



# Mojave National Preserve

## Management Plan For Developed Water Sources and Environmental Assessment

March 2018





# Management Plan for Developed Water Sources Mojave National Preserve

---

## Environmental Assessment

March 2018

## SUMMARY

### Introduction

This Environmental Assessment (EA) and plan evaluates a range of alternatives for water resources management in California's Mojave National Preserve (Preserve). The plan presents and analyzes the potential effects of three action alternatives and a no action alternative, which represents the continuation of current management practices. Based on the analysis of effects, the National Park Service (NPS) will select an alternative to implement, and guide future management actions in the Preserve.

### Purpose of the Plan

The purpose of the plan and EA is to develop a comprehensive strategy and identify techniques for managing the Preserve's water resources in a changing environment, to ensure the preservation of wildlife, historic, wilderness, and recreation values in a diverse desert ecosystem.

### Need for Action

The Mojave Desert is a water-scarce environment where most native plants and animals are adapted to survive with limited access to free-standing water and extended periods of drought. A variety of natural and developed water features exist on the landscape, including natural springs, developed springs, wildlife guzzlers, and wells. While many developed water features (or water developments) are important for wildlife conservation, have historical value, or are important for the Preserve's operations, others may not be necessary or may be detrimental to other Preserve resources.

There is uncertainty about the importance of these water resources to the desert ecosystem in the face of regional habitat loss, fragmentation, and climate change; and there is no comprehensive strategy to manage water resources in the Preserve. Considering the Preserve's legislative mandate to "perpetuate in their natural state significant and diverse ecosystems of the California desert," a water resource management plan is needed to:

- identify a proactive, consistent, and Preserve-wide management approach for developed and undeveloped water features;
- identify the type and level of management intervention that is appropriate and necessary to sustain habitat for native wildlife given human influences on climate and habitat fragmentation;
- reconcile competing policy guidance on resource management and wilderness stewardship;

- provide guidance as the Preserve responds to external development threats; and
- improve coordination between the Preserve, California Department of Fish and Wildlife, Bureau of Land Management, other desert national park system units, and stakeholders.

### Issues Raised During the Scoping Process

During the scoping period, several issues of concern related to water resources management were identified. The public and interest groups are highly polarized on the issue of water provisioning for wildlife. Some wilderness advocacy groups strongly oppose the presence of guzzlers in wilderness and dismiss the potential for adverse effects on native and nonnative wildlife by eliminating guzzlers. Other groups support the use and expansion of guzzlers, though some recognize that multiple values are at stake when making decisions about water resources in the Preserve. Neighboring wildlife managing agencies in the Mojave region consider guzzlers a routine approach to managing bighorn sheep in the Mojave Desert. The alternatives reflect this range of perspectives.

The key issues identified during scoping included:

- Surface water features,
- Wetland and riparian vegetation,
- Groundwater conditions and availability,
- Wildlife and wildlife habitat,
- Rare, unique, threatened, and endangered species,
- Historic water developments,
- Wilderness character,
- Recreational opportunities and visitor, experience, and
- Regional context.

### Impact Topics Retained for Analysis in the EA

The issues listed above form the basis for the impact topics that were selected for detailed analysis in this plan and EA. The topics retained for analysis are:

- Wildlife,
- Cultural resources, and
- Wilderness character.

These impact topics are described in detail in *Chapter 3: Affected Environment*. Environmental setting, regional context, and water resources are discussed in detail in *Chapter 3: Affected Environment* because they are foundational to water resource management, but are not included as resource topics analyzed for impacts in *Chapter 4: Environmental Consequences*.

### Issues Considered and Dismissed from Further Consideration

Issues that are not relevant to this plan were eliminated from further consideration and analysis by the planning team. In some instances, issues were dismissed because they relate to resources that are not present in the Preserve. In other instances, Preserve staff considered potential issues for certain resource areas, but because the impacts were considered minimal, those topics were also dismissed from further analysis. Issues considered and dismissed from further analysis are:

- Water resources,
- Vegetation communities,
- Recreation and hunting,
- Preserve operations,
- Geology, geohazards, and soils,
- Air quality,
- Land use,
- Ethnographic resources,
- Socioeconomics, and
- Environmental justice.

## Factors Influencing Water Resource Management

The following environmental factors set the context for water resource management in the Preserve. These are described in greater detail in *Chapter 3: Affected Environment* and are the basis for the impact topics analyzed in *Chapter 4: Environmental Consequences*.

### Environmental Setting

The Preserve includes an ecologically diverse yet fragile desert ecosystem consisting of vegetative attributes that are unique to the Mojave Desert, as well as components of the Great Basin and Sonoran Deserts. The climate is extreme and is characterized by very hot summers and limited precipitation. Changing climate trends are likely to have a profound effect on the relationships between desert ecology, wildlife populations, and the spatial and temporal distribution of available surface water on the landscape.

The Mojave Desert ecosystem has been affected by multiple human pressures. The Preserve lies between Las Vegas, Nevada, and Los Angeles, California, and is bounded by two interstate highways (I-15 and I-40). These and other disturbances associated with human development continue to alter and fragment regional habitat for a variety of wildlife species, including desert bighorn sheep.

### Groundwater and Surface Water Resources

Within the broad valleys of the Preserve are deep alluvial groundwater basins that contain centuries-old aquifers. Some of these deep aquifers are associated with perennial springs such as Piute Springs and Soda Springs, which support small riparian ecosystems. The more common types of springs or seeps are those located along the slopes and edges of mountain ranges and fed by small, localized perched aquifers. These small aquifers have limited groundwater storage, resulting in highly variable spring discharge that is correlated with annual precipitation rates. About 311 springs, seeps, and wells and 137 guzzlers (big and small) are known to exist in the Preserve.

### Wildlife Conservation and Management

While most native species of plants and animals are adapted to survive in this water-scarce environment, many species use natural or human-made sources of water to survive. As a result of regional loss of habitat connectivity and climate change, some species (such as the desert bighorn sheep) rely on both natural and developed water sources. Other species of native wildlife are less reliant on water features, but use those sources opportunistically.

Three sensitive species are uniquely relevant to the management of natural and developed water resources in the Preserve:

- The Mohave tui chub is a small minnow that is listed as federally endangered and is found in several groundwater-fed ponds in the Preserve.

### Types of Water Features

**Big game guzzlers** – Large tanks and systems intended to provide water for desert bighorn sheep.

**Small game guzzlers** – Concrete aprons leading to underground tanks to provide water to game birds.

**Springs and seeps** – Natural or human-induced water expressions.

**Water developments** – Excavations, pipes, tanks, and other infrastructure to collect and convey water.

**Wells** – Hand-dug or drilled vertical holes intended to lift water to the surface.

**Ponds and reservoirs** – Natural and excavated depressions or embankments that hold surface water.

- The desert tortoise is a federally threatened species, and its habitat is found through most of the lower-elevation portions of the Preserve.
- The desert bighorn sheep is not federally listed, but is managed as a fully protected species by the State of California. Populations in the Preserve rely on developed water sources, or guzzlers.

### **Designated Wilderness**

The 1994 California Desert Protection Act, which established the Mojave National Preserve, also designated almost half of the Preserve (804,949 acres) as wilderness. Almost half of the small game guzzlers and all of the big game guzzlers are located in wilderness. These water features provide some element of habitat for wildlife, and many require routine maintenance to ensure their effectiveness and safety. While wildlife conservation is a purpose of wilderness and some guzzlers may help preserve some qualities of wilderness character, the presence of structures and the use of motorized vehicles or equipment may adversely affect other qualities.

## **Water Management Plan Alternatives**

The following four water resource management alternatives are considered for implementation: one no action alternative and three action alternatives. Each action alternative represents a distinct approach to managing water resources that is intended to achieve a particular set of desired conditions and depends on a particular rationale. The alternatives and their anticipated effects are summarized in Table S-1 and Table S-2 below.

The Mojave Desert is rapidly changing as a result of the combined anthropogenic effects of climate change, habitat fragmentation, and habitat loss. Habitat loss and fragmentation increase the importance of large national parks for wildlife habitat conservation. Each action alternative recognizes the importance of wilderness qualities, the need for active management to support wildlife conservation in the face of anthropogenic change, and the desire to balance sometimes conflicting values and mandates. Each alternative would optimize the use of water developments to meet diverse land and wildlife management objectives by maintaining those that are important to native wildlife populations, removing those that do not contribute to habitat value, and strategically using water developments outside of wilderness to support wildlife conservation.

### **Alternative 1 – No Action**

The NPS would continue current water management practices, which would retain the current number and distribution of water developments and respond to external proposals or initiatives on an ad hoc basis. In particular, water resource management actions related to wildlife, historic features, and preserve operations, and the impacts of those changes, would be addressed on a case-by-case basis based on land designations (e.g., wilderness or critical habitat) without any overarching guidance.

### **Alternative 2**

Alternative 2 emphasizes minimizing water developments in wilderness. The overall management philosophy would be strategic intervention to limit intrusion into wilderness while using a variety of tools to conserve and maintain self-sustaining native wildlife populations. At full implementation, Alternative 2 would result in fewer water developments in wilderness, and in the Preserve overall, compared to the No Action.

Alternative 2 includes the following:

- Three big game guzzlers would be removed, two would be relocated, one would be retained, and two new water sources would be developed.
- Most small game guzzlers would be neglected, removed, or disabled.
- Water developments at most springs would be neglected.
- Other elements, including groundwater resources, water rights, hazardous materials, and other water uses not included above would be monitored and managed proactively.

### **Alternative 3 (Preferred Alternative)**

Alternative 3 emphasizes reducing of the number of water developments in wilderness while supporting native species conservation. The overall management philosophy would be strategic intervention to ensure that native wildlife populations are stable as the overall number of water developments in wilderness is reduced and regional habitat connectivity is improved. Big game guzzlers would be removed from wilderness in a manner that results in no net loss of functioning dry season habitat. At full implementation, Alternative 3 would result in more developed water sources in the Preserve compared to Alternative 2 and the No Action; and one more big game guzzler in wilderness compared to Alternative 2.

Alternative 3 includes the following:

- Two big game guzzlers would be removed, two would be relocated, two would be retained in place, and three new water sources would be developed.
- Most small game guzzlers would be neglected, removed, or disabled, while select non-wilderness guzzlers would be maintained to support native wildlife.
- Water developments at 5 to 10 managed springs would be evaluated for ecological importance and potential maintenance, while most others would be neglected.
- Other elements, including groundwater resources, water rights, hazardous materials, and other water uses not included above would be monitored and managed proactively.

### **Alternative 4**

Alternative 4 emphasizes the use of water developments to augment native wildlife habitat in the Preserve while reducing, where possible, the number of water developments within wilderness. The overall management philosophy would be to use water developments to improve existing habitat in the Preserve and to maintain or develop connections between the Preserve and surrounding habitat in the larger landscape. At full implementation, Alternative 4 would result in more water developments in wilderness compared to the other alternatives, and more water developments in the Preserve compared to the No Action and Alternative 2. There would be the same number of big game guzzlers compared to Alternative 3.

Alternative 4 includes the following:

- One big game guzzler would be removed, two would be relocated, three would be retained in place, and two new water sources would be developed.
- Small game guzzlers would be maintained and improved outside of wilderness to support native wildlife.
- Water developments at 10 to 15 managed springs would be maintained or stabilized, while the rest would continue to be neglected.



- Other elements, including groundwater resources, water rights, hazardous materials, and other water uses not included above would be monitored and managed proactively.

### Alternative Objectives and Management Strategies

Each alternative represents a distinct objective and approach to managing water developments in the Preserve, representing different assumptions about environmental conditions and approaches to water resource management and decision making. Four alternatives were retained for detailed analysis and are described in greater detail in the following sections of this chapter.

**Alternative 1 (No Action).** Manage water developments on an ad hoc basis, often in response to external proposals or directives. All existing water developments would be retained, but would not be rebuilt or replaced.

**Alternative 2.** Minimize water developments in wilderness while strategically using water developments to conserve native wildlife populations. Under Alternative 2:

- Three big game guzzlers would be removed, two would be relocated, one would be retained, and two new water sources would be developed.
- Most small game guzzlers would be neglected and some would be removed or disabled, while select non-wilderness guzzlers would be maintained to support native wildlife.
- Water developments at 5 to 10 managed springs would be evaluated for ecological importance and potential maintenance, while most others would be neglected.

**Alternative 3 (Preferred Alternative).** Manage water developments to support native species conservation and population stability while reducing the number of water developments in wilderness. Under Alternative 3:

- Two big game guzzlers would be removed, two would be relocated, two would be retained, and three new water sources would be developed.
- Most small game guzzlers would be neglected and some would be removed or disabled, while select non-wilderness guzzlers would be maintained to support native wildlife.
- Water developments at 5 to 10 managed springs would be evaluated for ecological importance and potential maintenance, while most others would be neglected.

**Alternative 4.** Manage water resources to augment native wildlife habitat and restore connectivity. Under Alternative 4:

- One big game guzzler would be removed, two would be relocated, three would be retained, and two new water sources would be developed.
- Small game guzzlers would be maintained and improved outside wilderness to support native wildlife.
- Water developments at 10 to 15 managed springs would be maintained or stabilized, while the rest would continue to be neglected.



Table S-1. Water Resource Management Alternatives Summary

|                                       |   | Alternative 1 – No Action   | Alternative 2   | Alternative 3<br>(Preferred Alternative)   | Alternative 4 |
|---------------------------------------|---|---|---|--|---------------|
| <b>Big Game Guzzlers</b>              |   |   |   |  |               |
| Guzzler Actions                       | Continue filling and maintaining guzzlers as needed   | <ul style="list-style-type: none"> <li>Remove Clark, Piute, and Old Dad guzzlers</li> <li>Retain Kelso guzzler</li> <li>Relocate Kerr and Vermin guzzlers to outside wilderness (New Kerr and New Vermin)</li> <li>Build potential new guzzlers at Vontrigger and Ginn sites</li> <li>5 guzzlers within the Preserve, 1 within wilderness</li> </ul>              | <ul style="list-style-type: none"> <li>Remove Clark and Piute guzzlers</li> <li>Retain Old Dad and Kelso guzzlers</li> <li>Relocate Kerr and Vermin guzzlers to outside wilderness (New Kerr and New Vermin)</li> <li>Build potential new guzzlers at Piute North, Vontrigger, and Ginn sites</li> <li>7 guzzlers within the Preserve, 2 within wilderness</li> </ul> | <ul style="list-style-type: none"> <li>Remove Clark guzzler</li> <li>Retain Piute, Old Dad, and Kelso guzzlers</li> <li>Relocate Kerr and Vermin guzzlers to outside wilderness (New Kerr and New Vermin)</li> <li>Build potential new guzzlers at Vontrigger and Ginn sites</li> <li>7 guzzlers within the Preserve, 3 within wilderness</li> </ul> |               |
| <b>Small Game Guzzlers</b>            |   |   |   |  |               |
| Guzzlers in Wilderness                | <i>Common to All Alternatives:</i> <ul style="list-style-type: none"> <li>Neglect all; allow guzzlers to deteriorate over time</li> </ul>   |   |   |  |               |
| Non-wilderness Guzzlers               | <ul style="list-style-type: none"> <li>Allow ad hoc maintenance</li> <li>Neglect all other small game guzzlers</li> </ul>   | <ul style="list-style-type: none"> <li>Evaluate sets of 10 to 15 guzzlers for condition and wildlife use</li> <li>Repair escape ramps as needed</li> <li>Maintain or improve a select few for native wildlife</li> <li>Remove or disable some</li> <li>Neglect remaining guzzlers</li> </ul>  | Same as Alternative 2   | <ul style="list-style-type: none"> <li>Evaluate sets of 15 to 25 guzzlers for condition and wildlife use</li> <li>Maintain and repair escape ramps as needed</li> <li>Repair, maintain, or improve for native wildlife</li> <li>Remove or disable select few</li> </ul>  |               |
| <b>Springs and Water Developments</b> |   |   |   |  |               |
| Developed Springs                     | <ul style="list-style-type: none"> <li>Allow maintenance of springs per outside requests</li> <li>Clean up spring sites if needed for visitor safety</li> <li>Neglect all others</li> </ul> | <ul style="list-style-type: none"> <li>Evaluate 5 to 7 spring developments per year for ecological importance and condition</li> <li>Maintain 5 to 10 springs if determined important for native wildlife</li> <li>Neglect all others</li> </ul>  | Same as Alternative 2   | <ul style="list-style-type: none"> <li>Evaluate 5 to 7 spring developments per year for ecological importance and condition</li> <li>Maintain 10 to 15 springs if determined important for native wildlife</li> <li>Neglect all others</li> </ul>  |               |
| Wells                                 | Actively close/abandon or maintain wells to comply with state regulations   | <i>Common to All Action Alternatives:</i> <ul style="list-style-type: none"> <li>Maintain 8 NPS water supply wells and 28 grazing/ monitoring wells for administrative purposes</li> <li>Retain up to 3 wells for future water supply</li> <li>Add 1-2 wells in the Hole in the Wall area to support Preserve operations</li> <li>Destroy unused wells</li> </ul> |   |  |               |

|                                 | Alternative 1 – No Action  | Alternative 2  | Alternative 3<br>(Preferred Alternative) | Alternative 4 |
|---------------------------------|--|--|--|---------------|
| Ponds and Lakes                 | <ul style="list-style-type: none"> <li>• Maintain habitat for endangered Mohave tui chub on an ad hoc basis</li> <li>• Neglect other (ephemeral) ponds, with no active management, maintenance, or improvements</li> </ul> | <p><i>Common to All Action Alternatives:</i></p> <ul style="list-style-type: none"> <li>• Maintain springs for Mohave tui chub and pursue additional restoration sites</li> <li>• Neglect other ponds</li> </ul>   |  |               |
| <b>Other Elements</b>           |  |  |  |               |
| Deep Alluvial Basin Groundwater | Provide technical review and comments on outside proposals   | <p><i>Common to All Action Alternatives:</i></p> <ul style="list-style-type: none"> <li>• Monitor groundwater quality and water levels for long-term trends/public health</li> <li>• Develop new water supply wells as needed to support NPS operations</li> <li>• Provide technical review and comments on outside proposals</li> <li>• Pursue legal avenues to prevent or mitigate impacts on Preserve resources</li> <li>• Complete well inventory and destroy abandoned wells according to state code</li> </ul> |  |               |
| Water Rights                    | Continue filing as directed by NPS Water Resources Division  | <p><i>Common to All Action Alternatives:</i></p> <ul style="list-style-type: none"> <li>• Evaluate water rights acquired by the Preserve with assistance from NPS Water Resources Division</li> <li>• Develop and assert federal reserved water rights as needed to protect resources</li> </ul>   |  |               |
| Other Programs                  | Identify and mitigate hazardous materials as lands are acquired  | <p><i>Common to All Action Alternatives:</i></p> <ul style="list-style-type: none"> <li>• Identify and mitigate hazardous materials as lands are acquired</li> <li>• Use water source manipulation to manage livestock grazing per Grazing Management Plan (under development) and consistent with this plan</li> </ul>  |  |               |

Table S-2. Environmental Effects of the Water Resource Management Alternatives

| Resource                           | No Action<br>(Existing Conditions)   | Alternative 2   | Alternative 3<br>(Preferred Alternative)  | Alternative 4  |
|------------------------------------|--|---|---|--|
| Wildlife –<br>Desert Bighorn Sheep | <ul style="list-style-type: none"> <li>No effects</li> <li>No strategy for long-term management</li> </ul> | <ul style="list-style-type: none"> <li>Guzzler removal, relocation, and new guzzler implementation would result in a potential 10% decrease in the Preserve’s dry season habitat value</li> <li>Decreased habitat value would occur in the Old Dad/Kelso Mountains and Piute/Castle Mountains. A slight decrease would occur in the Clark Mountains</li> <li>Increased habitat value in the Mescal/Ivanpah Range and Woods/Hackberry Mountains</li> <li>Two new water sources would increase dry season habitat value, support migration corridors, and support the expansion and establishment of populations</li> <li>Guzzler removal/relocation would result in short-term adverse effects on individual sheep</li> <li>Implementation sequencing to reduce adverse effects, site-specific planning, and monitoring would guard against significant adverse impacts (see Figure 3)</li> <li>Overall, potential for long-term adverse effects on bighorn sheep is low, due to careful implementation, monitoring, and increased habitat connectivity</li> </ul> | <ul style="list-style-type: none"> <li>Guzzler removal, relocation, and new guzzler implementation would result in a potential 19% increase in the Preserve’s dry season habitat value</li> <li>Slight decrease in habitat value would result in the Old Dad/Kelso Mountains and Clark Mountains</li> <li>Increased habitat value in the Piute/Castle Mountains, Mescal/Ivanpah Range, and Woods/Hackberry Mountains</li> <li>Three new water sources would increase dry season habitat value, support migration corridors, and support the expansion and establishment of populations</li> <li>Guzzler removal/relocation would result in short-term adverse effects on individual sheep</li> <li>Implementation sequencing to reduce adverse effects, site-specific planning, and monitoring would guard against significant adverse impacts (see Figure 3)</li> <li>Overall, some short-term adverse impacts on sheep with the potential for long-term benefits</li> </ul> | <ul style="list-style-type: none"> <li>Guzzler removal, relocation, and new guzzler implementation would result in a potential 18% increase in the Preserve’s dry season habitat value</li> <li>Slight decrease in habitat value would result in the Old Dad/Kelso Mountains and Clark Mountains</li> <li>No change to habitat value in the Piute/Castle Mountains</li> <li>Increased habitat value in the Mescal/Ivanpah Range and Woods/Hackberry Mountains</li> <li>Two new water sources would increase dry season habitat value, support migration corridors, and support the expansion and establishment of populations</li> <li>Guzzler removal/relocation would result in short-term adverse effects on individual sheep</li> <li>Implementation sequencing to reduce adverse effects, site-specific planning, and monitoring would guard against significant adverse impacts (see Figure 3)</li> <li>Overall, some short-term adverse impacts on sheep with the potential for long-term benefits</li> </ul> |

| Resource             | No Action<br>(Existing Conditions)   | Alternative 2   | Alternative 3<br>(Preferred Alternative)  | Alternative 4  |
|----------------------|--|---|---|--|
| Wildlife –General    | <ul style="list-style-type: none"> <li>• Benefits to Mohave tui chub and desert tortoise</li> <li>• Localized benefit from ad hoc maintenance</li> <li>• Localized and low-magnitude impacts from long-term deterioration of water sources</li> <li>• Uncertain wildlife population effects</li> </ul>   | <p><i>Common to All Action Alternatives:</i></p> <ul style="list-style-type: none"> <li>• Benefits to Mohave tui chub and desert tortoise</li> <li>• Localized and small impacts from long-term deterioration of water sources and limited removal of water sources</li> <li>• Localized and small benefits from limited maintenance of non-wilderness water sources</li> <li>• Uncertain wildlife population effects</li> </ul>                          |   |  |
| Cultural Resources   | <ul style="list-style-type: none"> <li>• Adverse effects on features that are left to deteriorate</li> <li>• Benefits from ad hoc maintenance of historic water features</li> <li>• No comprehensive strategy or compliance approach for treatment of historic water features</li> </ul>   | <p><i>Common to All Action Alternatives:</i></p> <ul style="list-style-type: none"> <li>• Adverse long-term effects from neglect, deterioration, and disabling of other historic water features</li> <li>• Benefits to non-wilderness water features that are maintained and stabilized</li> <li>• Effects would be resolved through a consultation with the State Historic Preservation Office (SHPO)</li> </ul>   |   |  |
| Wilderness Character | <ul style="list-style-type: none"> <li>• Adverse impacts on untrammeled and undeveloped qualities due to the presence of developed guzzlers in wilderness</li> <li>• Benefits to natural qualities from the conservation value of guzzlers to desert bighorn sheep</li> <li>• Overall, small adverse effect on wilderness character</li> </ul> | <ul style="list-style-type: none"> <li>• Benefits to untrammeled and undeveloped qualities from the removal of five big game guzzlers from wilderness</li> <li>• No impacts on natural qualities associated with bighorn conservation</li> <li>• Some adverse impacts associated with spring maintenance in wilderness</li> <li>• Overall benefit to wilderness from the reduction of active guzzler development and maintenance in wilderness</li> </ul> | <ul style="list-style-type: none"> <li>• Benefits to untrammeled and undeveloped qualities from the removal of four big game guzzlers from wilderness</li> <li>• No impacts on natural qualities associated with bighorn conservation</li> <li>• Some adverse impacts associated with spring maintenance in wilderness</li> <li>• Overall benefit to wilderness from the reduction of active guzzler development and maintenance in wilderness</li> </ul> | <ul style="list-style-type: none"> <li>• Benefits to untrammeled and undeveloped qualities from the removal of three big game guzzlers from wilderness; but adverse effects from three guzzlers that would remain</li> <li>• Benefits to natural qualities associated with bighorn conservation</li> <li>• Overall, small adverse effects on wilderness character due to retention of big game guzzlers and maintenance of select springs in wilderness</li> </ul> |

## CONTENTS

|  |               |
|--|---------------|
| <b>SUMMARY</b> .....   | <b>I</b>      |
| <b>Introduction</b> .....  | <b>i</b>      |
| <b>Purpose of the Plan</b> .....                                   | <b>i</b>      |
| Need for Action .....  | i             |
| Issues Raised During the Scoping Process .....                     | ii            |
| Impact Topics Retained for Analysis in the EA .....                | ii            |
| Issues Considered and Dismissed from Further Consideration .....   | ii            |
| <b>Factors Influencing Water Resource Management</b> .....         | <b>iii</b>    |
| Environmental Setting .....  | iii           |
| Groundwater and Surface Water Resources .....                      | iii           |
| Designated Wilderness .....  | iv            |
| <b>Water Management Plan Alternatives</b> .....                    | <b>iv</b>     |
| Alternative 1 – No Action.....                                     | iv            |
| Alternative 2 .....  | iv            |
| Alternative 3 (Preferred Alternative).....                         | v             |
| Alternative 4 .....  | v             |
| <br><b>CHAPTER 1: PURPOSE OF AND NEED FOR ACTION</b> .....         | <br><b>1</b>  |
| <b>Introduction</b> .....  | <b>1</b>      |
| Purpose of the Plan / Environmental Assessment .....               | 1             |
| Need for Action .....  | 1             |
| Objectives in Taking Action .....                                  | 2             |
| Project Location .....   | 2             |
| <b>Preserve History, Purpose, and Significance</b> .....           | <b>5</b>      |
| History of Mojave National Preserve .....                          | 5             |
| Purpose of Mojave National Preserve.....                           | 5             |
| Significance of Mojave National Preserve.....                      | 6             |
| <b>Factors Influencing Water Resource Management</b> .....         | <b>6</b>      |
| Environmental Setting, Climate, and Geology .....                  | 6             |
| Groundwater and Surface Water Resources .....                      | 7             |
| Wildlife Conservation and Management .....                         | 7             |
| Designated Wilderness .....  | 8             |
| <b>Impact Topics</b> .....   | <b>8</b>      |
| Impact Topics Retained for Analysis .....                          | 8             |
| Issues Considered but Dismissed from Further Consideration .....   | 9             |
| <br><b>CHAPTER 2: WATER RESOURCE MANAGEMENT ALTERNATIVES</b> ..... | <br><b>15</b> |
| <b>Alternatives Development Process</b> .....                      | <b>15</b>     |
| Scoping Process and Public Participation.....                      | 15            |

|   |               |
|---|---------------|
| <b>Water Resource Management Alternatives .....</b>                                     | <b>18</b>     |
| Alternative 1 – No Action.....  | 21            |
| Common Objectives of the Action Alternatives .....                                      | 21            |
| Alternative 2 .....   | 22            |
| Alternative 3 (Preferred Alternative).....  | 24            |
| Alternative 4 .....   | 25            |
| <b>Alternatives by Water Feature Type .....</b>   | <b>27</b>     |
| Big Game Guzzlers .....   | 27            |
| Small Game Guzzlers .....   | 49            |
| Springs, Wells, Lakes, and Ponds .....  | 53            |
| <b>Other Water Resource Management Elements .....</b>                                   | <b>58</b>     |
| Deep Alluvial Basin Groundwater .....   | 58            |
| Water Rights .....  | 58            |
| Other Programs.....   | 59            |
| <b>Alternatives and Alternative Elements Eliminated from Further Consideration.....</b> | <b>59</b>     |
| Removal of All Water Developments .....   | 59            |
| Removal of All Water Developments from Wilderness.....                                  | 60            |
| Significant Expansion of Water Developments .....                                       | 60            |
| Prohibition of Hunting.....   | 60            |
| <br><b>CHAPTER 3: AFFECTED ENVIRONMENT .....</b>  | <br><b>63</b> |
| <b>Introduction .....</b>   | <b>63</b>     |
| <b>Environmental Setting .....</b>  | <b>63</b>     |
| Topography .....  | 63            |
| Geologic Overview .....   | 63            |
| Climate Trends and History.....   | 64            |
| Regional Context.....   | 66            |
| Existing Infrastructure .....   | 66            |
| Federal Land Management.....  | 66            |
| Energy Development.....   | 67            |
| Water Development .....   | 70            |
| Proposed Transportation Development Projects .....                                      | 70            |
| <b>Water Resources.....</b>   | <b>71</b>     |
| Groundwater .....   | 71            |
| Surface Water .....   | 72            |
| Water Features .....  | 74            |
| <b>Wildlife .....</b>   | <b>95</b>     |
| Desert Bighorn Sheep.....   | 95            |
| Other Wildlife Species.....   | 102           |
| <b>Cultural Resources .....</b>   | <b>109</b>    |
| Introduction .....  | 109           |
| Legal and Policy Guidance .....   | 109           |
| Historical Context .....  | 110           |

|   |            |
|---|------------|
| Documented Cultural Resources .....                                 | 113        |
| <b>Wilderness Character .....</b>                                   | <b>114</b> |
| Water Resources in Wilderness .....                                 | 115        |
| Mojave Wilderness Qualities .....                                   | 115        |
| Wilderness Management .....   | 119        |
| <br>  |            |
| <b>CHAPTER 4: ENVIRONMENTAL CONSEQUENCES .....</b>                  | <b>121</b> |
| <b>Introduction .....</b>   | <b>121</b> |
| Resource Topics Analyzed .....                                      | 121        |
| Methods and Assumptions for Assessing Impacts of Alternatives ..... | 121        |
| <b>Wildlife – Desert Bighorn Sheep.....</b>                         | <b>126</b> |
| Methods and Assumptions.....  | 126        |
| Cumulative Impacts Common to All Alternatives .....                 | 128        |
| Impacts of the Alternatives.....                                    | 130        |
| <b>Wildlife – General .....</b>                                     | <b>142</b> |
| Methods and Assumptions.....  | 142        |
| Cumulative Impacts Common to All Alternatives .....                 | 144        |
| Impacts of the Alternatives.....                                    | 145        |
| <b>Cultural Resources .....</b>                                     | <b>148</b> |
| Methods and Assumptions.....  | 148        |
| Cumulative Impacts Common to All Alternatives .....                 | 149        |
| Impacts of the Alternatives.....                                    | 149        |
| <b>Wilderness Character .....</b>                                   | <b>152</b> |
| Methods and Assumptions.....  | 152        |
| Cumulative Impacts Common to All Alternatives .....                 | 153        |
| Impacts of the Alternatives.....                                    | 154        |
| <br>  |            |
| <b>CHAPTER 5: CONSULTATION AND COORDINATION.....</b>                | <b>163</b> |
| <b>History of Public Involvement.....</b>                           | <b>163</b> |
| The Scoping Process.....  | 163        |
| Administrative Draft Plan and NEPA Pathway Change .....             | 165        |
| <b>Agency Consultation .....</b>                                    | <b>166</b> |
| California Department of Fish and Wildlife.....                     | 166        |
| California State Historic Preservation Officer.....                 | 166        |
| U.S. Fish and Wildlife Service.....                                 | 166        |
| <b>Tribal Consultation .....</b>                                    | <b>166</b> |
| <b>Technical Contributors.....</b>                                  | <b>166</b> |
| <b>List of Preparers.....</b>                                       | <b>167</b> |
| <br>  |            |
| <b>REFERENCES.....</b>  | <b>169</b> |



|   |            |
|---|------------|
| <b>APPENDICES</b> .....                                       | <b>181</b> |
| <b>Appendix A Minimum Requirements Analysis</b> .....         | <b>1</b>   |
| <b>Appendix B Desert Bighorn Sheep Habitat Analysis</b> ..... | <b>3</b>   |

## LIST OF TABLES

|   |     |
|---|-----|
| Table S-1. Water Resource Management Alternatives Summary .....                                 | vii |
| Table S-2. Environmental Effects of the Water Resource Management Alternatives.....             | ix  |
| Table 1. Water Resource Management Alternatives Summary .....                                   | 19  |
| Table 2. Summary of Implementation Actions for Big Game Guzzlers .....                          | 27  |
| Table 3. Big Game Guzzler Indicators and Monitoring .....                                       | 29  |
| Table 4. Priorities for Big Game Guzzler Actions under Each Action Alternative .....            | 33  |
| Table 5. Implementation Actions for Big Game Guzzlers .....                                     | 39  |
| Table 6. Small Game Guzzler Implementation Actions .....  | 50  |
| Table 7. Small Game Guzzlers – Indicators .....   | 52  |
| Table 8. Characteristics of Known Springs and Water Developments .....                          | 53  |
| Table 9. Summary of Actions for Springs, Wells, Lakes, and Ponds .....                          | 55  |
| Table 10. Spring and Water Developments – Indicators .....                                      | 56  |
| Table 11. Water Features in the Preserve .....  | 74  |
| Table 12. Documented Springs in the Preserve .....  | 83  |
| Table 13. Water Supply Wells in the Preserve .....  | 87  |
| Table 14. Small Game Guzzler Status.....  | 88  |
| Table 15. Desert Bighorn Sheep Habitat Patches and Population Estimates .....                   | 100 |
| Table 16. Special Status Wildlife Species Potentially Occurring in the Preserve .....           | 106 |
| Table 17. Cumulative Impact Scenario .....  | 124 |
| Table 18. Change to Habitat Value under Each Alternative .....                                  | 126 |
| Table 19. Summary of Implementation Actions for Big Game Guzzlers .....                         | 128 |
| Table 20. Effects from Removal of Developed Water Features by Species Group .....               | 144 |
| Table 21. Summary of Small Game Guzzler Actions by Alternative .....                            | 145 |
| Table 22. Summary of Water Resource Management Alternatives Environmental<br>Consequences ..... | 160 |
| Table 23. Technical Contributors .....  | 166 |
| Table 24. Preparers and Contributors.....   | 167 |

## LIST OF FIGURES

|   |    |
|---|----|
| Figure 1. Mojave National Preserve.....   | 3  |
| Figure 2. Big Game Guzzlers and Bighorn Movement Corridors in the Preserve..... | 35 |

Figure 3. Big Game Guzzler Implementation Sequence..... 37

Figure 4. Guzzler Transition Sequence under Alternative 3 (Preferred Alternative)..... 38

Figure 5. Alternative 2 Big Game Guzzler Actions..... 42

Figure 6. Alternative 3 (Preferred Alternative) Big Game Guzzler Actions ..... 45

Figure 7. Alternative 4 Big Game Guzzler Actions..... 48

Figure 8. U.S. Climate Change Hotspots ..... 65

Figure 9. Regional Context ..... 68

Figure 10. Illustrative Cross-Section of Lanfair Valley ..... 72

Figure 11. Surface Water Feature Expressions in the Preserve..... 75

Figure 12. Water Features in the Preserve ..... 81

Figure 13. Montane Spring Schematic..... 84

Figure 14. Springs and Wells in the Preserve..... 85

Figure 15. Big Game Guzzlers in the Preserve ..... 89

Figure 16. Typical Small Game Guzzler Cross-Section..... 91

Figure 17. Small Game Guzzlers in the Preserve..... 93

Figure 18. Dispersal of Collared Bighorn Ewe Occurrences in the Old Dad/Kelso Mountain Area (ODKM)..... 101

Figure 19. Dry Season Habitat Value of Existing Guzzlers..... 102

Figure 20. Wilderness in Mojave National Preserve ..... 117

Figure 21. Dry Season Habitat Value for Each Guzzler under No Action and Action Alternatives ..... 127

Figure 22. Big Game Guzzler Actions under Alternative 2 ..... 132

Figure 23. Big Game Guzzler Actions under Alternative 3 (Preferred Alternative) ..... 135

Figure 24. Big Game Guzzler Actions under Alternative 4 ..... 139



# CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

## Introduction

This Environmental Assessment (EA) and plan evaluates a range of alternatives for water resources management in California's Mojave National Preserve (Preserve). The plan presents and analyzes the potential effects of three action alternatives and a no action alternative, which represents the continuation of current management practices. Based on the analysis of effects, the National Park Service (NPS) will select an alternative to implement, and guide future management actions in the Preserve.

This plan and EA has been developed by an interdisciplinary team of NPS and consultant staff, with input from the public and interested stakeholders. In addition, the California Department of Fish and Wildlife (CDFW) participated as a cooperating agency. See *Chapter 5: Consultation and Coordination* for a full list of participating individuals and entities.

## Purpose of the Plan / Environmental Assessment

The purpose of the plan and EA is to develop a comprehensive strategy and identify techniques for managing the Preserve's water resources in a changing environment, to ensure the preservation of wildlife, historic, wilderness, and recreation values in a diverse desert ecosystem.

## Need for Action

The Mojave Desert is a water-scarce environment where most native plants and animals are adapted to survive with limited access to free-standing water and extended periods of drought. A variety of natural and developed water features exist on the landscape, including natural springs, developed springs, wildlife guzzlers, and wells. While many developed water features (or water developments) are important for wildlife conservation, have historical value, or are important for the Preserve's operations, others may not be necessary or may be detrimental to other Preserve resources.

There is uncertainty about the importance of these water resources to the desert ecosystem in the face of regional habitat loss, fragmentation, and climate change; and there is no comprehensive strategy to manage water resources in the Preserve. Considering the Preserve's legislative mandate to "perpetuate in their natural state significant and diverse ecosystems of the California desert," a water resource management plan is needed to:

- identify a proactive, consistent, and Preserve-wide management approach for developed and undeveloped water features;
- identify the type and level of management intervention that is appropriate and necessary to sustain habitat for native wildlife given human influences on climate and habitat fragmentation;
- reconcile competing policy guidance on resource management and wilderness stewardship;
- provide guidance as the Preserve responds to external development threats; and
- improve coordination between the Preserve, CDFW, Bureau of Land Management (BLM), other desert national park system units, and stakeholders.

## Objectives in Taking Action

Objectives are qualitative statements of values that serve to guide natural resource decision making and the evaluation of success. All water resource management alternatives selected for detailed analysis address the purpose and need for action and meet all objectives to a large degree. The following objectives for water management are based on the enabling legislation for the Preserve, the Preserve's General Management Plan, and other planning documents and mandates, as well as service wide objectives, management policies, and the NPS Organic Act. Plan objectives for each type of water source include:

**Big Game Guzzlers.** Conserve desert bighorn sheep habitat in a manner that complements regional sheep conservation goals and is consistent with wilderness values.

**Small Game Guzzlers.** Identify and manage the appropriate number and distribution of small game guzzlers that is necessary to support wildlife habitat, protect desert tortoise populations, and protect wilderness values.

**Historic Water Developments.** Maintain historic water developments in a manner that is compatible with their location and condition relative to designated wilderness, and manage the conveyance of water from historic developments in a manner that is consistent with the overall water management approach of each alternative.

**Springs.** Manage naturally occurring seeps and springs to preserve water sources for wildlife and native riparian vegetation and to minimize impacts from nonnative vegetation.

**Deep Alluvial Basin Groundwater.** Protect deep groundwater resources, and the surface water features that rely on them, through both long-term monitoring and active engagement in regional processes and proposals that may affect those resources.

These objectives are common to all action alternatives, although each has its own management strategies and implementation activities that reflect different objectives to water resources management. The alternatives are described in detail in *Chapter 2: Alternatives*.

## Project Location

Located in Southern California, the Preserve is a 1.6-million-acre unit of the national park system, established by Congress on October 31, 1994, by the California Desert Protection Act (CDPA). The Preserve is located in San Bernardino County, about halfway between Barstow, California, and Las Vegas, Nevada. The Preserve is bounded to the north and south by major interstate highways, I-15 and I-40, while the Nevada–California state line makes up most of the eastern boundary (Figure 1). The Preserve headquarters are located in Barstow.

The Preserve is a vast expanse of desert lands that includes vegetation representative of the Great Basin, Sonoran, and Mojave Desert ecosystems. This provides an unusually diverse variety of desert plant and animal life. The Preserve also contains several diverse mountain ranges, the Kelso dune system, dry lake beds, and evidence of volcanic activity (domes, lava flows, and cinder cones).

### Key Plan Terms

**Water features** – All natural or human-made surface water sources known to occur in the Preserve, including springs, wells, guzzlers, lakes, and ponds

**Water developments** – Excavations, pipes, troughs, or other infrastructure intended to facilitate the use of natural water sources

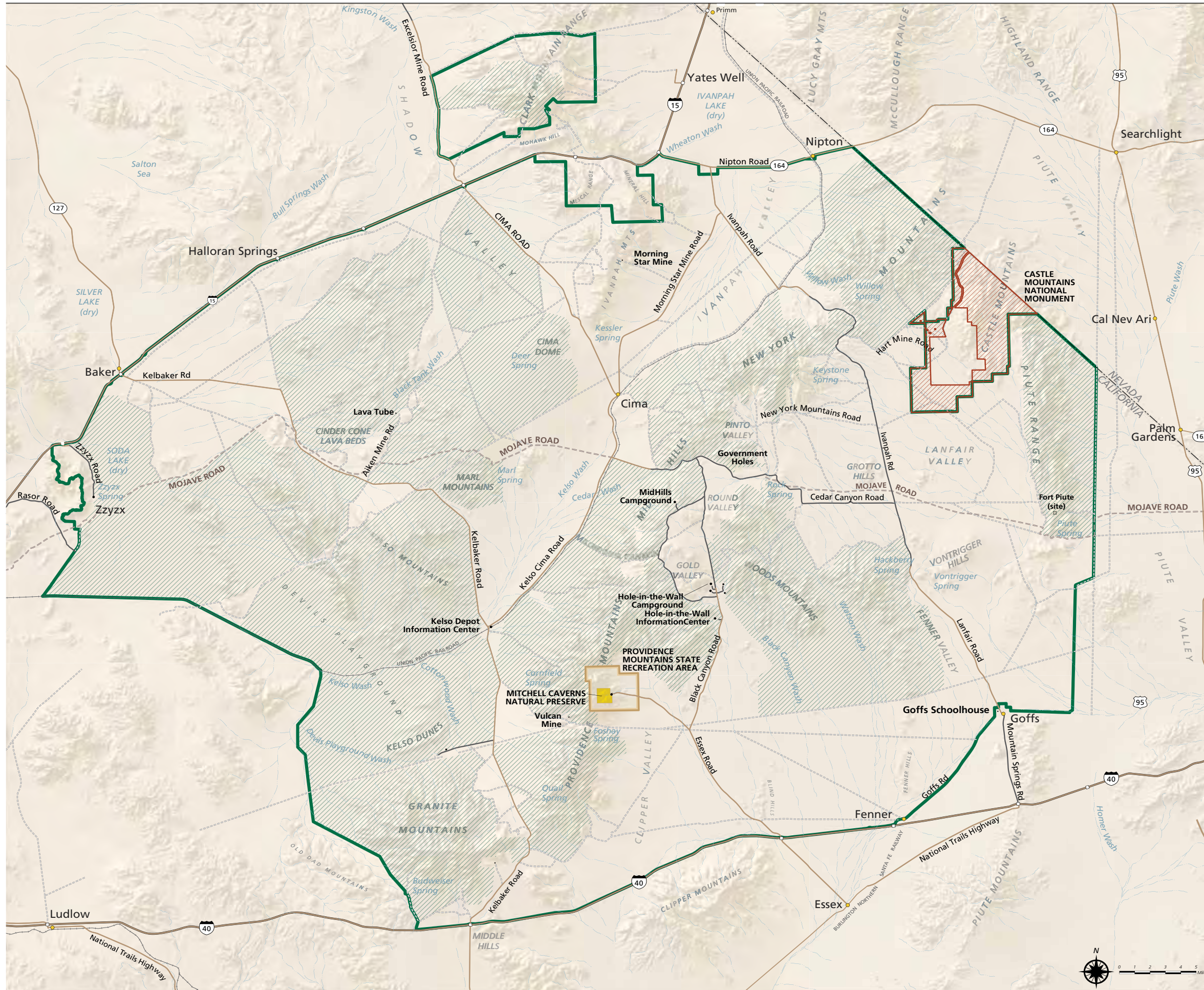
**Guzzlers** – Artificial structures developed to collect, store, and convey water specifically for wildlife



# Mojave National Preserve



Mojave National Preserve  
Water Resources Management Plan and Environmental Assessment



- Mojave National Preserve boundary
- National Park Service Wilderness
- Castle Mountains National Monument
- Paved road
- Unpaved 2-wheel drive road
- Unpaved 4-wheel drive road
- Mojave Road 4-wheel drive road
- Desert wash









Of the Preserve's 1.6 million acres, 804,949 acres are designated as wilderness, and the other half of the Preserve is designated as critical habitat for the federally threatened desert tortoise (*Gopherus agassizii*).

On February 12, 2016, President Obama established the Castle Mountains National Monument (monument) on federal land immediately adjacent to the Preserve, along its northeastern boundary. While this approximately 21,000-acre monument is managed by the NPS and is part of the ecological, hydrologic, and management context of the Preserve, it is not included in this plan. Additional work needs to be completed to inventory water features at the monument and to understand issues related to water resources therein.

## **Preserve History, Purpose, and Significance**

### **History of Mojave National Preserve**

The history of human occupation in the Mojave Desert extends back centuries. In 1776, early explorers were met by members of the Mohave Tribe, who were concentrated along the floodplain of the Colorado River. In the early 1800s, the Mojave Road, originally part of tribal trading routes, became a major route across the desert for European explorers and travelers. By the 1860s, army outposts were established to protect mail carriers and other travelers on the Mojave Road. Soon after the beginning of the mining era, several cattle ranches were established in the vicinity of Government Holes and Cima Dome. Bolstered by the construction of nearby railroads, several other cattle ranches were established and eventually consolidated into the sprawling Rock Springs Land and Cattle Company in 1894. The ranching era lasted through most of the 1900s. Some of the extensive infrastructure to develop and transport water still exists and continues to provide surface water in the Preserve.

In 1994, the CDPA was passed and the Preserve was created from federal lands that were previously administered by the BLM as the East Mojave National Scenic Area. The CDPA also included the designation of 804,949 acres of wilderness.

### **Purpose of Mojave National Preserve**

Congress provided specific direction for the new California desert parks (Mojave National Preserve, Joshua Tree National Park, and Death Valley National Park) and wilderness areas in section 2(b)(1) of the CDPA. These lands were included in the national park system and the national wilderness preservation system to:

- preserve unrivaled scenic, geologic, and wildlife values associated with these unique natural landscapes;
- perpetuate in their natural state significant and diverse ecosystems of the California desert;
- protect and preserve the historical and cultural values of the California desert associated with ancient Indian cultures, patterns of western exploration and settlement, and sites exemplifying the mining, ranching and railroading history of the Old West;
- provide opportunities for compatible public outdoor recreation; protect and interpret ecological and geological features and historic, paleontological, and archeological sites; maintain wilderness resource values; and promote public understanding and appreciation of the California desert; and
- retain and enhance opportunities for scientific research in undisturbed ecosystems.

## Significance of Mojave National Preserve

An NPS unit's statement of significance clearly defines the importance of its resources as they relate to the Park (or Preserve) purpose. These statements help set resource protection priorities, identify primary interpretive themes, and develop desirable visitor experiences. Significance in this context is the importance of a feature or an outstanding value. It may be locally, regionally, nationally, or globally significant, unique, extraordinary, or important to our national and cultural heritage. Significance is not used here in a legal sense, such as with the National Environmental Policy Act (NEPA) or the National Historic Preservation Act (NHPA).

The Preserve's General Management Plan includes the following relevant significance statements, which serve as the basis for management actions (NPS 2002). Mojave National Preserve:

- Protects an extensive variety of habitats, species, and landforms unique to the Mojave Desert and is the best place to experience this ecosystem.
- Contains outstanding scenic resources, rich in visual diversity and containing a varied landscape of sand dunes, mountain ranges, dry lake beds, lava flows, cinder cones, Joshua tree forests, and far-reaching vistas.
- Is a naturally quiet desert environment with very dark night skies that offers visitors and researchers opportunities for natural quiet, solitude, and stargazing with few human-caused noise or light glare sources.
- Protects numerous historic sites from early mining, ranching, homesteading, and railroading endeavors that serve as reminders of the bold and tough people who opened the harsh and forbidding western frontier.

## Factors Influencing Water Resource Management

Water resource management activities within the Preserve must consider the broad context of activities throughout the Mojave Desert region. The Mojave Desert region consists of a complex mosaic of land management types, proposed and existing development areas, transportation corridors, and ecologically core habitat areas. A long history of land and water development throughout the Mojave Desert has direct implications on both water source availability and wildlife populations in the Preserve. These effects may be compounded by the effects of a changing climate on the desert environment. As the availability of water from natural and artificial sources within the Preserve changes due to climate change or management, maintaining the overall connectivity of ecologically core habitat areas will be important to allow wildlife to migrate and adapt to changing conditions.

As stated above in "Need for Action" section, a variety of ecological, historical, regional, and policy factors influence water resources management in the Preserve, as well as the development of the water resource management alternatives analyzed in this EA. These factors are described below and explored in greater detail in *Chapter 3: Affected Environment*.

### Environmental Setting, Climate, and Geology

The Preserve includes an ecologically diverse yet fragile desert ecosystem consisting of vegetative attributes that are unique to the Mojave Desert, as well as components of the Great Basin and Sonoran Deserts. The topography of the Preserve consists of tall, rugged mountain ranges interspersed with broad, flat valleys. The climate is extreme and is characterized by very hot summers and limited precipitation. Changing climate trends are likely to have a profound

effect on the relationships between desert ecology, wildlife populations, and the spatial and temporal distribution of available surface water on the landscape.

The Mojave Desert ecosystem has been affected by multiple human pressures. Due to its proximity to Las Vegas, the Preserve's dark night skies are adversely impacted by light pollution. Interstate highways, aircraft overflights (both military and commercial), military training bases, energy transmission corridors, solar energy developments, and motorized vehicle-enabled recreation have greatly reduced and fragmented the habitat available to support a fully functional desert ecosystem.

## Groundwater and Surface Water Resources

Within the broad valleys of the Preserve are deep alluvial groundwater basins that contain aquifers. Some of these deep aquifers are associated with perennial springs such as Piute Springs and Soda Springs, which support small riparian ecosystems. The more common types of springs or seeps are those located along the slopes and edges of mountain ranges and fed by small, localized perched aquifers.

Surface water availability for wildlife has been fundamentally altered throughout the history of the Mojave Desert. About half of the Preserve's springs and seeps have been modified at some time to facilitate human uses of the landscape. Starting in the mid-20th century, land management agencies and local volunteers constructed wildlife water sources known as "guzzlers." Guzzlers intercept and store rain water for use by various wildlife species. While many of the developed water sources in the Preserve were originally intended to augment game species populations, over time they may have come to serve a broader ecosystem role.

An estimated 311 springs, seeps, and wells and 137 guzzlers (big and small) are known to exist in the Preserve. For the purpose of this plan and EA, the NPS has categorized the types of water features as (NPS 2010a):

- *Springs*—flowing or ponded springs, seeps, bogs, and tinajas
- *Water Developments* – tunnels, springboxes, adits, excavations, troughs, and pipes
- *Wells* – shallow wells and deep drilled wells
- *Ponds and reservoirs* – ponds, mining pit lakes, and wet playas
- *Guzzlers* – water developments built specifically to collect and distribute water to big game or game birds

## Wildlife Conservation and Management

While most native species of plants and animals are adapted to survive in this water-scarce environment, many species use natural or human-made sources of free-standing water to supplement moisture from forage. As a result of regional loss of habitat connectivity and climate change, some species (such as the desert bighorn sheep) rely on both natural and developed water sources to survive. Other species of native wildlife are less reliant on water features, but use those sources opportunistically to enhance habitat and facilitate migration.

The following three sensitive species are relevant to the availability and management of natural and developed water resources:

- The **Mohave tui chub** (*Siphateles bicolor mohavensis*) is a minnow that is federally and state-listed as endangered, and is the only fish native to the Preserve. A small population persists at groundwater-fed pools at Soda Springs (Zzyzx), while another population has been introduced to the pit pond in the abandoned Morningstar Mine. Other thriving populations exist outside of the Preserve.

- The **desert tortoise, Mojave population** (*Gopherus agassizii mohavensis*), is a federally and state-listed threatened species with habitat found at lower elevations in the Preserve. Critical habitat was designated in 1994 before the passage for the California Desert Preservation Act (CDPA).
- The **desert bighorn sheep** (*Ovis canadensis nelsoni*) is managed by the State of California as a fully protected species. Some existing populations are thought to be largely dependent on big game guzzlers in the Preserve, and efforts are underway to improve the size and regional distribution of bighorn sheep populations in the Mojave Desert.

These three species and other wildlife species and their relationship with water resources and management in the Preserve are described in greater detail in *Chapter 3: Affected Environment*.

### Designated Wilderness

The 1994 CDPA designated almost half of the Preserve (804,949 acres) as wilderness. Almost half of the Preserve's small game guzzlers and all of the big game guzzlers are located in wilderness. This presents a dilemma for both water resource management and policy compliance. Most of these water features provide some element of habitat for wildlife, and many require routine maintenance to ensure their effectiveness and safety. These features also fall within the definition of being installations, which are generally not allowed in wilderness.

Other prohibited activities include temporary roads, motor vehicles, motorized equipment, landing of aircraft, and other forms of mechanical transport. The Wilderness Act allows exceptions to this prohibition "as necessary to meet minimum requirements for the administration of the area for the purpose of this Act." This exception gives the agency discretion to engage in these "prohibited uses" if the prohibited use is deemed necessary for management of the area as wilderness. The existence of a prohibited structure, and the mechanized access and tools used for its maintenance, are only permitted if they are determined to be the minimum necessary to preserve wilderness character and achieve wilderness purposes. While wildlife conservation is a purpose of wilderness and some guzzlers may help preserve some qualities of wilderness character (e.g., the "natural" quality associated with wildlife), the presence of developed structures and the use of motorized vehicles or equipment may adversely affect other qualities of wilderness character (e.g., "undeveloped" and "untrammelled").

## Impact Topics

### Impact Topics Retained for Analysis

Impact topics represent specific park resources (and can be thought of as "headings" used in the NEPA review) and are described in detail in *Chapter 3: Affected Environment* and analyzed in *Chapter 4: Environmental Consequences*.

#### **Wildlife**

The Preserve provides habitat for wildlife species characteristic of southwestern deserts. Approximately 35 different habitat types have been documented, supporting a wide variety of native and nonnative wildlife species, including at least 300 bird, 49 mammal, 38 reptile and amphibian, and 1 native fish species. As previously stated above under "Concerns and Issues," the long-term management of water resources in the Preserve can have both beneficial and adverse impacts on a variety of native and nonnative wildlife species (including special status species). In particular, desert ungulates and riparian-dependent species rely on available surface water to survive in the Mojave Desert.

Loss of water developments in the Preserve could result in loss of habitat for some species, while others would not be affected. Wildlife species, such as desert bighorn sheep, that persist in small isolated populations are more vulnerable to a loss of habitat and genetic diversity. Changes in water resource management in the Preserve could result in beneficial impacts for other species, such as desert tortoise, as water developments are a potential source of mortality for these species. Because proposed actions could affect habitat and species distribution in the Preserve, this topic was retained for further analysis and focuses on water availability for desert bighorn sheep.

### ***Cultural Resources***

The Preserve has a rich cultural heritage spanning both prehistoric and historic eras. Eight sites/districts in the Preserve are currently listed or are eligible for listing on the National Register of Historic Places (NRHP). In addition, 15 cultural landscapes/historic districts and sites have been identified by the Preserve as potentially eligible for listing on the NRHP. Many of the tanks, windmills, pumpjacks, troughs, dams, pipelines, springs, wells, and other features in the Preserve are listed as significant contributing features to the NRHP-eligible cultural landscape districts. The Preserve has identified 85 spring developments that are potentially considered historic. Of the 85 spring developments, 47 were identified to potentially have prehistoric significance. For the purposes of this plan, all water features (except big game guzzlers) are considered potentially eligible historic resources.

Since the proposed management actions have the potential to directly affect the cultural landscape in the Preserve this topic is retained for further analysis.

### ***Wilderness Character***

The Preserve has 804,949 acres of designated wilderness, which is nearly half of the land area in the Preserve. The Wilderness Act generally requires that wilderness areas be administered to provide for their protection and preserve their wilderness character. Most of the water resources that are described in this plan are located in wilderness, including 75 percent of the documented springs, nearly half of the small game guzzlers, and all six of the big game guzzlers. Most of these water sources provide some element of habitat for wildlife, and many require routine maintenance to ensure their effectiveness and safety. However, the existence of developed water features, and the mechanized access and tools used for their maintenance, are only permitted if they are necessary to meet minimum requirements for the administration of the area for wilderness purposes.

The presence of structures in wilderness and actions needed to maintain water structures (e.g., the use of motorized vehicles or equipment) could adversely affect certain qualities of wilderness character (i.e., “undeveloped” and “untrammled”). Therefore, issues associated with wilderness character are retained for further analysis.

### **Issues Considered but Dismissed from Further Consideration**

Issues that are not relevant to this plan were eliminated from further consideration by the planning team. In some instances, issues were dismissed because they relate to resources that are not present in the Preserve. In other instances, Preserve staff considered potential issues for certain resource areas, but because the impacts were considered minimal, they were also dismissed from further analysis. These issues, and the rationale for dismissing them, are described below.

### ***Water Resources***

Water resources include groundwater, surface water, and the various types of water features including springs, developments, wells, ponds, and guzzlers. The Preserve contains several

deep alluvial groundwater basins that are important hydrological and ecological resources. Some of these deep aquifers are associated with perennial springs, which support small riparian ecosystems. A variety of natural and developed water features exist on the landscape, including natural springs, developed springs, wildlife guzzlers, and wells. An overview of groundwater and surface water resources in the Preserve is presented in the “Water Resources” section in *Chapter 3: Affected Environment*. All water resource management alternatives include some level of management or neglect of water resources, as well as administrative actions to address groundwater and water rights. The adverse and beneficial impacts of actions or neglect on water resources themselves would be similar under all water resource management alternatives and are better described in terms of the effects of those actions on wildlife, and are speculative in terms of their effect and timing. For these reasons, water resources—as a resource in itself—was dismissed from further analysis.

### **Vegetation Communities**

Past inventories have documented more than 900 plant species in the Preserve. Sonoran plant species such as pancake prickly pear (*Opuntia chlorotica*) and smoke tree (*Dalea spinosa*) are found in the southeast portion of the Preserve. Grasslands, sagebrush, blackbrush, pinyon-juniper woodlands, and unique remnant habitats containing small white fir (*Abies concolor concolor*) forests occur in the higher elevations in the Preserve. Upland desert communities make up most of the Preserve’s vegetation. Although wetlands and riparian areas are uncommon in the Preserve, they are disproportionately important from an ecological perspective and are often associated with developed or natural water features.

Following are brief descriptions of the vegetation communities at the Preserve.

- **Upland Desert Communities** – The most common plant communities in the Preserve, from low-elevation basins to the high mountains, are alkali playa, desert wash, creosote bush (*Larrea tridentata*) scrub, desert dunes, cactus-yucca scrub, blackbrush scrub, big sagebrush (*Artemisia tridentata*) scrub, Joshua tree (*Yucca brevifolia jaegeriana*) woodland, and pinyon-juniper woodland.
- **Wetlands and Riparian Areas** – Vegetation in these areas is often dense and fast growing. Dominant tree species in the riparian community vary based on hydrologic conditions at a given site and can include cottonwood (*Populus fremontii*), willows (*Salix* spp.), mesquite (*Prosopis glandulosa* and *P. pubescens*), and tamarisk (*Tamarix ramosissima*). Subcanopy species may include seepwillow (*Baccharis salicifolia*), desert willow (*Chilopsis linearis*), sandbar willow (*Salix exigua*), cattail (*Typha* spp.), and sedges (*Carex* spp.) and rushes (*Juncus* spp.).

Under all water resource management alternatives, changes to vegetation communities, particularly wetland and riparian areas, would be localized and minimal. Localized disturbance to upland desert species could result from proposed management actions (e.g., construction, repairs, and removal of water developments); however, the impacts would be localized and short-term. Disturbed vegetation is expected to recover following management activities. Removal of nonnative phreatophyte vegetation (e.g., tamarisk) from water features would be an ongoing practice that would continue under all water resource management alternatives. Therefore, this topic was dismissed from further analysis.

### **Recreation and Hunting**

Changes to recreational hunting were identified as an issue of concern during the scoping process. Hunting is a unique and important visitor use opportunity in the Preserve. Although hunting is prohibited in most national park system units, it is specifically authorized in the Preserve by the 1994 CDPA. Hunting is reaffirmed as an appropriate activity in the 2001

General Management Plan (GMP), with the goal of providing opportunities for hunters to take game species during the fall and winter, while also providing a park experience with no hunting or shooting during the spring and summer.

The Preserve is one of the few places in California where bighorn sheep hunting is allowed. A very limited number of bighorn sheep licenses are issued throughout the state through a lottery and auction system. The CDFW determines the number of tags to be issued based on population estimates. In the recent past, the CDFW has issued up to three hunting licenses for bighorn sheep within the Preserve (Old Dad and Kelso Peak hunt zone). Therefore, changes to guzzler management is not likely to have an impact on the hunting or the issuance of tags in the Preserve.

In addition to desert bighorn sheep, hunting opportunities in the Preserve include mule deer (*Odocoileus hemionus*), mourning dove (*Zenaida macroura*) and white-winged dove (*Zenaida asiatica*), Gambel's quail (*Callipepla gambelii*), chukar (red-legged partridge) (*Alectoris chukar*), rabbit (cottontail) (*Sylvilagus* spp.), hare (jackrabbit) (*Lepus californicus*), bobcat (*Lynx rufus*), and coyote (*Canis latrans*) (NPS 2009). Under all the water resource management alternatives many of the small game guzzlers and most of the springs would continue to be neglected and would eventually fall into disrepair. Over time, many of these would cease to provide water or habitat for wildlife, including game species. In addition, the action alternatives include select removal of some small game guzzlers and limited maintenance of some water features.

These potential impacts on game species resulting from water resource management are not expected to result in detectable changes in recreational hunting opportunities for the following reasons:

- The greatest change in the number of water features on the landscape would be due to ongoing neglect. This neglect is a continuation of the status quo, would be similar under all water resource management alternatives (including No Action), and the actual effect on wildlife habitat (the point at which an individual water source fails and no longer supports wildlife) would be geographically dispersed and would occur over a very long period, in many cases beyond the horizon of this plan.
- Considering the temporally and spatially dispersed effects of neglect described above, most wildlife species—including mule deer and small mammals—would adjust habitat use patterns over time. This is not unlike the ongoing adjustments that occur between seasons and between wet and dry years as local populations seek favorable forage and water.
- While localized game bird populations may be reduced or may move to locations with better water availability, those changes may not affect hunting availability or success. Literature cited in the Western Quail Management Plan suggests that quail nesting success, and corresponding hunting success, is more dependent on precipitation-driven vegetation than the availability of open surface water (Zornes and Bishop 2009). Annual variations in precipitation, which produces the green vegetation that these birds rely on for their water requirements, will continue to be the main factor affecting hunting quality.
- None of the alternatives change the locations, seasons, or other hunting regulations in the Preserve.

For these reasons, the NPS does not believe changes in the management of water features in the Preserve would result in detectable impacts on the availability or success of recreational hunting in the Preserve. Therefore, recreation and visitor experience was dismissed from further analysis.



***Preserve Operations***

Under all water resource management alternatives, the Preserve would continue to develop groundwater wells to support Preserve operations as needed. Operations may be supported by wells including administrative support facilities, as well as expanded or relocated campgrounds and visitor centers. This use would be common to all water resource management alternatives, and none would affect the ability of the Preserve to develop or maintain water features for management and operations. Therefore, this topic was dismissed from further analysis.

***Geology, Geohazards, and Soils***

None of the water resource management alternatives would affect geological features or geohazards in the Preserve. Any management actions that would involve construction could potentially impact soils. However, any such impacts would be small, localized, and would have a negligible effect on soil resources in the Preserve; therefore, these issues were dismissed from further analysis.

***Air Quality***

Potential sources of air quality emissions resulting from the proposed alternatives would be limited to the infrequent use of vehicles and equipment to implement the management actions over time. Any increase in air emissions from these activities would be extremely minimal and indistinguishable from routine management activities, with negligible impacts on air quality. Therefore, air quality was dismissed from further analysis.

***Land Use***

None of the alternatives would change the ownership, occupancy, or use of land within the Preserve, within inholdings, or in neighboring communities. Therefore, land use was dismissed from further analysis.

***Ethnographic Resources***

Ethnographic resources are traditional sites, structures, objects, landscapes, and natural resources that communities define as significant to their way of life. No ethnographic resources or issues have been identified in the Preserve; therefore, this topic was dismissed from further analysis.

***Indian Trust Resources and Sacred Sites***

The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights. No formerly established or recognized Indian trust resources or sacred sites have been identified at in or near the project area, and this impact topic was dismissed from further consideration.

***Socioeconomics***

None of the alternatives would affect Preserve visitation, visitor spending, or income to surrounding communities; therefore, this topic was dismissed from further analysis.

***Environmental Justice***

Executive Order 12898 directs federal agencies to assess whether their actions have disproportionately high and adverse effects on minority and low-income populations. All of the water resource management actions proposed in the alternatives are focused on either scattered and remote water features or administrative efforts to monitor and protect groundwater systems over the long term. None of the proposed water management alternatives would affect visitor access and use of the Preserve, or economic conditions in surrounding communities, and none of the proposed alternatives would have disproportionate effects on

minority or low-income populations. Therefore, environmental justice was dismissed from further analysis.



## CHAPTER 2: WATER RESOURCE MANAGEMENT ALTERNATIVES

### Alternatives Development Process

The National Environmental Policy Act (NEPA) requires federal agencies to evaluate a range of reasonable water resource management alternatives that address the purpose and need for taking action. The Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] 1502.14) also require that federal agencies analyze a “no action” alternative, which evaluates the future conditions that would result from continuing current management practices and allows the public to evaluate what would happen if no new plan were adopted. In addition to the “no action” alternative, this chapter describes three alternative approaches water resource management in the Preserve. This chapter also provides background information that is necessary to understand the rationale for each action alternative and a discussion of implementation and evaluation methods.

The water resource management alternatives for this plan were developed based on an understanding of this plan’s purpose, need, and objectives; the complex resource conditions and issues influencing water management; and public and stakeholder input obtained during the scoping process.

### Scoping Process and Public Participation

The planning process began in November 2010 with an internal scoping meeting to understand the need for this plan and define an approach for the planning process. Public scoping began on May 11, 2011, with the publication of the notice of intent in the Federal Register (76 FR 27344). The public was invited to submit comments through July 11, 2011, on the scope of the planning process and to identify potential environmental impacts, issues, concerns, and alternative concepts. The scoping comment period was subsequently extended to August 12, 2011. Four public meetings were held during the scoping period: June 27 (Henderson, Nevada), June 28 (Needles, California), June 29 (San Bernardino, California), and June 30 (Barstow, California). During the scoping period, 67 pieces of correspondence were received. The issues identified during scoping form the basis for the impact topics that were selected for detailed analysis (see “Impact Topics” section in *Chapter 1- Purpose and Need*).

In October 2011, the interdisciplinary planning team participated in a three-day alternatives workshop, which focused on identifying a range of reasonable water management approach alternatives, how various types of water resources in the Preserve would be managed under the alternative approaches, and how those approaches would translate to actual water features. The alternatives development workshop resulted in a range of alternative concepts, an

#### Types of Water Features

**Big game guzzlers** – Large tanks and systems intended to provide water for desert bighorn sheep

**Small game guzzlers** – Concrete aprons leading to underground tanks to provide water to game birds

**Springs** – Natural or human-induced water expressions

**Water developments** – Excavations, pipes, tanks, and other infrastructure to collect and convey water

**Wells** – Hand-dug or drilled vertical holes intended to lift water to the surface

**Ponds and reservoirs** – Natural and excavated depressions or embankments that hold surface water

*These water features are described in detail in the “Water Resources” section in Chapter 3: Affected Environment.*

understanding of concepts to be dismissed from further consideration (see discussion at the end of this chapter), and a framework for further alternatives development and refinement. Following the alternatives development workshop, the planning team continued refining the alternative concepts to ensure the alternatives presented for analysis were feasible, logical, met the requirements of NEPA and sound resource planning, and were responsive to the complex, unique, and variable resources in the Preserve. In August 2012, three action alternatives—each proposing a different philosophical and management approach to water resources—were published for review and comment. The comments that were received were integrated into the alternatives that are described in this chapter.

### ***Concerns and Issues Raised during Scoping***

During the scoping period, several issues of concern related to water resources management were identified. Issues are problems, opportunities, and concerns related to existing conditions, or those that may arise during implementation of water resource management alternatives. The key issues identified during scoping are summarized below, along with a description of how they are or are not addressed.

#### **Surface Water Features**

The appropriate management and disposition of natural and developed surface water features is a central issue to this plan. While some people believe water developments should be removed to promote natural ecosystem processes, others believe all water developments should be maintained or expanded to preserve wildlife habitat. Three action alternatives reflect different philosophical and management approaches to surface water features, which are analyzed under each impact topic. Effects on the physical water features themselves was dismissed as an impact topic.

#### **Wetland and Riparian Vegetation**

Many natural and developed surface waters support wetland and riparian vegetation and provide habitat for riparian-dependent plant and animal species. This issue was dismissed from detailed analysis because the actions in this plan would not affect wetland and riparian vegetation. Protection and management of wetland and riparian habitat is an ongoing practice that would not be affected by the water resource management alternatives.

#### **Groundwater Conditions and Availability**

Most naturally occurring water features in the Preserve depend on perched aquifers fed by precipitation. Two springs, Piute Springs and Soda Springs, depend on deep alluvial groundwater basins. The relationship between groundwater conditions, water development and extraction proposals, and surface water features in the Preserve should be understood. This topic was dismissed from further analysis as the water resources but is included in *Chapter 3: Affected Environment* because groundwater resources are foundational to water management in the Preserve. While perched aquifers are part of the environmental setting, all water resource management alternatives include measures to protect deep alluvial groundwater basins, and the potential benefits are uncertain.

#### **Wildlife and Wildlife Habitat**

Many wildlife species rely on available surface water to survive in the Mojave Desert. While some species are adapted to water scarcity and harsh environmental conditions, others are partially or wholly dependent on natural and developed water features to maintain their current populations. The long-term management of water resources in the Preserve can have both

beneficial and adverse effects on a variety of wildlife species. The three action alternatives present different approaches to managing water resources as they relate to wildlife, which are analyzed under the *Wildlife* impact topic.

### **Rare, Unique, Threatened, or Endangered Species**

The Preserve is home to several wildlife species of special concern, the management and health of which are directly or indirectly influenced by water resources. These species include the Mohave tui chub, desert tortoise, and desert bighorn sheep. Long-term water resource management strategies in the Preserve should consider the implications of those strategies on the conservation of these species. All water resource management alternatives include conservation measures for the Mohave tui chub and desert tortoise, while the three action alternatives present different approaches for the desert bighorn sheep. These species are analyzed under the *Wildlife* impact topic.

### **Historic Water Developments**

Many of the existing water features in the Preserve were originally developed to support ranching activities, and most are considered to have historic properties. This plan will consider how the management of historic water developments affects historic features and preservation requirements. The management of historic water features is different in each alternative; the background and effects are analyzed under the *Cultural Resources* impact topic.

### **Wilderness Character**

The Preserve has 804,949 acres of designated wilderness. Many water developments are located in wilderness. This plan considers how these water features are managed in a manner consistent with broader water management objectives while preserving wilderness qualities. The three action alternatives present different approaches to managing water resources within wilderness, which are analyzed under the *Wilderness* impact topic.

### **Recreational Opportunities and Visitor Experience**

Legislation has established hunting as an appropriate recreational activity in the Preserve, as well as the authority of the NPS to manage wildlife populations. Water management strategies for the Preserve will need to consider the effects of various management approaches on recreational hunting, as well as other recreational opportunities that visitors enjoy in the Preserve. This issue was dismissed from detailed analysis because the actions in this plan were determined to not result in detectable impacts on the availability or success of recreational hunting within the Preserve.

### **Regional Context**

A long history of land development, water development, and habitat fragmentation throughout the Mojave Desert has direct implications on both water source availability and wildlife populations in the Preserve. These effects may be compounded by the effects of a changing climate on the desert environment. Long-term water management strategies will need to be considered in context with regional development, changes, and uncertainties. Issues related to the regional context of the Mojave Desert are common to all alternatives and are presented in the “Regional Context” discussion in *Chapter 3: Affected Environment* and cumulative effects analysis for each impact topic in *Chapter 4: Environmental Consequences*.

## Water Resource Management Alternatives

The following four water resource management alternatives (alternatives) are considered for implementation: one no action alternative and three action alternatives (see Table 1 for big game guzzler implementation example). Each action alternative represents a distinct approach to managing water resources that is intended to achieve a different set of desired conditions. The different desired conditions represent different emphases in terms of resource values, while the management strategy for each alternative reflects different assumptions about environmental conditions and different approaches to water resource management and decision making.

### Alternative Objectives and Management Strategies

Each alternative represents a distinct objective and approach to managing water developments in the Preserve, representing different assumptions about environmental conditions and approaches to water resource management and decision making. Four alternatives were retained for detailed analysis and are described in greater detail in the following sections of this chapter.

**Alternative 1 (No Action).** Manage water developments on an ad hoc basis, often in response to external proposals or directives. All existing water developments would be retained, but would not be rebuilt or replaced.

**Alternative 2.** Minimize water developments in wilderness while strategically using water developments to conserve native wildlife populations. Under Alternative 2:

- Three big game guzzlers would be removed, two would be relocated, one would be retained, and two new water sources would be developed.
- Most small game guzzlers would be neglected and some would be removed or disabled, while select non-wilderness guzzlers would be maintained to support native wildlife.
- Water developments at 5 to 10 managed springs would be evaluated for ecological importance and potential maintenance, while most others would be neglected.

**Alternative 3 (Preferred Alternative).** Manage water developments to support native species conservation and population stability while reducing the number of water developments in wilderness. Under Alternative 3:

- Two big game guzzlers would be removed, two would be relocated, two would be retained, and three new water sources would be developed.
- Most small game guzzlers would be neglected and some would be removed or disabled, while select non-wilderness guzzlers would be maintained to support native wildlife.
- Water developments at 5 to 10 managed springs would be evaluated for ecological importance and potential maintenance, while most others would be neglected.

**Alternative 4.** Manage water resources to augment native wildlife habitat and restore connectivity. Under Alternative 4:

- One big game guzzler would be removed, two would be relocated, three would be retained, and two new water sources would be developed.
- Small game guzzlers would be maintained and improved outside wilderness to support native wildlife.
- Water developments at 10 to 15 managed springs would be maintained or stabilized, while the rest would continue to be neglected.



Table 1. Water Resource Management Alternatives Summary

|                                       | Alternative 1 – No Action   | Alternative 2   | Alternative 3<br>(Preferred Alternative)  | Alternative 4  |
|---------------------------------------|---|---|---|--|
| <b>Big Game Guzzlers</b>              |   |   |   |  |
| Guzzler Actions                       | Continue filling and maintaining guzzlers as needed   | <ul style="list-style-type: none"> <li>Remove Clark, Piute, and Old Dad guzzlers</li> <li>Retain Kelso guzzler</li> <li>Relocate Kerr and Vermin guzzlers to outside wilderness (New Kerr and New Vermin)</li> <li>Build potential new guzzlers at Vontrigger and Ginn sites</li> <li>5 guzzlers within the Preserve, 1 within wilderness</li> </ul>              | <ul style="list-style-type: none"> <li>Remove Clark and Piute guzzlers</li> <li>Retain Old Dad and Kelso guzzlers</li> <li>Relocate Kerr and Vermin guzzlers to outside wilderness (New Kerr and New Vermin)</li> <li>Build potential new guzzlers at Piute North, Vontrigger, and Ginn sites</li> <li>7 guzzlers within the Preserve, 2 within wilderness</li> </ul> | <ul style="list-style-type: none"> <li>Remove Clark guzzler</li> <li>Retain Piute, Old Dad, and Kelso guzzlers</li> <li>Relocate Kerr and Vermin guzzlers to outside wilderness (New Kerr and New Vermin)</li> <li>Build potential new guzzlers at Vontrigger and Ginn sites</li> <li>7 guzzlers within the Preserve, 3 within wilderness</li> </ul> |
| <b>Small Game Guzzlers</b>            |   |   |   |  |
| Guzzlers in Wilderness                | <i>Common to All Alternatives:</i> <ul style="list-style-type: none"> <li>Neglect all; allow guzzlers to deteriorate over time</li> </ul>   |   |   |  |
| Non-wilderness Guzzlers               | <ul style="list-style-type: none"> <li>Allow ad hoc maintenance</li> <li>Neglect all other small game guzzlers</li> </ul>   | <ul style="list-style-type: none"> <li>Evaluate sets of 10 to 15 guzzlers for condition and wildlife use</li> <li>Repair escape ramps as needed</li> <li>Maintain or improve a select few for native wildlife</li> <li>Remove or disable some</li> <li>Neglect remaining guzzlers</li> </ul>  | Same as Alternative 2   | <ul style="list-style-type: none"> <li>Evaluate sets of 15 to 25 guzzlers for condition and wildlife use</li> <li>Maintain and repair escape ramps as needed</li> <li>Repair, maintain, or improve for native wildlife</li> <li>Remove or disable select few</li> </ul>  |
| <b>Springs and Water Developments</b> |   |   |   |  |
| Developed Springs                     | <ul style="list-style-type: none"> <li>Allow maintenance of springs per outside requests</li> <li>Clean up spring sites if needed for visitor safety</li> <li>Neglect all others</li> </ul> | <ul style="list-style-type: none"> <li>Evaluate 5 to 7 spring developments per year for ecological importance and condition</li> <li>Maintain 5 to 10 springs if determined important for native wildlife</li> <li>Neglect all others</li> </ul>  | Same as Alternative 2   | <ul style="list-style-type: none"> <li>Evaluate 5 to 7 spring developments per year for ecological importance and condition</li> <li>Maintain 10 to 15 springs if determined important for native wildlife</li> <li>Neglect all others</li> </ul>  |
| Wells                                 | Actively close/abandon or maintain wells to comply with state regulations   | <i>Common to All Action Alternatives:</i> <ul style="list-style-type: none"> <li>Maintain 8 NPS water supply wells and 28 grazing/ monitoring wells for administrative purposes</li> <li>Add 1-2 wells in the Hole in the Wall area to support Preserve operations</li> <li>Retain up to 3 wells for future water supply</li> <li>Destroy unused wells</li> </ul> |   |  |

|                                 | Alternative 1 – No Action  | Alternative 2  | Alternative 3<br>(Preferred Alternative) | Alternative 4 |
|---------------------------------|--|--|--|---------------|
| Ponds and Lakes                 | <ul style="list-style-type: none"> <li>Maintain habitat for endangered Mohave tui chub on an ad hoc basis</li> <li>Neglect other (ephemeral) ponds, with no active management, maintenance, or improvements</li> </ul> | <p><i>Common to All Action Alternatives:</i></p> <ul style="list-style-type: none"> <li>Maintain springs for Mohave tui chub and pursue additional restoration sites</li> <li>Neglect other ponds</li> </ul>   |  |               |
| <b>Other Elements</b>           |  |  |  |               |
| Deep Alluvial Basin Groundwater | Provide technical review and comments on outside proposals   | <p><i>Common to All Action Alternatives:</i></p> <ul style="list-style-type: none"> <li>Monitor groundwater quality and water levels for long-term trends/public health</li> <li>Develop new water supply wells as needed to support NPS operations</li> <li>Provide technical review and comments on outside proposals</li> <li>Pursue legal avenues to prevent or mitigate impacts on Preserve resources</li> <li>Complete well inventory and destroy abandoned wells according to state code</li> </ul> |  |               |
| Water Rights                    | Continue filing as directed by NPS Water Resources Division  | <p><i>Common to All Action Alternatives:</i></p> <ul style="list-style-type: none"> <li>Evaluate water rights acquired by the Preserve with assistance from NPS Water Resources Division</li> <li>Develop and assert federal reserved water rights as needed to protect resources</li> </ul>   |  |               |
| Other Programs                  | Identify and mitigate hazardous materials as lands are acquired  | <p><i>Common to All Action Alternatives:</i></p> <ul style="list-style-type: none"> <li>Identify and mitigate hazardous materials as lands are acquired</li> <li>Use water source manipulation to manage livestock grazing per Grazing Management Plan (under development) and consistent with this plan</li> </ul>  |  |               |

## Alternative 1 – No Action

### **Objective and Approach**

The NPS would continue current water management practices, which would retain the current number and distribution of water developments and respond to external proposals or initiatives on an ad hoc basis. Water resource management actions related to wildlife, historic features, and Preserve operations; and the impacts of those changes, would be addressed on a case-by-case basis based on land designations (e.g., wilderness or critical habitat) without overarching guidance.

### **Common Objectives of the Action Alternatives**

All three action alternatives are designed to meet common objectives that address the plan’s purpose and need (see “Introduction” section in *Chapter 1-Purpose and Need*).

### **Wilderness Values and Wildlife Habitat Conservation**

The Mojave Desert is rapidly changing as a result of the combined anthropogenic effects of climate change, habitat fragmentation, and habitat loss. Habitat loss and fragmentation increase the importance of large national parks for wildlife habitat conservation. Each action alternative recognizes the importance of wilderness qualities, the need for active management to support wildlife conservation in the face of anthropogenic change, and the desire to balance sometimes conflicting values and mandates.

All action alternatives recognize that the presence of water developments on the landscape supplements free-standing water for many native wildlife species. These supplemental water features are believed to be essential in supporting the conservation of sensitive species such as desert bighorn sheep, mitigating the regional effects of human development on their habitat, and supporting overall biodiversity in the Preserve.

Each alternative would optimize the use of water developments to meet diverse land and wildlife management objectives by maintaining those that are important to native wildlife populations, removing those that do not contribute to habitat value, and strategically using water developments outside of wilderness to support wildlife conservation.

### **Habitat Connectivity**

Within the Mojave Desert ecosystem, native vegetation and wildlife are adapted to survive extreme temperatures, prolonged drought, and limited free-standing water. In this context, many

### **Definitions of Key Planning Terms**

**Objectives** – Qualitative statements of values that serve to guide natural resource decision making and the evaluation of success. All action alternatives meet all objectives to a large degree, while also addressing the purpose and need for actions. (See “Objectives in Taking Action” in *Chapter 1: Purpose of and Need for Action*.)

**Desired Conditions** – Natural and cultural resource conditions that the NPS aspires to achieve and maintain over time. Desired conditions are different for each action alternative, reflecting a different set of values and assumptions about the resources being addressed.

**Indicators** – Specific, measurable physical and ecological variables that reflect the overall condition of the resource.

**Unacceptable Impacts** – Impacts that, individually or cumulatively, would be inconsistent with a park’s purpose or values, or impede the attainment of a park’s desired future conditions for natural and cultural resources as identified through the park’s planning process, or diminish opportunities for current or future generations to enjoy, learn about, or be inspired by park resources or values. The NPS will avoid impacts that it determines to be unacceptable.

*Based on NPS Management Policies 2006*

broad-ranging wildlife populations have historically relied on interconnected habitat islands and regional metapopulations to buffer against drought conditions and maintain long-term stability. During extended periods of drought, native wildlife have responded by moving to areas with better habitat, facilitated by the presence of free-standing water features. However, expanding human development in the region conditions and compromising the function of the Mojave Desert as an interconnected regional ecosystem.

Many of these habitat areas and migration corridors have been compromised as a result of decades of human development in the Mojave Desert, while climate conditions are expected to become increasingly dry and severe. In addition, a changing climate is expected to result in increasingly hot, dry, and severe conditions. The loss of habitat and ecosystem function, combined with the anticipated effects of global climate change on the Mojave Desert, is expected to result in more isolated and concentrated wildlife populations in the Preserve and in other areas with protected habitat. Protected areas such as the Preserve provide and maintain islands of wildlife habitat in the face of these changes.

Each of the action alternatives recognizes the habitat fragmentation and addresses the need for improved habitat connectivity for bighorn sheep.

### ***Monitoring and Evaluation***

Within the Preserve, there is uncertainty about the relationships between water resources, wildlife populations, climate change, and other resources in the desert environment. To proceed with water resource management in the face of these uncertainties, each alternative is based on a set of reasonable assumptions about the relationship between water resources and other resources. As the Preserve's understanding of these relationships evolves, management actions (in any action alternative) would be adjusted accordingly to achieve desired resource conditions, based on the best available data and professional judgment.

At each step of implementation (see Figure 3), the NPS would evaluate the success of management actions and the results of monitoring, with a focus on use of water sources and associated habitat by native wildlife. The determination of acceptability is based on professional judgment and recommendations from NPS staff and subject matter experts, based on resource specific indicators. Indicators are specific measurable physical and ecological variables that reflect the overall condition of a resource (see Table 3, Table 7, and Table 10). The ultimate decision on acceptability is made by the Preserve superintendent.

## **Alternative 2**

### ***Objective***

Alternative 2 emphasizes minimizing water developments in wilderness. The overall management philosophy would be strategic intervention to limit intrusion into wilderness while using a variety of tools to conserve and maintain self-sustaining native wildlife populations.

The NPS would assume that removing or relocating some water developments from wilderness, combined with more efficient use of water developments outside of wilderness, would minimize intrusion into wilderness, preserve wilderness qualities and support wildlife conservation.

### ***Approach***

Big game guzzlers would be removed from wilderness in a manner that does not result in unacceptable impacts to dry season habitat value. At full implementation, Alternative 2 would result in fewer water developments in wilderness, and in the Preserve overall, compared to the No Action. Alternative 2 includes the following:

- Three big game guzzlers would be removed, two would be relocated, one would be retained, and two new water sources would be developed.
- Most small game guzzlers would be neglected, removed, or disabled.
- Water developments at most springs would be neglected.
- Other elements, including groundwater resources, water rights, hazardous materials, and other water uses not included above would be monitored and managed proactively.

### ***Desired Conditions***

Desired conditions for Alternative 2 are:

#### *Desert Bighorn Sheep:*

- Big game guzzlers are removed from wilderness, with minimal net loss of functioning dry season habitat for desert bighorn sheep.
- Almost all sheep use guzzler relocation sites before the old guzzler sites are dismantled.
- Health and physical condition of most sheep are not adversely affected by guzzler removal or relocation
- New guzzlers and relocation sites maintain or improve connectivity between habitat areas.
- The Preserve contributes to regional bighorn conservation strategies.

#### *Other Wildlife:*

- Supplemental water for wildlife that is provided by developed springs and small game guzzlers slowly diminishes over time as individual sites continue to deteriorate.

#### *Cultural Resources:*

- Historic springs and water developments continue to fall into disrepair, as sites slowly revert to a pre-settlement condition.

#### *Wilderness:*

- The adverse effects of the presence and active maintenance of guzzlers and water developments on the undeveloped and untrammelled quality of wilderness are reduced from current conditions.

### ***Rationale***

Alternative 2 emphasizes the strategic balance between native wildlife conservation needs and the desire to maintain a natural desert ecosystem. While the presence of water developments helps supplement wildlife habitat, it also runs counter to the role of the Preserve to protect and maintain a naturally functioning ecosystem with limited human intervention. This is even more evident in wilderness areas, where the expectation of many visitors and guiding policies is a natural landscape that is undeveloped and untrammelled, meaning that it is to be free from human control or manipulation.

Understanding the conflicting values, mandates, and objectives of wildlife conservation and wilderness preservation, Alternative 2 seeks to reduce intrusions into wilderness while continuing to support native wildlife populations. Water developments would be located and managed to maximize their value for native wildlife populations while also reducing impacts on natural ecosystem functions within wilderness. This would include removing or disabling some

water developments within wilderness and other select areas and establishing new guzzlers or water sources outside of wilderness to support desert bighorn sheep conservation.

### **Alternative 3 (Preferred Alternative)**

#### ***Objective***

Alternative 3 would emphasize reducing of the number of water developments in wilderness while supporting native wildlife habitat conservation and population stability. The overall management philosophy would be strategic intervention to ensure that native wildlife populations are stable as the overall number of water developments within wilderness is reduced and regional habitat connectivity is improved.

In this alternative, the NPS would assume that removing or relocating some water developments from wilderness (subject to monitoring and adaptive management), combined with implementation of new water developments and more efficient use of existing water developments outside of wilderness, would preserve wilderness qualities and support wildlife conservation and habitat connectivity.

#### ***Approach***

Alternative 3 would minimize guzzlers within wilderness while optimizing the total number of guzzlers within the Preserve. Big game guzzlers would be removed from wilderness in a manner that results in no net loss of dry season habitat value. At full implementation, Alternative 3 would result in more developed water sources in the Preserve compared to Alternative 2 and the No Action; and one more big game guzzler in wilderness compared to Alternative 2.

Alternative 3 includes the following:

- Two big game guzzlers would be removed, two would be relocated, two would be retained in place, and three new water sources would be developed.
- Most small game guzzlers would be neglected, removed, or disabled, while select non-wilderness guzzlers would be maintained to support native wildlife.
- Water developments at 5 to 10 managed springs would be evaluated for ecological importance and potential maintenance, while most others would be neglected.
- Other elements, including groundwater resources, water rights, hazardous materials, and other water uses not included above would be monitored and managed proactively.

#### ***Desired Conditions***

Desired conditions for Alternative 3 are:

##### ***Desert Bighorn Sheep:***

- There is no net loss of functioning dry season habitat for desert bighorn sheep.
- Almost all sheep use guzzler relocation sites before the old guzzler sites are dismantled.
- Health and physical condition of most sheep are not adversely affected by guzzler removal or relocation.
- New guzzlers and relocation sites maintain or improve connectivity between habitat areas.
- The Preserve contributes to regional bighorn conservation strategies.

*Other Wildlife:*

- Native wildlife habitat and connectivity is supported by maintaining a limited number of small game guzzlers and springs outside of wilderness.

*Cultural Resources:*

- Select historic springs and water developments are maintained and improved in a manner consistent with an approved treatment plan and in consultation with the California State Historic Preservation Office (SHPO), though most continue to slowly deteriorate.

*Wilderness:*

- The adverse effects of guzzlers and water developments on the undeveloped and untrammeled quality of wilderness are reduced from current conditions.

**Rationale**

Alternative 3 emphasizes supporting and improving dry season habitat for desert bighorn sheep, regional habitat connectivity, and the need to maintain a natural desert ecosystem. Supplemental water features are assumed to be important tools for mitigating the effects of regional habitat fragmentation and for preserving overall biodiversity. However, while water developments can be useful for habitat conservation, such active intervention runs counter to NPS policies to manage biological resources by relying on natural processes, and to limit human intervention to special cases where such management is necessary (NPS Management Policies 4.4.2). In addition, water developments in wilderness areas run counter to the general prohibition on structures in wilderness and the goal of preserving wilderness in an undeveloped and untrammeled state. As with NPS Management Policies, the Wilderness Act allows for exceptions to this general prohibition when the agency can show the structure to be necessary (see Appendix A – Minimum Requirements Analysis).

Alternative 3 seeks to find a balanced and strategic approach that reduces wilderness intrusion while supporting and potentially enhancing native wildlife habitat. Water developments would be managed to maximize their value for native wildlife populations while reducing impacts on natural ecosystem functions within wilderness. This would include removing some water developments within wilderness while establishing new water sources outside of wilderness to support desert bighorn sheep conservation.

**Alternative 4*****Objective***

Alternative 4 emphasizes the use of water developments to augment native wildlife habitat in the Preserve while reducing, where possible, the number of water developments within wilderness. The overall management philosophy would be to use water developments to improve existing habitat in the Preserve and to maintain or develop connections between the Preserve and surrounding habitat in the larger landscape.

***Approach***

Alternative 4 would expand the use of water developments to augment existing wildlife habitat and improve connectivity between the Preserve and surrounding habitat. The overall strategy for Alternative 4 is to maintain and expand water resource development to bolster wildlife habitat in the Preserve and to reestablish regional habitat corridors that would allow wildlife populations to better respond to changing conditions. The management strategy emphasizes intervention to improve habitat value and to increase habitat connectivity. At full implementation, Alternative 4

would result in more water developments in wilderness compared to the other alternatives, and more water developments in the Preserve compared to the No Action and Alternative 2. There would be the same number of big game guzzlers compared to Alternative 3.

The NPS would assume that maintaining and expanding water developments would expand the distribution and population sizes of native wildlife species and would help mitigate the effects of human development, habitat loss, and climate change. Alternative 4 includes the following:

- One big game guzzler would be removed, two would be relocated, three would be retained in place, and two new water sources would be developed.
- Small game guzzlers would be maintained and improved outside of wilderness to support native wildlife.
- Water developments at 10 to 15 managed springs would be maintained or stabilized, while the rest would continue to be neglected.
- Other elements, including groundwater resources, water rights, hazardous materials, and other water uses not included above would be monitored and managed proactively.

### ***Desired Conditions***

Desired conditions for Alternative 4 are:

#### *Desert Bighorn Sheep:*

- There is a net gain in functional dry season habitat for desert bighorn sheep.
- Most sheep use guzzler relocation sites before the old guzzler sites are dismantled.
- Health and physical condition of most sheep are not adversely affected by guzzler removal or relocation.
- New guzzlers and relocation sites maintain or improve connectivity between habitat areas.
- The Preserve provides a foundation for regional bighorn conservation strategies.

#### *Other Wildlife:*

- Native wildlife habitat and connectivity is improved by maintaining small game guzzlers and springs outside of wilderness.

#### *Cultural Resources:*

- Select historic springs and water developments are maintained and improved in a manner consistent with an approved treatment plan and in consultation with the California SHPO, though most continue to slowly deteriorate.

#### *Wilderness:*

- The adverse effects of guzzlers and water developments on the undeveloped and untrammled quality of wilderness are reduced from current conditions, while the natural quality of wilderness as it relates to wildlife conservation is maintained.

### ***Rationale***

Alternative 4 places primary emphasis on the continued use of water developments to support native wildlife species. This is consistent with NPS Management Policies Section 4.4.1.1, which states “in addition to maintaining all native plant and animal species and their habitats inside



parks, the Service will work with other land managers to encourage the conservation of the populations and habitats of these species outside parks whenever possible.”

Considering these ongoing anthropogenic impacts on the ecosystem, a management approach that emphasizes continued intervention is needed to mitigate human impacts and maintain native wildlife habitat and populations. Continued use of existing water developments is necessary to achieve these objectives, along with the strategic placement of new water developments to improve new habitat areas and connectivity between habitat islands. Although new water development would be focused on non-wilderness areas, the maintenance and conservation of wildlife species as a natural quality in wilderness would be emphasized, while impacts on the undeveloped and untrammelled qualities would be anticipated and tolerated.

## Alternatives by Water Feature Type

### Big Game Guzzlers

Big game guzzlers (also known as “guzzlers”) are large water developments that are specifically intended to support desert bighorn sheep populations. Six big game guzzlers are located in the Preserve: Kerr, Old Dad, Vermin, Clark, Piute, and Kelso. All of these guzzlers are in wilderness. None of the alternatives include the removal of all big game guzzlers in the Preserve, and none involve the construction of new guzzlers in wilderness (Table 2).

Table 2. Summary of Implementation Actions for Big Game Guzzlers

| Guzzler            | Alternative 2                      | Alternative 3<br>(Preferred Alternative) | Alternative 4                      |
|--------------------|------------------------------------|--|------------------------------------|
| Clark              | Remove                             | Remove                                   | Remove                             |
| Piute              | Remove                             | Remove                                   | Retain                             |
| Old Dad            | Remove                             | Retain                                   | Retain                             |
| Kelso              | Retain                             | Retain                                   | Retain                             |
| Kerr               | Relocate                           | Relocate                                 | Relocate                           |
| Vermin             | Relocate                           | Relocate                                 | Relocate                           |
| New Water Sources  | Yes – Two sites outside wilderness | Yes – Three sites outside wilderness     | Yes – Two sites outside wilderness |
| Total Guzzlers     | 5                                  | 7  | 7                                  |
| Within Wilderness  | 1                                  | 2  | 3                                  |
| Outside Wilderness | 4                                  | 5  | 4                                  |

### Management Approaches

Potential management approaches considered for big game guzzlers include:

- **Remove** – The physical removal of guzzler infrastructure following a short-term shutoff and monitoring period.
- **Relocate** – Construct a new guzzler at a nearby suitable location outside wilderness, followed by the physical removal of the existing guzzler and long-term maintenance of the new guzzler.
- **Retain** – Continued use and repair of a guzzler in its present location.
- **New Water Sources** – Placement of new guzzlers or development of existing springs outside of wilderness to support bighorn and improve habitat connectivity.

### ***Big Game Guzzlers: Alternative 1 – No Action***

Under Alternative 1, the current ad hoc program for managing and retaining big game guzzlers would continue. The NPS would continue to work with the CDFW, research scientists, and volunteer groups to monitor the condition of desert bighorn sheep populations and the function of individual guzzlers. Routine and urgent maintenance activities are planned and coordinated with these partners to continue to ensure the safe function of the guzzlers. Typical guzzler management and maintenance activities include replacing or repairing tanks, pipes, and valves; repairing catchment basins; and refilling tanks by truck or by helicopter.

NPS procedures and instruments for guzzler management and maintenance include the following:

- ***Agreements and Authorizations*** – Any non-NPS entity wanting to perform maintenance, repair, or replenishment activities at guzzlers must obtain authorization from the Preserve superintendent. Authorizing instruments include special use permits, memoranda of understanding, and cooperative agreements.
- ***Minimum Requirements Analysis (MRA)*** – Any action that would otherwise be prohibited in wilderness must be reviewed in a minimum requirements analysis (MRA), which documents that the proposed methods for access and guzzler maintenance in wilderness are necessary and are the minimum level of activity that can achieve the project's outcome.
- ***NEPA Compliance*** – Implementation of specific proposed actions would require additional site-specific impact analysis in an appropriate NEPA document (Categorical Exclusion or EA), and other laws as applicable.

These guzzler management activities would continue on an ad hoc basis in response to immediate problems with guzzler function or project proposals from outside entities. The NPS would not engage in long-term planning for the removal, relocation, or addition of big game guzzlers in the Preserve.

### ***Big Game Guzzlers: Elements Common among Action Alternatives***

The common objective for guzzler management actions under the action alternatives is to retain guzzlers that have demonstrated benefits to bighorn sheep populations, relocate guzzlers where doing so is likely to retain benefits to bighorn sheep while reducing impacts on wilderness, remove guzzlers that do not support bighorn sheep populations and that also impact wilderness values, and implement new guzzlers outside wilderness in key areas where benefits to bighorn sheep habitat are likely to result. Removal and relocation of these guzzlers would only occur if monitoring indicated that new relocated guzzlers are sufficiently used by bighorn populations.

All actions within wilderness will be planned and implemented to ensure that the techniques and types of equipment needed minimize impacts on wilderness resources and character. Any future actions that involved 4(c) prohibited uses will be subject to project and site-specific MRA. A draft MRA for this plan is included in Appendix A.

### **Indicators**

Indicators are specific measurable physical and ecological variables that reflect the overall condition of a resource. The variables in Table 3 are useful for understanding the condition of desert bighorn sheep populations and their habitat and their need for guzzlers in the Preserve. Indicators for desert bighorn sheep populations, habitat, and guzzler use include the following:

- guzzler condition – water levels and functionality

- guzzler use – water levels and sheep use
- use of alternative water features – frequency and timing of visits
- bighorn population size – total and local population estimates, distribution, and sex/age ratios
- bighorn behavior – habitat selection, sexual segregation, and visits to water sources
- population health – body condition, mortality, and disease
- habitat quality – amount, timing, and location of precipitation

Note that in some planning processes and monitoring studies, indicators are associated with specific and defined thresholds or standards at which a certain action may be triggered. In this plan, indicators would be used to collect information that is evaluated holistically to develop management actions. No specific triggers or standards are specified.

Table 3. Big Game Guzzler Indicators and Monitoring

| Indicator                       | Potential Monitoring Methods   |
|---------------------------------|--|
| Guzzler condition               | <ul style="list-style-type: none"> <li>• Storage tank level monitors</li> <li>• Precipitation</li> <li>• Routine inspections for functionality</li> </ul>  |
| Guzzler use                     | <ul style="list-style-type: none"> <li>• Remote cameras (motion-triggered or time-lapse)</li> <li>• GPS/radio-telemetry collars</li> <li>• Human observation</li> <li>• Storage tank level monitors</li> </ul>                                 |
| Use of alternate water features | <ul style="list-style-type: none"> <li>• Remote cameras (motion-triggered or time-lapse)</li> <li>• Seasonal surveys of water features in bighorn sheep habitat</li> <li>• GPS/radio-telemetry collars</li> <li>• Human observation</li> </ul> |
| Bighorn population              | <ul style="list-style-type: none"> <li>• Aerial surveys</li> <li>• Remote cameras</li> <li>• GPS/radio-telemetry collars</li> <li>• Human observation</li> <li>• Guzzler use/water levels</li> </ul>   |
| Bighorn behavior                | <ul style="list-style-type: none"> <li>• Aerial surveys</li> <li>• Remote cameras</li> <li>• GPS/radio-telemetry collars</li> <li>• Human observation</li> </ul>   |
| Bighorn population health       | <ul style="list-style-type: none"> <li>• Remote cameras</li> <li>• GPS/radio-telemetry collars</li> <li>• Autopsy samples (deceased animals)</li> <li>• Fecal nitrogen analysis</li> <li>• Human observation</li> </ul>                        |
| Habitat context                 | <ul style="list-style-type: none"> <li>• Precipitation</li> <li>• Fecal nitrogen analysis</li> <li>• Vegetation sampling</li> </ul>  |

Although some relationships between bighorn and their habitat are known, there are also some basic gaps in knowledge that need to be addressed during the implementation and evaluation process. For example, the amount, timing, and location of precipitation during the winter-spring growing season of the Mojave Desert determines forage availability and quality, which directly contributes to bighorn reproductive success and lamb survival (Wehausen 2005). However,

desert bighorn populations in the Preserve have rarely been surveyed multiple times within a year, and there is no reliable or standardized population estimator that allows managers to estimate annual populations. Previous approaches allow for some general or minimum population size estimates that are appropriate to set conservative hunting levels, but these approaches are inadequate for evaluating the effect of guzzler removals on bighorn population size or clearly establishing limits on population level effects from guzzler removals. Other considerations such as disease can override all of these factors.

## Monitoring

The monitoring and evaluation under the action alternatives would emphasize tracking bighorn use of water sources as existing water sources are removed or relocated. Monitoring variables would include bighorn populations, use of existing guzzlers, use of alternative water features, and environmental factors such as drought and temperature. In addition, monitoring would occur for as long as needed at both existing and new guzzler locations (with water disabled at original locations) before finalizing relocation.

The NPS proposes the following monitoring approaches to track the indicators for desert bighorn sheep population and guzzler function and use. The data gathered from these approaches will influence implementation decisions associated with the action alternatives (e.g., remove, relocate, retain, or new guzzlers) under the selected alternative.

- Install cameras at water features (motion-triggered and time-lapse) for both guzzlers and nearby springs (all or some sample of water features). These can be used for behavior monitoring, sight/resight population estimates in conjunction with aerial surveys, guzzler use (animals per day or similar metric), sexual segregation, and body condition. This information is most critical for understanding the need for or effectiveness of implementation actions.
- Aerial (helicopter preferred but potentially fixed-wing) surveys can be used to estimate population, distribution, and sex/age ratios. Surveys could include fixed transects, using radio collars to determine mark/resight estimates, or random flights to maximize sample sizes. This is the second highest monitoring priority.
- Guzzler storage tank water level monitoring can be used to assess guzzler use over time. Combined with camera data, monitoring can be used to develop population estimates. Precipitation should be monitored to document and measure rainfall and tank replenishing.
- Satellite upload and/or remote download Global Positioning System (GPS) collars can be used to monitor habitat selection, guzzler use, alternative water feature visits, and mortality. This approach is predicated on having enough collars out in enough different herds or subherds, and personnel to monitor collars and analyze data.
- Samples from recent bighorn sheep mortalities could indicate if death was from respiratory disease, predation, forage or nutrient deficiencies, or dehydration.
- Fecal nitrogen analysis would be used to infer diet, which could be related to herd health or body condition.
- Stealth human observation from high vantage points can be used for counts and water visits. This could be done on an ad hoc basis or with a more standardized approach using NPS employees or volunteers. In cases where a guzzler was disabled, removed, or relocated, bighorn sheep behavior at a dry former guzzler site could influence a decision to reinstate the guzzler.

Table 3 summarizes the relationship between the indicators and the potential approaches to monitor them. The specific methods used for monitoring would vary by alternative and would be determined as part of the implementation process. At each step of implementation, the NPS would evaluate the success of management actions and the results of monitoring, with a focus on the acceptability of change to bighorn populations and other park resources. The determination of acceptability is based on professional judgment and recommendation from NPS staff and subject matter experts. The ultimate decision on acceptability is made by the Preserve superintendent.

### **Interim Management**

Big game guzzlers are currently managed and maintained on an ad hoc basis, typically in response to immediate needs for guzzler repair, refilling, or other issues. These maintenance activities are conducted by volunteer groups, working under the guidance of the CDFW and the approval of the NPS, and often occur in urgent circumstances, when it is apparent a guzzler is not functioning properly during the hot summer season.

Under all action alternatives, these maintenance activities would continue, but would be administered directly by the NPS in collaboration with CDFW and volunteer groups. These activities would be managed under the NPS Volunteers-In-Parks program (see NPS Director's Order [DO] 7), including the completion of an Agreement for Sponsored Voluntary Services (Form 10-85), a job description that clearly describes the work to be completed, and other necessary approvals. This approach to routine and ongoing guzzler management and maintenance would continue under any action alternative until a particular guzzler is subject to implementation actions (including evaluation, disabling, removal, or relocation).

### **New Guzzler Development**

Under all action alternatives, new water sources (potentially at Ginn Spring and Vontrigger Spring) would be developed. Alternative 3 would include a third new water source (Piute North). The NPS would work with CDFW and BLM to place temporary or permanent water developments to encourage the use of existing underpasses. The new water sources would support important corridors that are potentially restorable across I-40 and I-15 (Figure 2). The new Vontrigger Spring source would connect habitat between the Hackberry Mountains and Piute Spring, and would be important for restoring the bighorn sheep migration corridor across I-40. A new water source at Ginn Mine Spring (Ginn Spring) in the Mescal/Ivanpah Range would be important for restoring the bighorn sheep migration corridor across I-15, as it would connect the New York/Castle Mountains and the Clark Mountains. No part of the Mescal/Ivanpah area is designated wilderness. If a population could be established in the Mescal/Ivanpah Range, demographic connectivity would potentially be restored across I-15.

The placement and design of the new guzzlers would emphasize reliability, water storage, and minimal maintenance. Currently, all the existing guzzlers consist of up to three aboveground storage tanks, which usually require manual refilling during hot summer months when water consumption outpaces replenishment from precipitation. Manual refilling typically consists of delivery by water truck, sometimes several times per year. Deteriorating aboveground storage tanks also pose a threat to sheep, as evidenced by the 1995 botulism episode (Swift et al. 2000). This is currently a concern with the Old Dad guzzler.

New guzzlers would take advantage of groundwater storage (as described above) and would also minimize aboveground infrastructure by using existing springs. The Ginn Mine in the Mescal Range (Ginn Spring) and an existing spring at Vontrigger Spring in the Hackberry Range could be modified to bring water to accessible locations using pipes and gravity flow or a

siphon to a drinker at a lower elevation. The only additions to these two potential sites would be drinkers and pipes.

### **Relocation of Kerr and Vermin Guzzlers**

Under all action alternatives, the Kerr and Vermin guzzlers would be relocated to suitable nearby locations outside of wilderness. In addition to the location of these guzzlers within wilderness, several functional issues suggest that it is prudent to relocate these guzzlers. Although they support the largest bighorn herd in the Preserve, the guzzlers in the Old Dad/Kelso Mountains can become dry during the hot season and are logistically difficult to refill because they are in rugged, remote locations that are closed to motorized vehicles.

Relocating guzzlers to more accessible, non-wilderness sites could allow for less refilling (by using new guzzler designs at better intake locations) and better access for monitoring and maintenance. Moving a guzzler to a more accessible location, however, may result in reduced use by bighorn due to proximity to human presence. Removal and relocation of these guzzlers would only occur if monitoring indicated that new relocated guzzlers are sufficiently used by bighorn populations.

Relocated guzzler sites would attempt to take advantage of bedrock-constricted channels filled with unconsolidated young alluvium, which naturally collects and stores precipitation. The Vermin relocation site (New Vermin) would take advantage of the watershed at the Big Horn and Old Dad Mountain mines, while the Kerr relocation site (New Kerr) would use the large watershed that is constricted at its outlet by Jackass Canyon. Subsurface (groundwater) storage potential is significantly greater than any tank, is replenished over long periods by precipitation recharge, and is protected from evaporative loss by being underground. A subsurface collection device, such as a french drain, could be buried where groundwater spills over the bedrock restriction, and a large underground tank could be buried in the alluvium farther downgradient such that water collected by the french drain would flow by gravity into the tank. The drinker could be placed farther downgradient to take advantage of gravity flow.

### **Repair and Improvement for Guzzlers Retained in Place**

Guzzlers that are retained may be redesigned and upgraded over time to improve the water collection systems and storage while reducing aboveground infrastructure. In addition to the site improvements described above, other efforts could include the removal of plastic sheeting in water catchment areas or installation of a wellpoint/drive pipe (a hand-driven water pipe that conveys shallow groundwater). The Preserve would cooperate with interested volunteer parties to implement improvements, subject to additional site-specific NEPA compliance.

### **Guzzler Implementation Sequence and Transitions**

Under all action alternatives, at least two new guzzlers would be installed outside of wilderness, one or more big game guzzlers would be removed, and two would be relocated (see Table 2). In each of these cases, implementation would follow a deliberate and phased sequence to minimize unanticipated impacts on bighorn populations. After each step of the sequence (installation, relocation, or removal), the transition of bighorn to the new/relocated water source would be monitored for as long as needed to determine if the actions are successful (i.e., sheep have discovered and are using the new/relocated source and bighorn populations are stable); or if unanticipated or unacceptable impacts on bighorn are occurring. Guzzler actions would begin with the development of a detailed action and monitoring plan, in coordination with CDFW and volunteer parties. Each guzzler action implementation would require site- and task-specific compliance under NEPA to evaluate potential impacts. Under all action alternatives, implementation of actions would be based on the Preserve's water management priorities