

(Table 4). Figure 3 and Figure 4 outline the sequence and transition process, and Table 5 describes the implementation actions under each alternative.

Proposed sites for relocated guzzlers would be determined based on accessibility for maintenance and proximity to known bighorn populations and habitat. Probable relocation sites are shown in Figure 4, which illustrates the implementation scenario for Alternative 3. The existing conditions include all the guzzlers currently located in wilderness (No Action). The transition includes all existing, new, and relocated guzzlers that would be monitored for impacts and use. The final condition illustrates a successful implementation of Alternative 3, with a total of 7 guzzlers (2 retained, 2 relocated, and 3 new).

Table 4. Priorities for Big Game Guzzler Actions under Each Action Alternative

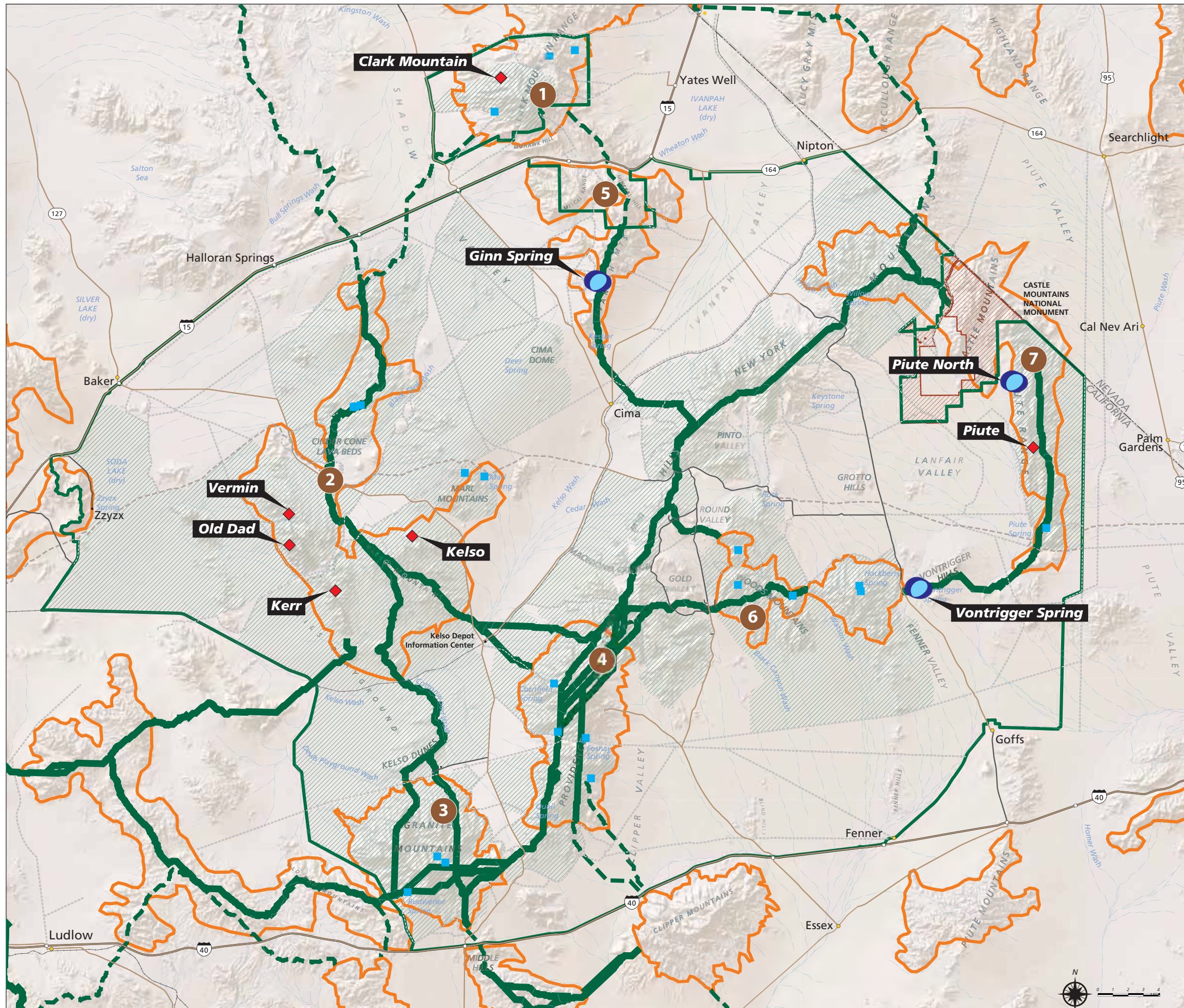
Alternative 2	Alternative 3 (Preferred Alternative)	Alternative 4
1. Kelso – retain and maintain	1. Old Dad – rebuild and repair as needed	1. Old Dad – rebuild and repair as needed
2. New Kerr and New Vermin – build and monitor discovery and use; collar Piute ewes	2. Kelso – retain and maintain	2. Kelso and Piute – retain and maintain
3. Clark – continue to monitor for an additional year before disabling and removal	3. New Kerr and New Vermin – build and monitor discovery and use; collar Piute ewes	3. New Kerr and New Vermin – build new guzzlers and monitor discovery and use; collar Piute ewes
4. Vontrigger – build and monitor discovery and use in coordination with monitoring, disabling, and removal of Piute	4. Piute North – build and monitor discovery and use	4. Clark – continue to monitor for an additional year before disabling and removal
5. Ginn Spring – install new water source	5. Clark – continue to monitor for an additional year before disabling and removal	5. Vontrigger – build and monitor discovery and use
6. Kerr and Vermin – monitor for transition to relocated guzzlers, disable, and remove	6. Vontrigger – build and monitor discovery and use in coordination with monitoring, disabling, and removal of Piute	6. Ginn Spring – build and monitor discovery and use
7. Old Dad – monitor use and transition to New Kerr and New Vermin; disable, monitor, and remove	7. Ginn Spring – build and monitor discovery and use	7. Kerr and Vermin – monitor for transition to relocated guzzlers, disable, and remove
8. Piute – monitor transition to Vontrigger, disable, and remove	8. Kerr and Vermin – monitor for transition to relocated guzzlers, disable, and remove	
	9. Piute – monitor transition to Piute North and Vontrigger, disable, and remove	

For guzzler removals and relocations, the primary approach would be to install a new/relocated water source and to keep both guzzlers in place while bighorn discover and transition to using the new water source. Monitoring would occur for as long as is needed to document the discovery and transition of sheep to the new site. As monitoring indicates and after bighorn have discovered and use the new/relocated source, the existing guzzler would be disabled for an extended period while monitoring of bighorn use continues. Once monitoring has demonstrated that bighorn have successfully adapted to the new site, the old guzzler infrastructure would be removed and the site rehabilitated. If monitoring indicates that unanticipated or unacceptable impacts on bighorn sheep populations are occurring, the NPS may reinstate use of the old disabled guzzler. (Once they have been physically removed from wilderness, reestablishing guzzlers at old sites would require new analysis and approvals under NEPA and the Wilderness Act. Such an action is not anticipated in this plan and would be pursued as a last resort to mitigate unforeseen circumstances.)

Big Game Guzzlers and Bighorn Movement Corridors



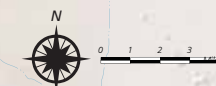
Mojave National Preserve
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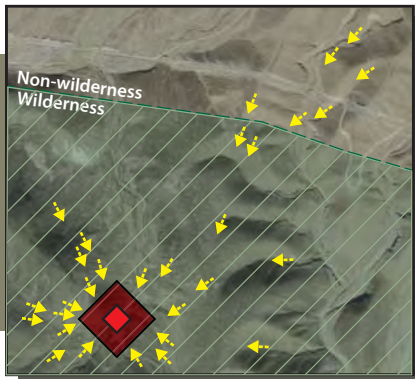


- Mojave National Preserve boundary
- Bighorn sheep habitat patches (Crech et al. 2014)
- Big game guzzler
- New water source
- Springs used by bighorn
- Bighorn migration corridor (Crech et al. 2014)
- Restorable bighorn migration corridor (Crech et al. 2014)
- National Park Service wilderness
- Paved road
- Unpaved 2-wheel drive road
- Unpaved 4-wheel drive road
- Mojave Road 4-wheel drive road
- Desert wash

Habitat Patches

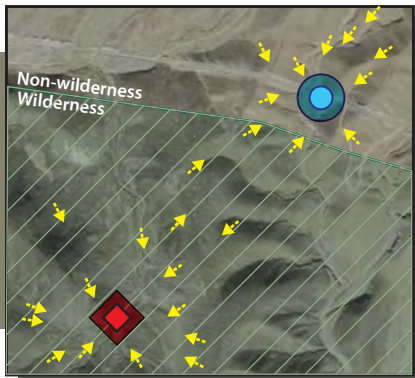
- 1** Clark Mountain
- 2** Old Dad/Kelso
- 3** Granite Mountains
- 4** Providence Mountains
- 5** Mescal/Ivanpah Range
- 6** Woods/Hackberry Mountains
- 7** Piute/Castle Mountains





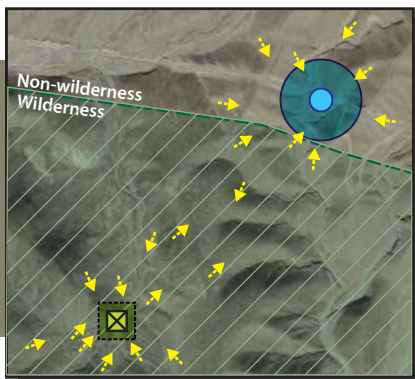
Existing Condition

- Guzzler in wilderness



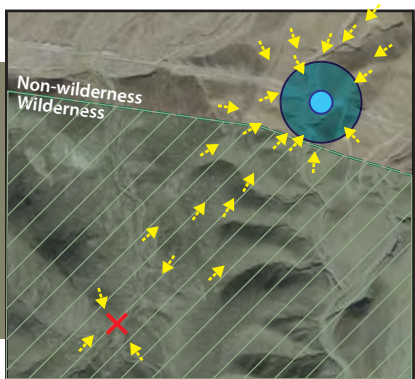
Transition - Step 1

- New guzzler outside of wilderness
- Two guzzlers during monitoring period
- Monitor bighorn use for several years



Transition - Step 2

- Bighorn documented to use new guzzler
- Shut off old guzzler
- Monitor bighorn transition

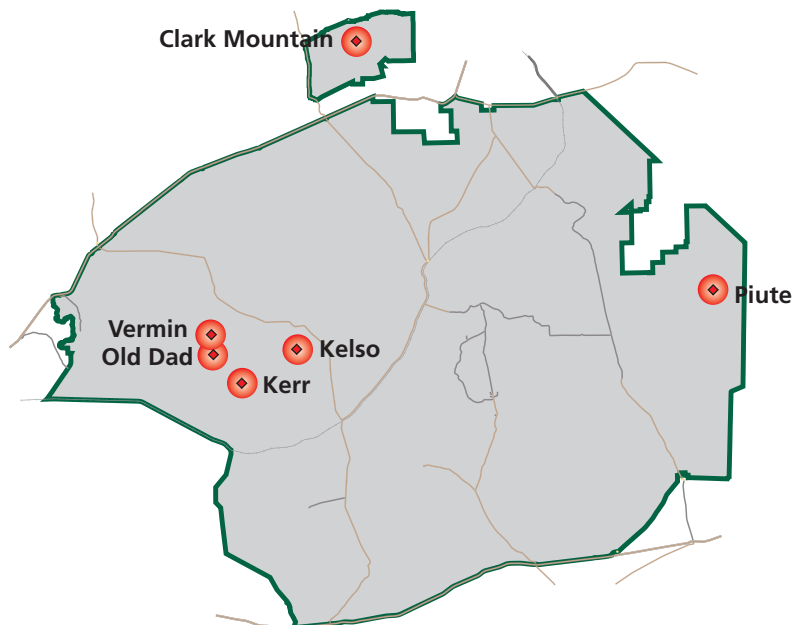


Transition - Step 3

- Bighorn only use new guzzler
- Remove old guzzler
- Continue monitoring

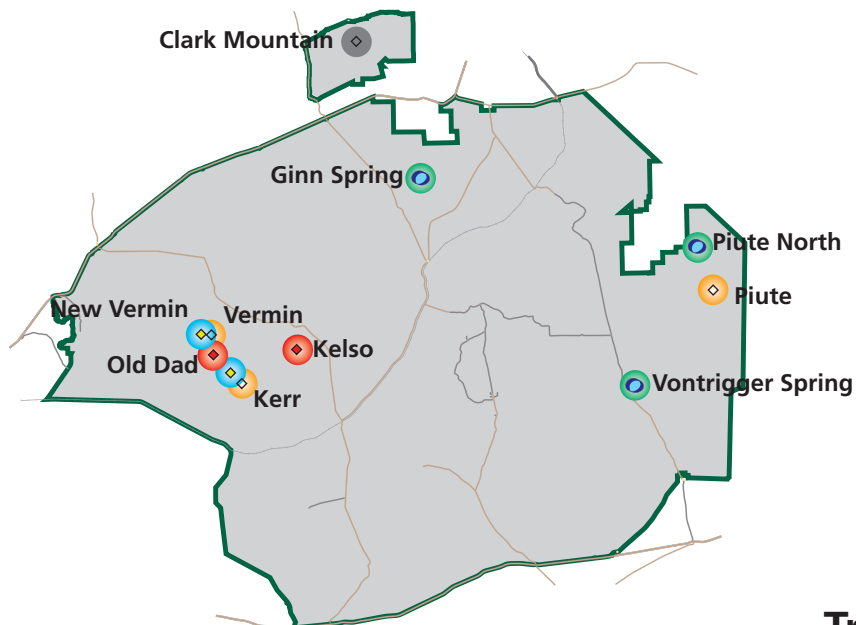
If monitoring indicates that the guzzler transition is not successful, or if severe impacts on bighorn are evident, each step can be reversed to ensure that impacts on bighorn populations are minimal.

Guzzler Transition Sequence

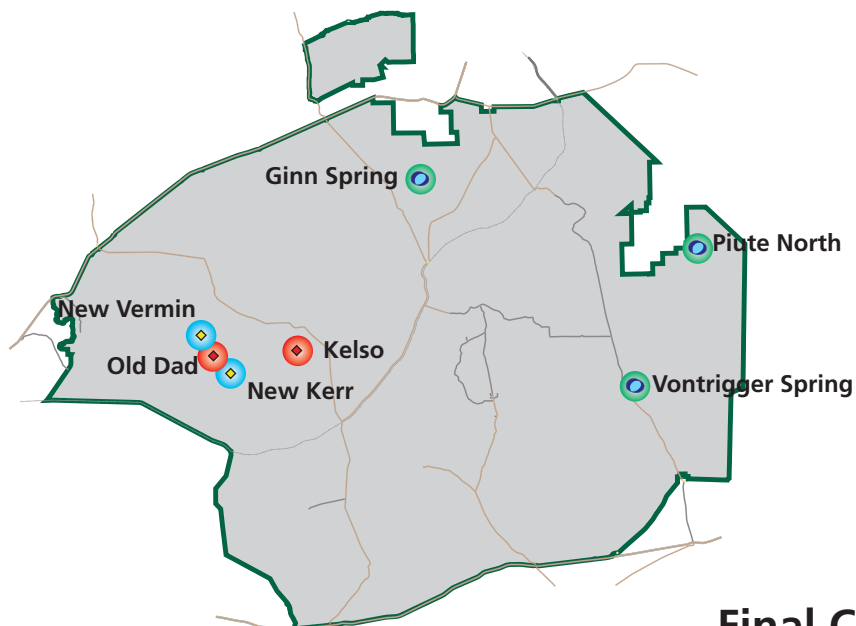


- ◊ Existing big game guzzler
- ◊ Existing big game guzzler on during transition
- ◊ Big game guzzler removed
- New water source location
- Big game guzzler relocation site

Existing



Transition



Final Condition

Implementation sequence for Alternative 3 shown

Table 5. Implementation Actions for Big Game Guzzlers

	No Action	Alternative 2	Alternative 3 (Preferred Alternative)	Alternative 4
Objective	Continue current, ad hoc management and maintenance activities	Minimize water developments in wilderness while strategically using water developments to conserve native wildlife populations	Manage water developments to support native species conservation and population stability while reducing the number of water developments in wilderness	Manage water resource to augment native wildlife habitat and restore connectivity
Existing Guzzlers				
Kelso	Filled every year or so depending on precipitation by driving about two miles into wilderness on an existing two-track road	<i>Common to All Action Alternatives:</i> Retain • Repair as needed		
Old Dad	Can be filled only by helicopter; repair of valves, tanks, pipes, drinker, and other parts done by dropping off equipment from helicopter; volunteers hike to site	Remove • Shut off water and initiate monitoring • If monitoring shows bighorn use New Kerr and New Vermin, remove	Retain Repair as needed	Retain <i>Same as Alternative 2</i>
Kerr	Filled every year or so depending on precipitation by driving about one mile into wilderness on an existing two-track road	<i>Common to All Action Alternatives:</i> Relocate • Identify suitable non-wilderness site • Initiate relocation process • Once new guzzler is established, remove		
Vermin	Filled every year or so depending on precipitation by driving on a cherry-stemmed road and then using a long hose	<i>Common to All Action Alternatives:</i> Relocate • Identify suitable non-wilderness site • Initiate relocation process • Once new guzzler is established, remove		
Clark	Requires very little to no repair	<i>Common to All Action Alternatives:</i> Remove • Dismantle and move parts to location outside of wilderness where it could provide more benefits to bighorn		
Piute	Infrequent filling and repair	Remove • Shut off water and initiate monitoring • Remove if supported by monitoring	Remove • Shut off water and initiate monitoring • Install new water sources in nearby locations • Remove if supported by monitoring	Retain • Repair as needed to support regional connectivity

		No Action	Alternative 2	Alternative 3 (Preferred Alternative)	Alternative 4
New Water Sources					
Alternative Approach	No new guzzlers would be permitted in the Preserve	<ul style="list-style-type: none"> Two new guzzlers located within the Preserve on non-wilderness land 	<ul style="list-style-type: none"> Three new guzzlers located within the Preserve on non-wilderness land 	<ul style="list-style-type: none"> Two new guzzlers located within the Preserve on non-wilderness land 	
New Water Source Objectives	<ul style="list-style-type: none"> None NPS recommended a translocation to N. Soda (BLM) for Soda Mountain Solar mitigation 	<i>Common to All Action Alternatives:</i> <ul style="list-style-type: none"> Improving regional habitat connectivity Restoring I-40/I-15 movement corridors Establishing a new population in the Mescal/Ivanpah Range 			
Proposed Locations of New Water Sources	None	<ul style="list-style-type: none"> Vontrigger Spring –connector between Hackberry and Piute Spring Ginn Spring –connector from New York/Castle north to Clark Mountains, in the Ivanpah Range 	<ul style="list-style-type: none"> Vontrigger Spring –connector between Hackberry and Piute Spring Ginn Spring –connector from New York/Castle north to Clark Mountains, in the Ivanpah Range Piute North Guzzler – located in northern Piute Range; connector between Piute Spring and Castle Mountains 	<i>Same as Alternative 2</i>	
Summary of Guzzler Actions	<ul style="list-style-type: none"> Total Guzzlers: 6 Wilderness: 6 Non-wilderness: 0 New: 0 	<ul style="list-style-type: none"> Total guzzlers: 5 Wilderness: 1 Non-wilderness: 4 New: 2 	<ul style="list-style-type: none"> Total guzzlers: 7 Wilderness: 2 Non-wilderness: 5 New: 3 	<ul style="list-style-type: none"> Total guzzlers: 7 Wilderness: 3 Non-wilderness: 4 New: 2 	
Guzzler Management and Maintenance					
Summary of Management Approach	Guzzler maintenance and refilling occurs on an ad hoc basis under CDFW guidance and with volunteer labor	<i>Common to All Action Alternatives:</i> <ul style="list-style-type: none"> Guzzlers are repaired or refilled by volunteers under NPS guidance Ongoing repair continues until implementation actions are initiated 			

The general sequence for the implementation of guzzler actions includes the following:

1. Install new or relocated guzzler outside of wilderness, in order of Preserve priorities.
2. Monitor both new/relocated and existing guzzlers for as long as needed to document transition.
3. When bighorn have been documented to use the new guzzler, manipulation/disabling of the existing guzzler can begin.
4. Continue monitoring to document use, transition, and impacts.
5. Remove existing guzzler if monitoring indicates that bighorn have transitioned to using new/relocated guzzler—or—
6. Reinstate existing guzzler if monitoring indicates conditions that are unacceptable or if bighorn are not transitioning to use new/relocated guzzler.

Big Game Guzzlers: Alternative 2

Objective

Under Alternative 2, the NPS would seek to retain a similar number of big game guzzlers (compared to the No Action Alternative) in the Preserve, but to minimize the number of within wilderness wherever possible. The overall management objective would be strategic use of big game guzzlers, to minimize intrusion into wilderness while using big game guzzles as a tool to conserve sustainable native wildlife populations, particularly bighorn sheep.

Approach

Implementation of Alternative 2 for big game guzzlers would consist of installing new/relocated water sources; monitoring discovery, use, and transition of bighorn to new/relocated sources; disabling guzzlers; and eventually removing guzzler infrastructure. During implementation, all guzzlers would continue to be retained and repaired in their current state until they are part of a relocation evaluation process or are physically relocated.

The end state of Alternative 2 would be the long-term use of five guzzlers within the Preserve. Three guzzlers (Clark, Piute, and Old Dad) would be removed, two (Kerr and Vermin) would be relocated out of wilderness, and one (Kelso) would remain in wilderness. Two new water sources (Vontrigger Spring and Ginn Spring) would be permitted within the Preserve on non-wilderness land (Figure 5). Final locations would be determined as part of the implementation process.

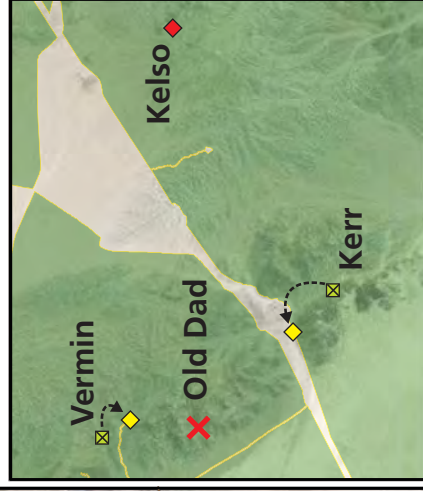
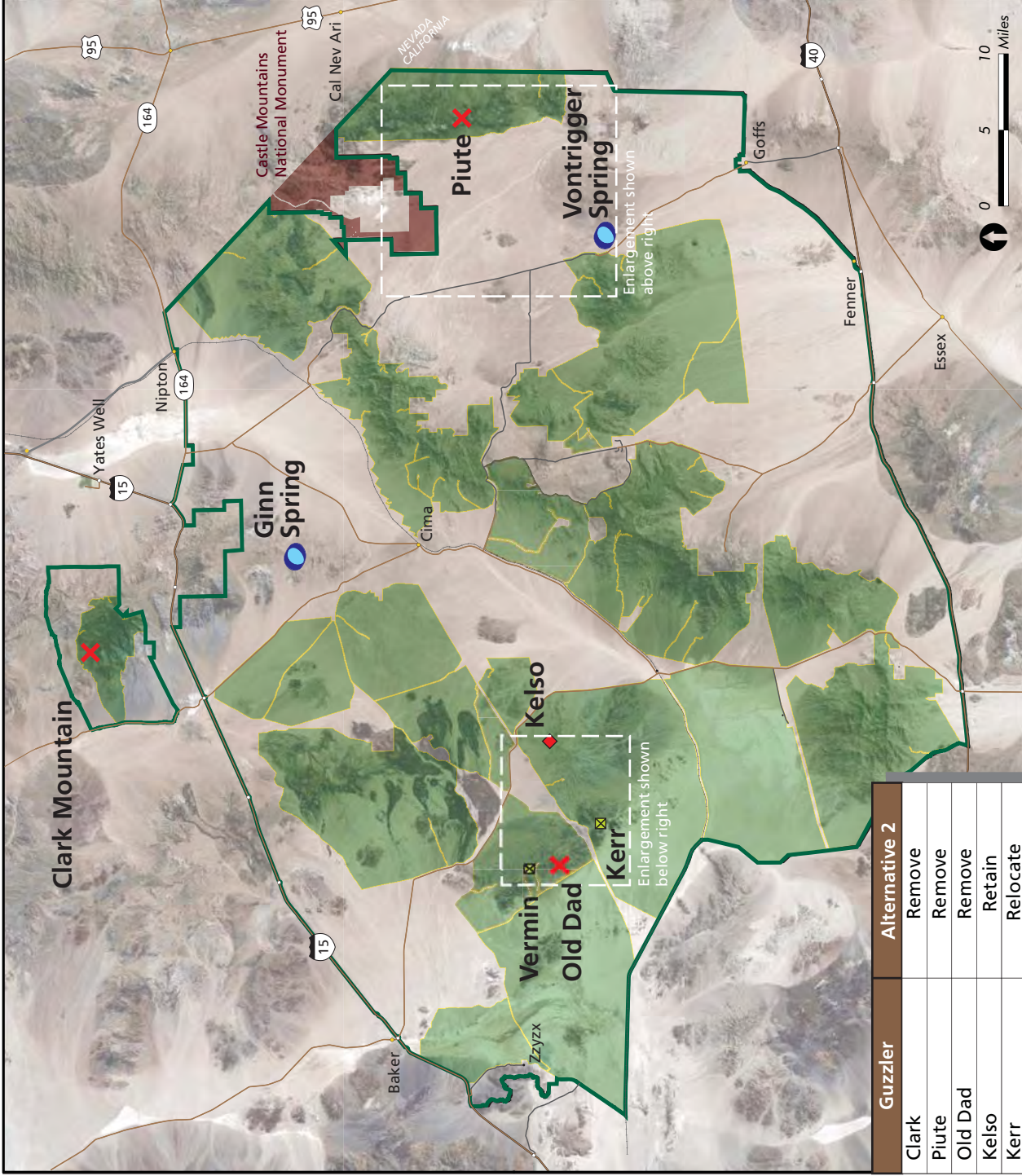
New Water Sources

The NPS would pursue the establishment of two new guzzlers or water sources in non-wilderness locations to support the potential restoration of migration corridors and demographic connectivity across I-40 and I-15, including the establishment of a population in the Mescal/Ivanpah Range (see “New Guzzler Development” above, and Figure 2). The NPS would work with CDFW and BLM to place temporary or permanent water developments to encourage the use of existing underpasses. Potential sites for new water sources are:

- **Vontrigger Spring** –would function as a habitat connector between Piute Spring and the Hackberry Range.
- **Ginn Spring** –would function as a habitat connector between the New York and Castle Mountains to the south and the Clark Mountains to the north.

Alternative 2 Big Game Guzzlers

Mojave National Preserve
Water Resources Management Plan and
Environmental Assessment



Alternative Actions

- ◆ Retain guzzler
 - X Remove guzzler
 - ⊠ Relocate guzzler
 - ◆ Guzzler relocation site
 - New water source location
 - Mojave National Preserve boundary
 - Wilderness*
- *Vermin relocation site is within a non-wilderness area associated with an existing road

Guzzler	Alternative 2
Clark	Remove
Piute	Remove
Old Dad	Remove
Kelso	Retain
Kerr	Relocate
Vermin	Relocate
New Water Sources	Yes – Two sites outside wilderness
Total Guzzlers	5
Within wilderness	1
Outside wilderness	4

Implementation Sequence

Before each implementation step, the Preserve would identify and secure funding and logistical support that is necessary to implement the actions and associated monitoring. Site-specific compliance under NEPA would be completed for each guzzler action. Detailed plans would be developed for guzzler relocations including material, equipment, and personnel costs; logistics; and monitoring. Priorities for guzzler actions include:

1. **Kelso** – Retain and maintain as needed in its present location because of its importance for rams and the lack of a nearby relocation site.
2. **New Kerr and New Vermin** – Build new guzzlers for relocation of Kerr and Vermin, and monitor for discovery and use.
3. **Clark** – Continue monitoring for an additional year, followed by disabling and removal if monitoring data supports action. Infrastructure may be reused at a suitable non-wilderness site.
4. **Vontrigger Spring** – Implement new water sources in conjunction with the monitoring and subsequent removal of Piute.
5. **Ginn Spring** – Implemented new water source and monitor for discovery and use.
6. **Kerr and Vermin** – Monitor as bighorn discover and use New Kerr and New Vermin. Once the relocated sites have been discovered and used by bighorn populations, and transition has been successful, disable and eventually remove the old sites if monitoring supports actions.
7. **Old Dad** – Monitor for use and to determine if a transition to New Kerr and New Vermin is possible. If so, continue monitoring use and transition, deactivate, and monitor for transition. Remove after transition is successful, due to its inaccessibility and the absence of a suitable relocation site. Infrastructure would be removed over the long term as resources allow.
8. **Piute** – Monitor use, including collaring ewes, to determine if a transition to the new Vontrigger water source is possible. If so, disable guzzler and continue to monitor transition. If transition is successful, remove guzzler if monitoring data supports action.

Proposed relocation sites for Vermin and Kerr guzzlers have been identified in potentially suitable non-wilderness locations near existing guzzlers. Factors considered in identifying relocation sites would include bighorn habitat quality, local terrain and hydrology, accessibility for maintenance, and contributions to regional movement corridors. Final locations would be determined as part of the implementation process. A detailed site-specific monitoring approach would be developed during implementation (see “Monitoring” above).

Big Game Guzzlers: Alternative 3 (Preferred Alternative)

Objective

Under Alternative 3, the NPS would seek to reduce the number of big game guzzlers in wilderness in a manner that results in no net loss of functioning dry season habitat for bighorn. It would emphasize reducing of the number of big game guzzlers in wilderness while improving the overall habitat value for bighorn sheep. The overall management objective would be strategic intervention to ensure that bighorn sheep populations are stable as the overall number of big game guzzlers within wilderness is reduced and regional habitat connectivity is improved.

Approach

Implementation of Alternative 3 for big game guzzlers would consist of installing new/relocated water sources; monitoring discovery, use, and transition of bighorn to new/relocated sources; disabling guzzlers; and eventually removing guzzler infrastructure. All guzzlers would continue to be retained and repaired in their current state until they are part of a relocation evaluation process or are relocated.

If all actions are implemented under this alternative, seven big game guzzlers or alternative water sources would exist in the Preserve. Two guzzlers (Clark and Piute) would be removed, two (Vermin and Kerr) would be relocated out of wilderness, and two would remain in wilderness (Old Dad and Kelso). Three new water sources (Vontrigger Spring, Ginn Spring, and Piute North) would be permitted within the Preserve on non-wilderness land (Figure 6).

New Water Sources

The NPS would pursue the establishment of three new guzzlers or water sources in non-wilderness locations to support the potential restoration of migration corridors and demographic connectivity across I-40 and I-15, including the establishment of a population in the Mescal/Ivanpah Range (see “New Guzzler Development” above, and Figure 2). The NPS would work with CDFW and BLM to place temporary or permanent water developments to encourage the use of existing underpasses. Potential sites for new water sources are:

- **Piute North Guzzler** –would function as a habitat connector between Piute Spring and the Castle Mountains.
- **Vontrigger Spring** –would function as a habitat connector between Piute Spring and the Hackberry Range.
- **Ginn Spring** –would function as a habitat connector between the New York and Castle Mountains to the south and the Clark Mountains to the north.

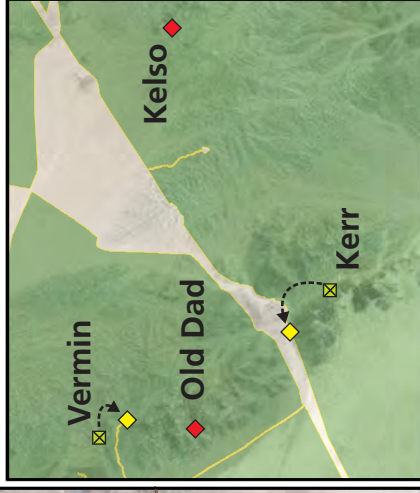
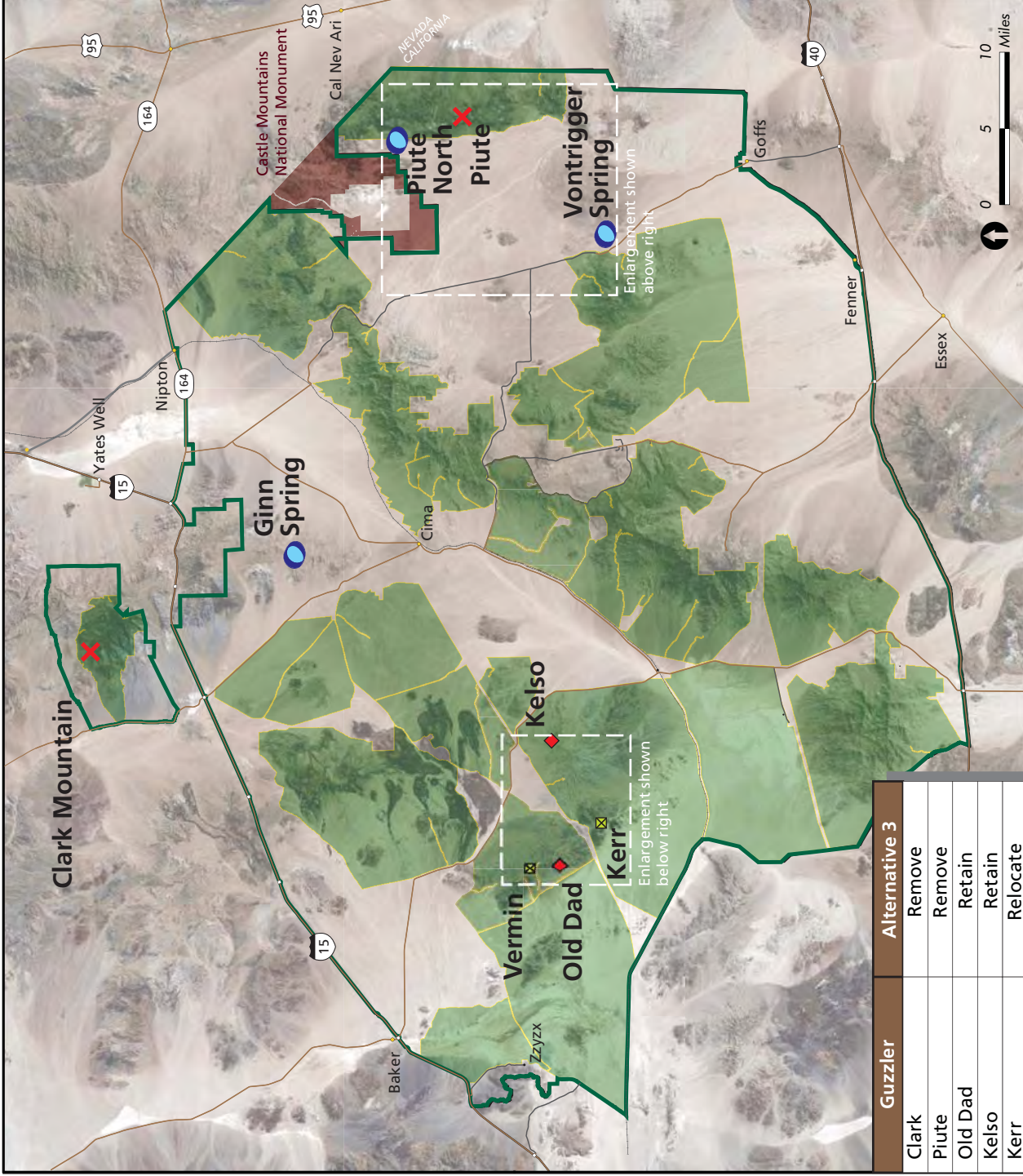
Implementation Sequence

Before each implementation step, the Preserve would identify and secure funding and logistical support that is necessary to implement the actions and associated monitoring. Site-specific compliance under NEPA would be completed for each guzzler action. Detailed plans would be developed for guzzler relocations including material, equipment, and personnel costs; logistics; and other information needed. Priorities for guzzler actions are:

1. **Old Dad** – Rebuild guzzler and repair as needed.
2. **Kelso** – Retain and maintain as needed in its present location because of its importance for rams and the lack of a nearby relocation site.
3. **New Kerr and New Vermin** – Build new guzzlers for relocation of Kerr and Vermin, and monitor for discovery and use.
4. **Piute North** – Build new guzzler and monitor for discovery and use. Collar ewes in Piute area to monitor use and transition.
5. **Clark** – Continue monitoring for an additional year, followed by disabling and removal if monitoring data supports action. Infrastructure may be reused at a suitable non-wilderness site.
6. **Vontrigger Spring** –Implemented new water sources in conjunction with the monitoring and subsequent removal of Piute.

Alternative 3 Big Game Guzzlers

Mojave National Preserve
Water Resources Management Plan and
Environmental Assessment



Alternative Actions

- ◆ Retain guzzler
- X Remove guzzler
- Relocate guzzler
- ◆ Guzzler relocation site
- New water source location
- Mojave National Preserve boundary
- Wilderness*

*Vermin relocation site is within a non-wilderness area associated with an existing road

Guzzler	Alternative 3
Clark	Remove
Piute	Remove
Old Dad	Retain
Kelso	Retain
Kerr	Relocate
Vermin	Relocate
New Water Sources	Yes – Three sites outside wilderness
Total Guzzlers	7
Within wilderness	2
Outside wilderness	5

7. **Ginn Spring** – Implement new water sources and monitor for discovery and use.
8. **Kerr and Vermin** – Monitor as bighorn discover and use New Kerr and New Vermin. Once the relocated sites have been discovered and used by bighorn populations, and transition has been successful, disable and eventually remove the old sites if monitoring supports actions.
9. **Piute** – Monitor use, including collared ewes, to determine if a transition to Piute Spring/Creek and the new Vontrigger and Piute North water sources is possible. If so, disable guzzler and continue to monitor transition. If transition is successful, remove guzzler if monitoring data supports action.

Final locations would be determined as part of the implementation process. Proposed relocation sites for Vermin and Kerr guzzlers have been identified in potentially suitable non-wilderness locations near existing guzzlers. Factors considered in identifying relocation sites would include bighorn habitat quality, local terrain and hydrology, accessibility for maintenance, and contributions to regional movement corridors. Final locations would be determined as part of the implementation process. A detailed site-specific monitoring approach would be developed during implementation (see “Monitoring” above).

Big Game Guzzlers: Alternative 4

Objective

Under Alternative 4, the NPS would seek to maximize the ecological benefits of big game guzzlers and place them in additional locations throughout the Preserve. Emphasis would be on augmenting bighorn sheep habitat value through the use of big game guzzlers in the Preserve while minimizing the number of water developments within wilderness, where possible. Alternative 4 aims to increase bighorn sheep metapopulation resilience by retaining water availability for existing populations, increasing the functional dry season habitat for bighorn sheep, and increasing connectivity between populations.

Alternative 4 seeks to retain and improve existing habitat and connectivity within and adjacent to the Preserve. Recent and past development is restricting bighorn connectivity in the Greater Mojave Desert (Epps et al. 2007; Creech et al. 2014). The current and future impact of climate change, which will result in warmer and drier conditions in the southwestern United States (see “Climate Trends and History” in *Chapter 3: Affected Environment*), is also likely to have a negative effect on bighorn in the region, because herds located in lower-elevation drier mountain ranges have been found to be more likely to be extirpated (Epps et al. 2004). NPS guidance has clearly emphasized the need for parks to cooperate with other agencies to conserve resources both inside and outside of parks and to manage for ecosystem integrity in the face of climate change and other anthropogenic disturbance. The integrity of the larger desert bighorn metapopulation can primarily be maintained through enhancing connectivity and increasing the genetic diversity and population persistence of existing and restorable bighorn herds (Epps et al. 2006; Creech et al. 2014). This alternative seeks to maintain bighorn integrity by expanding the use of guzzlers, as water is considered one of the most limiting factors for many bighorn herds in the Mojave Desert.

Approach

Implementation of Alternative 4 for big game guzzlers would consist of installing new/relocated water sources; monitoring discovery, use, and transition of bighorn to new/relocated sources; disabling guzzlers; and eventually removing guzzler infrastructure (Figure 7). During implementation, all guzzlers would continue to be retained and repaired in their current state until they are part of a relocation evaluation process or are physically relocated.

New Water Sources

The NPS would pursue the establishment of two new guzzlers or water sources in non-wilderness locations to support the potential restoration of migration corridors and demographic connectivity across I-40 and I-15, including the establishment of a population in the Mescal/Ivanpah Range (see “New Guzzler Development” above, and Figure 2). The NPS would work with CDFW and BLM to place temporary or permanent water developments to encourage the use of existing underpasses.

Potential sites for new water sources are:

- **Vontrigger Spring** –would function as a habitat connector between Piute Spring and the Hackberry Range.
- **Ginn Spring** –would function as a habitat connector between the New York and Castle Mountains to the south and the Clark Mountains to the north.

Implementation Sequence

Before each implementation step, the Preserve would identify and secure funding and logistical support that is necessary to implement the actions and associated monitoring. Site-specific compliance under NEPA would be completed for each guzzler action. Detailed plans would be developed for guzzler relocations including material, equipment, and personnel costs; logistics; and other information needed. Priorities for guzzler actions are:

1. **Old Dad** – Rebuild guzzler and repair as needed.
2. **Kelso** – Retain and maintain as needed in its present location because of its importance for rams and the lack of a nearby relocation site.
3. **Piute** – Retain and maintain as needed in its present location.
4. **New Kerr and New Vermin** – Build new guzzlers for relocation of Kerr and Vermin, and monitor for discovery and use.
5. **Clark** – Continue monitoring for an additional year, followed by disabling and removal if monitoring data supports action. Infrastructure may be reused at a suitable non-wilderness site.
6. **Vontrigger Spring** –New water sources would be implemented and monitored for discovery and use.
7. **Ginn Spring** –Implement new water sources and monitor for discovery and use.
8. **Kerr and Vermin** – Monitor as bighorn discover and use New Kerr and New Vermin. Once the relocated sites have been discovered and used by bighorn populations, and transition has been successful, disable and eventually remove the old sites if monitoring supports actions.

If all actions are implemented under this alternative, three big game guzzlers would be retained in wilderness and four guzzlers would exist in non-wilderness locations within the Preserve. Final locations would be determined as part of the implementation process. A detailed site-specific monitoring approach would be developed during implementation (see “Monitoring” above)