquifer, Post headquarters Area, White Sands Missile Range, New Mexic*o.

[107] G.F. Huff, "Simulation of Ground-Water Flow in the Basin-Fill Aquifer of the Tularosa Basin, South-Central New Mexico, Predevelopment Through 2040," USGS Scientific Investigations Report 2004-5197, Prepared in cooperation with Holloman Air Force Base and the City of Alamogordo (2005), https://pubs.usgs.gov/sir/2004/5197/pdf/sir20045197.pdf (accessed February 14, 2019).

[108] Huff, "Simulation of Ground-Water Flow in the Basin-Fill Aquifer of the Tularosa Basin, South-Central New Mexico, Predevelopment Through 2040."

[109] Lewis, *White Sands Missile Range 40-year Water Development Plan*.

[110] U.S. Environmental Protection Agency (USEPA), *Manual: Guidelines for Water Reuse*, EPA/625/R-92/004(NTIS 93-222180) (1992), https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryID=124770 (accessed September 14, 2018).

[111] J.S. McLean, "Saline Ground-water Resources of the Tularosa Basin, New Mexico," USGS Research and Development Progress Report 561, prepared in cooperation with the New Mexico State Engineer and the Office of Saline Water, Department of the Interior (1970), https://pubs.usgs.gov/unnumbered/70139928/report.pdf (accessed March 5, 2019).

[112] U.S. Environmental Protection Agency (USEPA), *2012 Guidelines for Water Reuse*, EPA/600/R-12/618(AR-1530) (September 2012), https://www3.epa.gov/region1/npdes/merrimackstation/pdfs/ar/AR-1530.pdf (accessed September 14, 2018).

[113] USEPA, "A Plain English Guide to the EPA Part 503 Biosolids Rule."

[114] Personal Conversation with Kelly Norwood, WSMR Water Quality Specialist, September 10, 2018, Waste Water Treatment Plant effluent sampling results reported as 19 mg/L nitrate, recorded by Jon W. Seekins.

[115] The Fertilizer Institute, "Fertilizer 101: The Big 3 - Nitrogen, Phosphorus and Potassium" (May 7, 2014), https://www.tfi.org/the-feed/fertilizer-101-big-3-nitrogen-phosphorus-and-potassium (accessed September 18, 2018).

[116] Dale A. Devitt, Lena Wright, Daniel C. Bowman, Robert L. Morris, and Michelle Lockett, "Nitrate-N Concentrations in the Soil Solution Below Reuse Irrigated Golf Course Fairways," *HortScience* 43, no 7 (2008): 2196-2202, file:///P:/Projects/WSMR%20EAs/Water%20Reuse/Data%20From%20WSMR/Golf%20Course%20Nevada%202196.full.pdf (accessed September 13, 2018).

[117] Anne M. Lockett, Dale A. Devitt, and Robert L. Morris, "Impact of Reuse Water on Golf Course Soil and Turfgrass Parameters Monitored Over a 4.5-Year Period," *HortScience* 43, no. 7 (2008): 2210-2218, http://hortsci.ashspublications.org/content/43/7/2210.full (accessed September 13, 2018).

[118] Natural Heritage New Mexico, Biology Department, *Delineation of Southwestern Willow Flycatcher and Yellow–billed Cuckoo Habitat on White Sands Missile Range*.

[119] Lewis, *White Sands Missile Range 40-year Water Development Plan*.

[120] Lockett et al, "Impact of Reuse Water on Golf Course Soil and Turfgrass Parameters Monitored Over a 4.5-Year Period."

[121]Courtney Johnson, Greg Albrecht, Quirine Ketterings, Jen Beckman, Kristen Stockin, 2005. Cornell University, Agronomy Fact Sheet Series, Fact Sheet 2, "*Nitrogen Basics – The Nitrogen Cycle*," Department of Crop and Soil Sciences, College of Agriculture and Life Sciences, http://cceonondaga.org/resources/nitrogen-basics-the-nitrogen-cycle (accessed November 13, 2019).

[122] Devitt et al, "Nitrate-N Concentrations in the Soil Solution Below Reuse Irrigated Golf Course Fairways."

[123] 29 Code of Federal Regulations (CFR) 1910.95, Title - Occupational Noise Exposure, https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9735 (accessed June 28, 2018).

[124] Matthew Terlich, "Assessment of Noise from CSG Pipeline Construction," *Proceedings of Acoustics 2012 – Fremantle, Australia* (2012), https://www.acoustics.asn.au/conference_proceedings/AAS2012/papers/p151.pdf (accessed October 18, 2018).

[125] Environmental Noise Branch, Environmental Health Sciences Division, Army Public Health Center, 2019. WSMR Installation Compatible Use Zone Study, 200-1 WS VAR INT 2019.

[126] USEPA 2012 Guidelines for Water Reuse

[127] Lewis, *White Sands Missile Range 40-year Water Development Plan*.

[128] White Sands Missile Range (WSMR), *WSMR Infrastructure Report*, Draft Wastewater Quantification BCT (Heavy) (April 20, 2009).

[129] Jacobs/Huitt-Zollars, "Draft 2009 Infrastructure Report: Potable Water System Analysis BCT (Heavy), WSMR."

[130] Devitt et al, "Nitrate-N Concentrations in the Soil Solution Below Reuse Irrigated Golf Course Fairways."

[131] Huff, "Simulation of Ground-Water Flow in the Basin-Fill Aquifer of the Tularosa Basin, South-Central New Mexico, Predevelopment Through 2040."

[132] University of California, Davis, "Groundwater Remediation and Management for Nitrate," 2012.

[133] Lewis, *White Sands Missile Range 40-year Water Development Plan*.

[134] University of California, Davis, "Groundwater Remediation and Management for Nitrate," 2012.

[135] WSMR, "Salt Water Management COAs."

[136] WSMR, "Salt Water Management COAs."

[137] WSMR, "Salt Water Management COAs."

[138] Richard K. Farnsworth and Edwin S. Thompson, *Mean Monthly, Seasonal, and Annual Pan Evaporation for the United States*, NOAA Technical Report NWS 34, Office of Hydrology, National Weather Service (December 1982), http://large.stanford.edu/courses/2010/ph240/harting2/docs/NWS34EvapTables.pdf (accessed October 9, 2018).

[139] Amec Foster Wheeler Environment & Infrastructure, Inc., "Pond Design Strategy Report Pond Optimization Study 2," submitted to Wastren Advantage, Inc. (2017).

[140] Amec Foster Wheeler Environment & Infrastructure, Inc. "Pond Design Strategy Report Pond Optimization Study 2."

[141] Water Education Foundation, "Evaporation Ponds" (2018), https://www.watereducation.org/aquapedia/evaporation-ponds (accessed October 12, 2018).

[142] Evaporation Ponds Technical Committee, *Task 4: Evaporation Ponds*, San Joaquin Valley Drainage Implementation Program and the University of California Salinity/Drainage Program (1999).

[143] Evaporation Ponds Technical Committee, *Task 4: Evaporation Ponds*.

[144] Cynthia Therese Martinez, "Selenium Levels in Select Species of Aquatic Birds on Imperial National Wildlife Refuge," M.S. Thesis, The University of Arizona (1994), https://nctc.fws.gov/Pubs2/SeleniumAquaticBirdsAZ.pdf (accessed March 5, 2019).

[145] Ecometrix Inc., "A Review of Environmental Management Criteria for Selenium and Molybdenum," prepared for the Mend Initiative (2007).

[146] U.S. Environmental Protection Agency (USEPA), "Biosolids Technology Fact Sheet: Land Application of Biosolids," EPA 832-F-00-064 (September 2000), https://www3.epa.gov/npdes/pubs/land_application.pdf (accessed March 5, 2019).

[147] Washburn and Begier, "Wildlife Response to Long-Term Application of Biosolids to Grasslands in North Carolina."

[148] U.S. Environmental Protection Agency (USEPA), "Biosolids Technology Fact Sheet: Land Application of Biosolids," EPA 832-F-00-064 (September 2000), https://www3.epa.gov/npdes/pubs/land_application.pdf (accessed March 5, 2019).

[149] Washburn and Begier, "Wildlife Response to Long-Term Application of Biosolids to Grasslands in North Carolina."

[150] U.S. Army, Programmatic Environmental Assessment Army Net Zero Installations.

[151] USEPA 2012 Guidelines for Water Reuse

[152] 29 Code of Federal Regulations (CFR) 1910.95.

[153] University of California, Davis, "Groundwater Remediation and Management for Nitrate," 2012.

[154] WSMR, "Salt Water Management COAs."

[155] WSMR, "Salt Water Management COAs."

[156] USEPA, "A Plain English Guide to the EPA Part 503 Biosolids Rule."

[157] U.S. Army Environmental Command. 2007. NEPA Analysis Guidance Manual. May

[158] Army Regulation 200-1 (32 CFR 651)

[159] White Sands Missile Range (WSMR). 2009. Final Environmental Impact Statement for Development and Implementation of Range-Wide Mission and Major Capabilities at White Sands Missile Range, New Mexico