U.S. Department of the Interior
Bureau of Land Management
Humboldt River Field Office

May 2025

Blue Wing Complex Wild Horse and Burro Gather & Herd Management Area Plan

Preliminary Environmental Assessment

DOI-BLM-NV-W010-2024-0027-EA

1.0 Introduction

This Environmental Assessment (EA) has been prepared to disclose and analyze the environmental effects of the Proposed Action and alternatives, which consist of establishing a Herd Management Area Plan (HMAP) (Appendix XIII) and gathering and removing excess wild horses and burros (WH&Bs) from within and outside the Blue Wing Complex (Complex). The Blue Wing Complex encompasses five Herd Management Areas (HMAs), four Herd Areas (HAs), and non-HMA areas where WH&Bs migrate back and forth. Refer to Map 1, Appendix I which displays the HMAs included within the Complex.

The BLM proposes to immediately gather and remove excess WH&Bs in accordance with the 1971 Wild Free-Roaming Horses and Burros Act (WFRHBA) in an initial gather (and a follow-up gather or gathers if necessary) in order to achieve Appropriate Management Levels (AMLs), and to continue fertility control management activities. This EA would assist the Bureau of Land Management (BLM) Humboldt River Field Office (HRFO) in project planning, as well as ensure compliance with the National Environmental Policy Act (NEPA)[1] and make a determination as to whether any significant effects could result from the analyzed actions. Following the requirements of NEPA, this EA describes the potential impacts of a No Action Alternative and the Proposed Action and the other action alternatives for the Blue Wing Complex. If the BLM adopts one of the action alternatives for the Complex and determines that it is not expected to have significant impacts, a Finding of No Significant Impact (FONSI) would be issued and a Decision Record would be prepared. If significant effects are anticipated, the BLM would prepare an Environmental Impact Statement.

This document is tiered to and/or conforms to the following documents:

- Winnemucca District Proposed Resource Management Plan and Final Environmental Impact Statement (2013 PRMP/FEIS)
- Winnemucca District Record of Decision and Resource Management Plan (2015 Winnemucca RMP) as amended by the Record of Decision and Nevada and Northeastern California Greater Sage-Grouse Approved Resource Management Plan Amendment (ARMPA) September 2015.
- Black Rock Desert-High Rock Canyon Emigrant Trails National Conservation Area (NCA) and Associated Wilderness, and other Contiguous Lands in Nevada Resource Management Plan (2004 BRRMP)

1.1 Background

The Blue Wing Complex is located in western Pershing County, approximately 65 miles northeast of Reno, Nevada. (Map 1, Appendix I) and lies within the Winnemucca BLM District. Tables 1 and 2, below, display the total acreage and established AML for each of the HMAs.
The 2015 Winnemucca RMP combined two existing HMAs (Shawave Mountains and Nightingale Mountains HMAs) into the Shawave Mountains HMA. The decision to combine the two HMAs was due

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[1] Executive Order 14154, Unleashing American Energy (Jan. 20, 2025), and a Presidential Memorandum, Ending Illegal Discrimination and Restoring Merit-Based Opportunity (Jan. 21, 2025), require the Department to strictly adhere to the National Environmental Policy Act (NEPA), 42 U.S.C. §§ 4321 et seq. Further, such Order and Memorandum repeal Executive Orders 12898 (Feb. 11, 1994) and 14096 (Apr. 21, 2023). Because Executive Orders 12898 and 14096 have been repealed, complying with such Orders is a legal impossibility. The BLM verifies that it has complied with the requirements of NEPA, including the Department's regulations and procedures implementing NEPA at 43 C.F.R. Part 46 and Part 516 of the Departmental Manual, consistent with the President's January 2025 Order and Memorandum. The BLM has also voluntarily considered the Council on Environmental Quality's rescinded regulations implementing NEPA, previously found at 40 C.F.R. Parts 1500–1508, as guidance to the extent appropriate and consistent with the requirements of NEPA and Executive Order 14154.

to the historical interchange of WH&Bs between the two HMAs and was also based on an in-depth analysis of habitat suitability and monitoring data as set forth in the 2013 PRMP/FEIS, which evaluated each HMA for five essential habitat components and herd characteristics: forage, water, cover, space, and reproductive viability. Through that analysis and through adoption of the subsequent 2015 RMP, the boundaries of the Shawave Mountains and Seven Troughs HMAs were adjusted to eliminate checkerboard areas and revert checkerboard portions to HA status.

Since the passage of the WFRHBA, management knowledge regarding WH&B population levels has increased. For example, it has been determined that WH&Bs are capable of increasing their numbers by 15% to 25% annually, resulting in the doubling of WH&B populations about every 4 years (NRC 2013). This has resulted in the BLM shifting program emphasis beyond just establishing AML and conducting WH&B gathers to include a variety of management actions that further facilitate the achievement and maintenance of viable and stable WH&B populations and a thriving natural ecological balance. Management actions resulting from shifting program emphasis include increasing fertility control, adjusting sex ratio, and collecting genetic diversity baseline data to support genetic diversity assessments.

The AML is defined as the number of WH&Bs that can be sustained within a designated HMA which achieves and maintains a thriving natural ecological balance[2] in keeping with the multiple-use management concept for the area. The Blue Wing Complex currently has a cumulative AML range of 333-553 horses and 55-90 burros, which was set through the Blue Wing – Seven Troughs Allotment Evaluation/Multiple Use Decision process in 1994, and established as a population range in the 2015 Winnemucca RMP. This population range was established at a level that would maintain healthy WH&Bs and rangelands over the long-term based on monitoring data collected over time as well as an in-depth analysis of habitat suitability.

Table 1. Herd Management Area, AML, and Estimated Population.

Herd Management Area	Appropriate Management Level	2025 population estimate including net growth 2024 and 2025
Kamma Mountains HMA	46-77 H, 0 B	77 H, 0 B
Lava Beds HMA	89-148 H, 10-16 B	179 H, 42 B
Blue Wing Mountains HMA	22-36 H, 17-28 B	10 H, 28 B
Seven Troughs HMA	94-156 H, 28-46 B	161 H, 46 B
Shawave Mountains HMA[1]	82-136 H, 0 B	150 H, 0 B
Selenite Range HA	0 H,0 B	32 H, 0 B
Antelope Range HA	0 H,0 B	0 H, 0 B
Trinity Range HA	0 H,0 B	0 H, 0 B
Truckee Range HA	0 H,0 B	0 H, 0 B
Eugene Mountains HA	0 H, 0B	0 H, 0 B

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[2] The Interior Board of Land Appeals (IBLA) defined the goal for managing wild horse (or burro) populations in a thriving natural ecological balance as follows: "In the words of the conference committee which adopted this standard: 'The goal of WH&B management…should be to maintain a thriving ecological balance between WH&B populations, wildlife, livestock and vegetation, and to protect the range from the deterioration associated with overpopulation of wild horses and burros.'" *Animal Protection Institute of America v. BLM,* 109 IBLA 112, 115 (1989).

Blue Wing Complex Totals	**333-553 horses, 55-90 burros**	**609 horses 116 burros**

[1]The 2015 Winnemucca RMP combined the Nightingale Mountain & Shawave Mountain HMAs into the Shawave Mountains HMA

Table 2. Blue Wing Complex and Proposed Gather Area Land Status

Ownership	Acres	Percent of Total Area
Bureau of Land Management	1,806,477	72.8%
Bureau of Indian Affairs	3,384	0.1%
Bureau of Reclamation	29,479	1.2%
Private	643,373	25.9%
Total	2,482,683	100%

*The total amount of land managed within the Blue Wing Complex, which only includes HMA and HA units is approximately 1,186,787 acres.

The BLM conducted a population census flight in March 2023, followed by statistical analysis of those data, and expected net growth rates of 20% per year after the March 2023 survey. A map of the 2023 survey can be found in Appendix XI.

Based upon all information available at this time, the BLM has determined that at least 337 excess WH&Bs above the low end of AML exist within the Blue Wing Complex. All excess WH&Bs need to be removed in order to achieve the established AML, restore a thriving natural ecological balance (TNEB), and prevent degradation of rangeland resources. This assessment is based on factors including, but not limited to the following rationale:

- Blue Wing Complex estimated populations exceed the established AML range for the Complex (Table 1).
- Excess WH&Bs are establishing or expanding populations outside of identified HMA and HA boundaries.
- Moderate, heavy, and severe utilization is evident on key forage species within the Blue Wing Complex.
- Grazing Permittees in the Blue Wing/Seven Troughs Allotment (which overlaps all of the HMAs in the Complex) are, and have been for multiple years, voluntarily running lower Animal Unit Months (AUMs) than permitted, due to excess WH&Bs (Table 9).
- WH&Bs are contributing to degradation of rangeland health throughout the Blue Wing Complex (See Appendix VII).
- In 2024, the BLM conducted a gather and removed 1,269 excess wild horses and 352 excess burros. However, it was unable to gather enough excess WH&Bs to reach and maintain AML for the Complex.
- Overuse by WH&Bs has contributed to degradation of multiple springs and surrounding riparian areas, evidenced by soil erosion & compaction, heavy trailing through riparian area, and trampling and hummocking of riparian vegetation. Affected springs include Rabbithole Spring and Unnamed Spring 78-40.

1.2 Purpose and Need

The BLM's purpose is to adopt and implement a Herd Management Area Plan (HMAP) consistent with the authority provided in 43 Code of Federal Regulations (CFR) 4700, restore and maintain a Thriving Natural Ecological Balance (TNEB) by gathering and removing excess WH&Bs and managing WH&Bs within the established AML ranges for the HMAs, and to reduce WH&B population growth rates to extend the time between gather events.

The BLM's need for federal action is to prevent undue or unnecessary degradation of the public lands associated with excess WH&Bs, and to restore a TNEB and multiple-use relationship on public lands, consistent with FLPMA and the WFRHBA, as well as conform with 43 CFR 4710.3-1 and BLM policies including the BLM Handbook H-4700 - Wild Horses and Burros Management.

1.3 Land Use Plan Conformance and Consistency with Other Authorities

The Proposed Action (Alternative A) and Alternatives B and C are in conformance with the 2015 Winnemucca District RMP.

- **Goal:** Protect, manage, and control healthy wild horse and burro (WHB) populations within established Herd Management Areas (HMAs) at Appropriate Management Levels (AMLs) in a manner designed to achieve and maintain a Thriving Natural Ecological Balance (TNEB) and multiple-use relationship on public lands.
- **Objective WHB 1:** Administer HMAs to support healthy populations and achieve land health standards for WHB where a TNEB and multiple-use relationship can be achieved and maintained.
- **Objective WHB 2**: Maintain Appropriate Management Levels within HMAs.

The Proposed Action (Alternative A) and Alternatives B and C are in conformance with the Black Rock Desert-High Rock Canyon Emigrant Trails National Conservation Area (NCA) and Associated Wilderness, and other Contiguous Lands in Nevada Resource Management Plan (BRRMP)

- **WHB-5:** Horses and burros will be gathered from the HMAs to maintain horses and burros within the AML as funding permits. Aircraft will continue to be used for the management of, and when necessary, removal of wild horses and burros. Gather activities will be scheduled to avoid high visitor use periods whenever possible.

The Proposed Action (Alternative A) and Alternatives B and C are in conformance with the Nevada and Northeastern California Greater Sage-grouse Approved Resource Management Plan Amendment (ARMPA) dated September 2015.

- **Management Decision (MD) WHB 2**: Manage herd management areas (HMAs) in GRSG habitat within established AML ranges to achieve and maintain GRSG habitat objectives (Table 2-2).
- **MD WHB 7**: Develop or amend herd management area plans (HMAPs) to incorporate GRSG habitat objectives (Table 2-2) and management considerations for all HMAs within GRSG habitat, with emphasis placed on SFA and PHMAs outside of SFA.

1.4 Relationship to Statutes, Regulations, or other Plans

The Proposed Action and action alternatives are consistent with the Federal Land Policy and Management Act of 1976 (FLPMA), which requires that an action under consideration be in conformance with the applicable BLM land use plan(s), and be consistent with other federal, state, and local laws and policies to the maximum extent possible.

The Proposed Action and action alternatives are also consistent with the WFRHBA, which mandates the Bureau to "*prevent the range from deterioration associated with overpopulation*", and "*remove excess horses in order to preserve and maintain a thriving natural ecological balance and multiple use relationships in that area"*.

The WFRHBA at section 1333 (b)(1) states: "*The purpose of such inventory shall be to: make determinations as to whether and where an overpopulation exists and whether action should be taken to remove excess animals; determine appropriate management levels or wild free-roaming horses and burros on these areas of public land; and determine whether appropriate managements should be achieved by the removal or destruction of excess animals, or other options (such as sterilization, or natural control on population levels)*."

The Proposed Action and action alternatives are consistent with all applicable regulations at 43 CFR Part 4700 "Protection, Management, and Control of Wild Free-Roaming Horses and Burros":

- 43 CFR 4700.0-6 (a) Wild horses shall be managed as self-sustaining populations of healthy animals in balance with other uses and the <u>productive capacity of their habitat</u> (emphasis added).

- 43 CFR 4710.4 Management of wild horses and burros shall be undertaken with the objective of limiting the animals' distribution to herd areas. Management shall be at the minimum level necessary to attain the objectives identified in approved land use plans and herd management area plans.

- 43 CFR 4720.1 Upon examination of current information and a determination by the authorized officer that an excess of wild horses or burros exists, the authorized officer shall remove the excess animals immediately….

- 43 CFR 4720.2 Upon written request from a private landowner……the authorized officer shall remove stray wild horses and burros from private lands as soon as practicable…

- 43 CFR 4740.1 (a) Motor vehicles and aircraft may be used by the authorized officer in all phases of the administration of the Act, except that no motor vehicle or aircraft, other than helicopters, shall be used for the purpose of herding or chasing wild horses or burros for capture or destruction. All such use shall be conducted in a humane manner. (b) Before using helicopters or motor vehicles in the management of wild horses or burros, the authorized officer shall conduct a public hearing in the area where such use is to be made.

The Interior Board of Land Appeals (IBLA) in *Animal Protection Institute et al.*, 118 IBLA 63, 75 (1991) found that under the WFRHBA, the BLM is not required to wait until the range has sustained resource damage to reduce the size of the herd, instead proper range management dictates removal of excess animals before range conditions deteriorate in order to preserve and maintain a thriving natural ecological balance and multiple-use relationship in that area.

1.5 Scoping and Identification of Issues

During preliminary Herd Management Area Plan/Gather planning process for the proposed Blue Wing Complex HMAP, a Blue Wing Complex HMAP Management Evaluation and Scoping Statement was made available to interested individuals, agencies and groups for a 30-day public review and scoping period that opened on May 2, 2024, and closed on June 1, 2024. Scoping comments were received from approximately 73 individuals (primarily as form letters) or organizations, and agencies. Many of the comments received expressed concern about the long-term management strategy for the Blue Wing Complex, including water development maintenance, development of additional water, the genetic diversity of the herd, and the long-term strategy for population management. The comments that were within scope were incorporated in the preparation of the preliminary environmental assessment and the Proposed HMAP.

The following concerns were identified as a result of public scoping and internal BLM interdisciplinary team evaluations and are addressed in this document:

1. Impacts to vegetation, riparian, and water resources. Measurement indicators for this issue include:
   - Expected forage utilization and distribution
   - Potential impacts to vegetation resources, including upland range and riparian communities
   - Potential impacts to forage available for use by livestock and WH&Bs

2. Impacts to wildlife species and their habitat. Measurement indicators for this issue include:
   - Potential competition for forage and water over time (expected change in actual forage utilization by wild horses and burros)

3. Impacts to individual WH&Bs and overall herd health. Measurement indicators for this issue include:
   - Expected effectiveness of proposed population control and management (PopEquus population modeling)
   - Potential impacts to animal health and condition
   - Expected impacts to herd social structure
   - Expected impacts of fertility control application
   - Potential impacts to genetic diversity
   - Expected impacts to individual WH&Bs from handling

4. Impacts to the WH&B herd's habitat. Measurement indicators for this issue include:
   - A need to maintain existing water developments and develop new waters as able
   - Opportunity to better distribute actual use of the available forage by wild WH&Bs
   - Potential impacts of WH&Bs on water availability
   - Potential impacts of noxious weeds and invasive species

2.0 DESCRIPTION OF ALTERNATIVES, INCLUDING PROPOSED ACTION

2.1 Introduction:

This chapter of the EA describes the Proposed Action and Alternatives, including any that were considered but eliminated from detailed analysis. Alternatives analyzed in detail include the following:

- **No Action Alternative.** Under the No Action Alternative, continue existing management, a gather to remove excess WH&Bs would not occur. There would be no active management to control population growth rates, the size of the WH&B population or to bring the WH&B population to AML. A HMAP would not be implemented for the Blue Wing Complex.

- **Proposed Action (Alternative A).**
  - Implement a HMAP as a management strategy to include several population growth suppression methods.
  - Immediately gather and remove excess animals in order to reach low AML as expeditiously as possible through an initial gather, and if necessary, a follow-up gather or gathers, in order to achieve low AML. Follow-up gathers to remove excess animals to achieve low AML shall be conducted as promptly as appropriate to allow sufficient time for the animals to settle after the previous gather and to provide for a safe, efficient, and

effective follow-up gather operation. [3]

- Apply fertility control methods (vaccines or other approved method of fertility control) to gathered and released mares.
- Manage no more than ¼ of the population at low AML as permanently non-reproducing (sterilized mares and geldings)[4].
- Maintain a sex ratio adjustment of 60% male and 40% female.
- Subject to funding and time availability: develop and exclose a water source (named "Unnamed Spring 78-40") to better disperse WH&B use and add available water within the Blue Wing Complex. See Appendix XIV for map of proposed water development.

- **Alternative B.** Alternative B is the same as Alternative A but would not include a permanently non-reproducing component (sterilized mares and geldings).

- **Alternative C.** Under Alternative C, Implement HMAP with management strategy, gather and remove excess animals to low AML without fertility control vaccine use, sex ratio adjustments, or any permanently non-reproducing portion of the population.

2.2 Herd Management Area Plan

The HMAP is a plan for the management of WH&Bs within the Blue Wing Complex. The potential HMAP Objectives are described in more detail in Appendix XIII, including management, monitoring, and implementation objectives. Potential future actions listed in the objectives of the HMAP would be reviewed prior to implementation to determine if additional NEPA documentation is required.

Table 3. Summary Comparison of the Impacts of Alternatives

Item	No Action	Alternative A (Proposed Action)	Alternative B	Alternative C
Population Management	AML for the Complex would remain at 333-553 horses and 55-90 burros	Excess WH&Bs would be removed to the low range of AML upon determination that excess animals are present. Once High-end of AML is reached follow-up gathers would occur to remove excess WH&Bs back down to low end of AML.	Same as Alternative A.	Same as Alternative A.
Future Adjustments to AML	AML would be evaluated, as needed, following an in-depth analysis of resource conditions including actual use, utilization, available forage and water, range conditions, trend, and precipitation.			
Population Control	Future gathers to remove excess WH&Bs would be implemented under all alternatives as outlined below.			

[3] While the BLM's plan would be to immediately remove all excess animals above low AML and include enough mare fertility control treatments to slow population growth, it is possible that a single gather would not achieve this because of limitations such as on gather efficiency, logistics, space capacity for holding removed animals, or contractor availability. The result would be a need to conduct a follow-up gather or gathers to achieve low AML.
[4] Permanently non-reproducing here refers primarily to mares or stallions that have been physically sterilized, and does not include mares that are infertile because of the effects of an immunocontraceptive fertility control vaccine.

Item	No Action	Alternative A (Proposed Action)	Alternative B	Alternative C
Methods	Continue existing management, a gather to remove excess WH&Bs would not occur. There would be no active management to control population growth rates, the size of the WH&B population or to bring the WH&B population to AML	Additional population growth suppression methods would be utilized, adjusting sex ratio in favor of males, implementing fertility control methods.	Same as Alternative A.	No population growth suppression would be utilized but area would be gathered once high-end of AML is reached and excess animals would be removed to achieve low-end of AML.
Size of Permanently Non-reproducing Population	No permanently non-reproducing population	No more than approximately ¼ of the population at low AML	No permanently non-reproducing population	No permanently non-reproducing population
Desired Sex Ratio (immediately following gathers)	N/A	60/40 Male/Female	Same as Alternative A	N/A
Total # Wild Horses and Burros Remain following Gathers	N/A	333 wild horses, 55 burros (low range AML)	333 wild horses, 55 burros (low range AML)	333 wild horses, 55 burros (low range AML)
Selective Removal Criteria		Selective Removals would only be implemented once the Complex is within Appropriate Management Levels. Selection would be focused on returning animals with good conformation or size. See Appendix XIII.		Gate Cut Removal only
Genetic Diversity	The objective under all alternatives is to maintain genetic diversity within the herd (avoid inbreeding depression, i.e. maintain DNA marker based Ho at 0.66 (+ or – 10%)			
	Under these alternatives, if future genetic sampling indicates a loss of 10% observed heterozygosity over one generation, 3-4 mares/jennies from similar HMAs would be introduced.			No mitigation to correct potential future genetic loss would be implemented under this alternative
Rangeland Health	Utilization by all herbivores is limited to 50% of current year's production for key plant species and 30% on key riparian species. In areas of the Complex that Sage			

Item	No Action	Alternative A (Proposed Action)	Alternative B	Alternative C
	Grouse Habitat exists, limit utilization to 40% of current year's production on herbaceous key plant species and 35% on shrub key species species.			
Riparian Health	Maintain existing water developments until they outlive their useful life then remove them and readjust AML based on available water.	Existing water developments would be periodically maintained, and new water development of unnamed spring 78-40 would be conducted when funding and time allows, and riparian area around springhead would be excluded from WH&B use to protect the resource.		

2.3 No Action Alternative

Although the No Action Alternative does not comply with the WFRHBA and does not meet the purpose and need for the action in this EA, it is included as a basis for comparison with the Proposed Action and alternatives.

Under the No Action Alternative, a gather to remove excess WH&Bs would not occur. A HMAP would not be implemented for the Blue Wing Complex. There would be no active management to control the size of the WH&B population or to bring the WH&B population to AML. The current WH&B population would continue to increase at a rate of 15-20% per year. Within five years, the WH&B population could exceed 1,500 animals. WH&Bs residing outside the HMAs and HA would remain in areas not designated for management of WH&Bs and population numbers would continue to increase. The presence of increasing numbers of excess WH&Bs would continue to deteriorate rangelands within the Complex, public safety concerns would increase along heavily traveled road as well as private property issues, and an increase in emergency actions would be necessary to address the overpopulations of WH&Bs and limited water/forage resources.

2.4 Alternative A: Proposed Action Alternative

2.4.1 Population Management

The Proposed Action (Alternative A) would implement a HMAP, which would incorporate a number of population growth suppression methods. Under this management strategy (HMAP Table 3), WH&Bs across the Blue Wing Complex would be managed within the AML range of 388-643 WH&Bs total in the Complex. Gather operations would be conducted to gather and remove excess WH&Bs both within and outside the Complex, which are currently estimated to number approximately 337 within the Complex, to achieve and maintain AML and administer or booster population control measures to gathered and released horses over a period of multiple years from the initial gather. This would allow BLM to achieve management goals and objectives of attaining a herd size that is at the low range of AML, reducing population growth rates, and achieving a thriving natural ecological balance on the range as identified within the WFRHBA.

It is expected that gather efficiencies and available WH&B holding space during the initial gather may not allow for the removal of sufficient excess animals during the initial gather to reach low AML. Based on

BLM's experience over the past few decades, there are a number of logistical and operational factors that can affect BLM's ability to achieve low AML with a single gather, including (but not limited to) that: gather efficiency is typically less than 80%, which reduces the likelihood that all excess animals can be removed in a single operation when the population significantly exceeds AML; the likely population undercount can result in additional excess WH&Bs being identified in a follow-up inventory even if the targeted numbers of estimated excess WH&Bs have been removed; the WH&Bs become more challenging to catch as the helicopter gather operation progresses and they learn to evade the helicopter; weather conditions may impede achieving the targeted removal numbers; limited availability of contractors with the expertise needed to gather animals safely can impact the ability to continue with a gather until all excess animal have been removed. For these reasons, if low AML cannot be achieved through a single initial gather, follow-up gather(s) may be necessary to achieve low AML. The BLM would return to the Complex to remove the remaining excess WH&Bs in follow-up gathers as necessary. Follow-up gathers would be scheduled as expeditiously as feasible, considering all factors including logistics, contractor availability, space capacity at holding facilities, and funding. In both initial and follow-up gathers, BLM would aim to remove excess WH&Bs necessary to achieve low AML, as well as to gather and release a sufficient number of WH&Bs to implement the population control component of the Proposed Action, which includes fertility control methods (PZP vaccines, GonaCon-Equine vaccine) and minimally invasive sterilization for WH&Bs remaining in the Complex. Removal of excess WH&Bs would be prioritized as follows: from areas where public health and safety issue have been identified; private land and non-HMA areas where resource degradation/deficiency has been identified; within HMAs from areas where resource degradation or habitat issues are most pressing; and where needed to reach and maintain low AML. Selective removal procedures would prioritize removal of younger excess WH&Bs within the Complex to keep the population from exceeding the high range of AML so that degraded range resources have sufficient opportunity for recovery, and allow older, less adoptable WH&Bs to be released back to the Complex.

BLM could begin implementing the population control components (PZP vaccines, GonaCon-Equine vaccine, and permanently non-reproducing mares or geldings) of this alternative as part of the initial gather and continue with increasing use of fertility controls in the follow-up gathers as the excess population is removed from the range. While in the temporary holding corral, horses would be identified for removal or release based on age, gender, and/or other characteristics. BLM may also apply fertility control treatments outside of removal operations, either through gather and release or other methods like darting. To help improve the efficacy and duration of fertility control vaccines, mares could be held for an additional 30 days and given a booster shot prior to release. It is expected that the number of fertile mares and stallions would always be a relatively large fraction (i.e., ~60% or more) of low AML, including those elusive animals that are never gathered and their offspring, fertile stallions, and mares whose reversible fertility control vaccines have become ineffective over time.

Population inventories and routine resource/habitat monitoring would continue to be completed every two to three years to document current population levels, growth rates, and areas of continued resource concerns (horse concentrations, riparian impacts, over-utilization, etc.). Funding limitations and competing national priorities may impact the timing and ability to gather and conduct population control components of the Proposed Action.

The management objective for the Blue Wing Complex would be to manage the WH&B population within the AML range to achieve and maintain TNEB. BLM would achieve this through gathering and removing excess wild horses within the Complex to the low AML and also by applying population growth suppression measures to include:

- Administration of fertility control measures (i.e. PZP vaccines, GonaCon-Equine vaccine or newly developed vaccine formulations) to released mares.
- Adjustment of sex ratios to achieve a 60% male to 40% female ratio.

- Manage a portion of the population as permanently non-reproducing. This would be no more than approximately ¼ of the population at low AML and would include mares that are sterilized with a minimally-invasive procedure and/or stallions that have been gelded. See Appendices II and III for fertility control SOPs and Appendix XII for literature reviews on the effects of fertility control.

The fertility control component of the Proposed Action would reduce the total number of WH&Bs that would otherwise be permanently removed from the range. Including some fertility control-treated mares and some geldings in the herd at mid-AML herd size would allow for management of a total wild horse population within the Complex that would be larger than low AML, while still reducing population growth rates compared to those of an untreated herd and achieving a thriving natural ecological balance. Primary gather methods would include helicopter drive, bait, and water trapping. It is expected that not all WH&Bs would be able to be captured, as gather efficiencies rarely exceed 80%, especially in larger Complexes. As a result of that and associated herd growth between gathers, it is expected that a proportion of WH&Bs (15-20%+) in the Complex and gather area would not be captured or treated over the 10-year period of the Proposed Action.

As a part of periodic sampling to monitor WH&B genetic diversity in the Complex, hair follicle samples would be collected from a minimum of 25 WH&Bs per species in the released population from an HMA or collection of HMAs. Samples would be collected for analysis to assess the levels of observed heterozygosity, which is a measure of genetic diversity (BLM 2010), within the Complex and may be analyzed to determine relatedness to established breeds and other WH&B herds. Horse and burro genetic monitoring results would be analyzed separately.

Mares / jennies identified for release would be aged, microchipped and freeze-marked for identification prior to being released to help identify the animals for future treatments/boosters and assess the efficacy of fertility control treatments.

2.4.2. Population Growth Suppression Methods

The Proposed Action would include population growth suppression methods such as fertility control vaccines, sex ratio adjustment, and a permanently non-reproducing component (up to ¼ of low AML) in the herd. In cases where a booster vaccine is required, mares could be held for approximately 30 days and given a booster shot prior to release. During gather operations to remove excess wild horses, in separate gathers where horses would not be removed, or using other methods like darting, BLM would treat/ retreat mares with fertility control to help meet herd management objectives. Since release of the 2013 National Research Council (NRC) Report, the BLM has explored the possibility of field trials for potential sterilization methods that may be used in WH&Bs management, but inclusion of any particular method for population management is not contingent on completion of any given research project. The use of any new fertility control method would conform to current best management practices at the direction of the National Wild Horse and Burro Program.

Mares that are selected for treatment would be treated with fertility control treatments (PZP vaccines [ZonaStat-H, PZP-22], GonaCon-Equine vaccine or most current formulation) to prevent pregnancy in the following year(s). Some number of mares could be sterilized through a minimally invasive procedure and stallions may be gelded, depending on herd size as noted above. Detailed analysis on population growth suppression methods are discussed further in Appendices II, VI and XII.

2.4.2.1. PZP

Porcine Zona Pellucida (PZP) Vaccine

Immunocontraceptive Porcine Zona Pellucida (PZP) vaccines have been used on over 75 areas managed for wild horses by the National Park Service, US Forest Service, and the Bureau of Land Management and its use is appropriate for free-ranging wild horse herds. Taking into consideration available literature on the subject, the National Research Council concluded in their 2013 report that PZP vaccine was one of the preferred available methods for contraception in WH&Bs (NRC 2013). PZP vaccine use can reduce the need for gathers and removals (Turner et al. 1997). PZP vaccines meet most of the criteria that the National Research Council (2013) used to identify promising fertility control methods, in terms of delivery method, availability, efficacy, and side effects. It has been used extensively in wild horses (NRC 2013), and in burros (Turner et al. 1996, Kahler and Boyles-Griffin 2022). PZP vaccine can be relatively inexpensive, meets BLM requirements for safety to mares and the environment, and is commercially produced as ZonaStat-H, an EPA-registered product (EPA 2012, SCC 2015), or as PZP-22, which is a formulation of PZP in polymer pellets that can lead to a longer immune response (Turner et al. 2002, Rutberg et al. 2017, Carey et al. 2019). It can easily be remotely administered (dart-delivered) in the field, but only where mares are relatively approachable.

Under the Proposed Action, mares being treated for the first time would receive a liquid primer dose along with time release pellets. BLM would return to the HMA as needed to re-apply PZP-22 and/or ZonaStat-H and initiate new treatments in order to maintain contraceptive effectiveness in controlling population growth rates. Application methods could be by hand in a working chute during gathers, or through field darting if mares in some portions of the Complex prove to be approachable. Both forms of PZP can safely be reapplied as necessary to control the population growth rate. Even with repeated booster treatments of PZP, it is expected that most, if not all, mares would return to fertility, and not all mares would be treated or receive boosters within the Complex due to the sheer numbers of the population, the large size of the Complex, and logistics of wild horse gathers. Once the population is at AML and population growth seems to be stabilized, BLM could use population planning software (PopEquus, USGS Fort Collins Science Centre, https://rconnect.usgs.gov/popequus/) to determine the required frequency of re-treating mares with PZP or other fertility control methods.

2.4.2.2. Gonadotropin Releasing Hormone (GnRH) Vaccine, GonaCon-Equine Vaccine

The immune-contraceptive GonaCon-Equine vaccine meets most of the criteria that the National Research Council of the National Academy of Sciences (NRC 2013) used to identify the most promising fertility control methods, in terms of delivery method, availability, efficacy, and side effects. GonaCon-Equine is approved for use by authorized federal, state, tribal, public, and private personnel, for application to wild and feral equids in the United States (EPA 2013, 2025). Its use is appropriate for free-ranging wild horse herds. Taking into consideration available literature on the subject, the National Research Council concluded in their 2013 report that GonaCon-B (which is produced under the trade name GonaCon-Equine for use in feral horses and burros) was one of the most preferable available methods for contraception in wild horses and burros (NRC 2013). Since 2013, additional studies have further confirmed the effects of and applicability of GonaCon-Equine for use in wild horses and burros. GonaCon-Equine has been used on feral horses in Theodore Roosevelt National Park (Baker et al. 2023) and is currently being administered in numerous BLM-managed HMAs. GonaCon-Equine can be remotely administered in the field in cases where mares are relatively approachable, using a customized pneumatic dart (Baker et al. 2023). Use of remotely delivered (dart-delivered) vaccine is generally limited to populations where individual animals can be accurately identified and repeatedly approached within 50 meters or less (BLM 2010).

As with other contraceptives applied to wild horses, the long-term goal of GonaCon-Equine use is to reduce or eliminate the need for gathers and removals (NRC 2013). GonaCon-Equine vaccine is an EPA-approved pesticide (EPA 2025) that is relatively inexpensive, meets BLM requirements for safety to mares and the environment, and is produced in a USDA-APHIS laboratory. Its categorization as a pesticide is consistent with regulatory framework for controlling overpopulated vertebrate animals, and in no way is meant to convey that the vaccine is lethal; the intended effect of the vaccine is as a contraceptive. GonaCon is produced as a pharmaceutical-grade vaccine, including aseptic manufacturing technique to deliver a sterile vaccine product (Miller et al. 2013). If stored at 4° C, the shelf life is 6 months (Miller et al 2013).

Miller et al. (2013) reviewed the vaccine environmental safety and toxicity. When advisories on the product label (EPA 2025) are followed, the product is safe for users and the environment (EPA 2009b). EPA waived a number of tests prior to registering the vaccine, because GonaCon was deemed to pose low risks to the environment, so long as the product label is followed (Wang-Cahill et al.2023).

Under the Proposed Action, the BLM would return to the Complex as needed to re-apply GonaCon-Equine and initiate new treatments in order to maintain contraceptive effectiveness in controlling population growth rates. Booster dose effects may lead to increased effectiveness of contraception, which is generally the intent. GonaCon-Equine can safely be reapplied as necessary to control the population growth rate. Even with one booster treatment of GonaCon-Equine, it is expected that most, if not all, mares would return to fertility at some point, as a study of boostered mares shows a gradual return to fertility over time (Baker et al. 2023), although the average duration of effect after booster doses has not yet been quantified. It is unknown what would be the expected rate for the return to fertility rate in mares boosted more than once with GonaCon-Equine has not been quantified. Once the herd size in the Complex is at AML and population growth seems to be stabilized, BLM could use population planning software (PopEquus, USGS Fort Collins Science Centre, https://rconnect.usgs.gov/popequus/) to make a determination as to the required frequency of new mare treatments and mare re-treatments with GonaCon or other fertility control methods, to maintain the number of horses within AML.

2.4.2.3 Sex Ratio Adjustment

Sex ratio adjustment, leading to a reduced fraction of mares in the herd, can be considered a form of contraceptive management, insofar as it can reduce the realized per-capita growth rate in a herd. By reducing the proportion of breeding females in a population (as a fraction of the total number of animals present), the technique leads to fewer foals being born, relative to the total herd size. Sex ratio is typically adjusted in such a way that 60 percent of the horses are male. In the absence of other fertility control treatments, this 60:40 sex ratio alone can temporarily reduce population growth rates from approximately 20% to approximately 15% (Bartholow 2004). While such a decrease in growth rate may not appear to be large or long-lasting, the net result can be that fewer foals are born, at least for a few years – this can extend the time between gathers, and reduce impacts on-range, and costs off-range.

2.4.2.4 Permanently Non-reproducing Component (gelding stallions and/or sterilization of mares)

In order to reduce the total number of excess WH&Bs that would otherwise be permanently removed from the Complex, a portion of the population (no more than ¼ of the population at low AML) would be managed as permanently non-reproducing. These using physical sterilization methods could be in addition to immunocontraceptive (fertility control vaccine) or sex ratio adjustment methods of population growth suppression. The procedures to be followed for gelding of stallions and sterilizing mares are detailed in Appendices II and III.

2.4.2.4.a Gelding Procedure

BLM routinely gelds all excess male horses that are captured and removed from the range prior to their adoption, sale, or shipment to Off-Range Pastures (ORPs). The gelding procedure for excess WH&Bs removed from the range would be conducted at temporary (field) or off range corrals by licensed veterinarians and follows industry standards. Under the Proposed Action, in addition to returning the population of wild horses to low AML, up to 138 geldings could be returned to resume their free-roaming behaviors on the public range instead of being permanently removed from the Complex, which could bring the population to mid-AML. Geldings have been released on BLM lands as a part of herd management in the Barren Valley complex in Oregon (BLM 2011), the Challis HMA in Idaho (BLM 2012), and the Conger HMA in Utah (BLM 2016). By including some geldings in the population and having a slightly skewed sex ratio with more males than females overall, the anticipated result would be a reduction in per-capita population growth rates while allowing for management of a larger total WH&B population on the range. Stallions that would otherwise be permanently removed as excess WH&Bs would be selected for gelding and release. No animals which appear to be distressed, injured, or in poor health or condition would be selected for gelding. Stallions would not be gelded within 72 hours of capture. The surgery would be performed at a BLM-managed holding center by a veterinarian using general anesthesia and appropriate surgical techniques (see Gelding SOPs in Appendix III).

The animal is sedated then placed under general anesthesia. Ropes are placed on one or more limbs to help hold the animal in position and the anesthetized animals are placed in either lateral or dorsal recumbency. The surgical site is scrubbed and prepped aseptically. The surgeon would wear sterile gloves. The scrotum is incised over each testicle, and the testicles are removed using a surgical tool to control bleeding. The incision is left open to drain. Each animal would be given a Tetanus shot, antibiotics, and an analgesic.

Any males that have an inguinal or scrotal hernias would be removed from the population, sent to a BLM prep corral facility and be treated surgically as indicated if possible or euthanized if they have a poor prognosis for recovery according to BLM policy (WO PIM 2021-007). Horses with only one descended testicle may be removed from the population and managed at a BLM prep corral facility according to BLM policy or anesthetized with the intent to locate the undescended testicle for castration. If an undescended testicle cannot be located, the animal may be recovered and removed from the population if no surgical exploration has started. Once surgical exploration has started those that cannot be completely castrated would be euthanized prior to recovering them from anesthesia according to BLM policy. All animals would be rechecked by a veterinarian the day following surgery. Those that have excessive swelling, are reluctant to move, or show signs of any other complications would be held in captivity and treated accordingly as they normally would in a BLM facility. Once released to the wild no further veterinary interventions are possible.

Selected stallions would be shipped to an off-range corral (ORC), gelded, and returned to the range within 30 days. When and where they are visible, gelded animals could be monitored periodically for complications for approximately 7-10 days following release. This monitoring may be completed either through aerial reconnaissance if available, or field observations from major roads and trails. The goal of this monitoring would be to detect complications if they are occurring. All adults would have been freeze-marked at the first gather to facilitate posttreatment and routine field monitoring. Periodic population inventories and future gather statistics may contribute to BLM's ongoing considerations about managing a portion of the herd as permanently non-reproducing animals, as an effective approach to slowing the annual population growth rate by replacing breeding mares with sterilized animals, when used in conjunction with other population control techniques. Management that includes some fraction of the population as geldings would allow for management at mid-AML, instead of gathering and removing excess animals to low AML.

By itself, it is unlikely that gelding would allow the BLM to achieve its horse and burro population management objectives since a single fertile stallion is capable of impregnating multiple mares, and stallions other than the dominant harem stallion may also breed with some mares. Adequate reduction of female horse fertility rates would be expected to result only if a large proportion of male horses in the population are sterile, because of their horses' behavior (Garrott and Siniff 1992). Therefore, to be fully effective, use of gelding (alone) to control population growth requires that nearly the entire male population be gathered and treated (which is not practical and is not being considered here) or that some percentage of the female wild horses in the population be gathered and treated with some form or forms of fertility control. If the mare treatment is not permanent (e.g., application of PZP vaccine, GonaCon-Equine vaccine) the mares may need to be gathered and retreated on a periodic basis.

2.4.2.4.b Mare Sterilization

Sterilizing mares has already been shown to be an effective part of feral horse management that reduced herd growth rates on federal lands (Collins and Kasbohm 2016). Herd-level birth rate is expected to decline in direct proportion to the fraction of sterile mares in the herd because sterile mares cannot become pregnant. A more detailed literature review of the effects of mare sterilization can be found in Appendix XII, which focuses on 4 methods of mare sterilization: pharmacological or immunocontraceptive methods, minimally invasive physical sterilization, ovariectomy via colpotomy, and ovariectomy via flank laparoscopy. However, only minimally-invasive physical sterilization would be included in Alternative A.

Pharmacological or immunocontraceptive sterilization methods would use a drug or vaccine to cause sterilization. BLM has not yet identified a pharmacological or immunocontraceptive method to sterilize mares that has been proven to reliably and humanely sterilize wild horse mares from one dose. However, there is the possibility that current or future development and testing of new methods could make an injectable sterilant available for wild horse mares.

Minimally-invasive, physical sterilization procedure could include any physical form of sterilization that does not involve surgery. This could include any form of physical procedure that leads a mare to be unable to become pregnant, or to maintain a pregnancy. For example, endoscopic oviduct ablation causes a long-term blockage of the oviduct by infusion of a surgical-grade glue, so that fertile eggs cannot go from the ovaries to the uterus (Bigolin et al. 2009). In endoscopic laser ablation of the oviduct papilla, scarring caused by heat applied at the junction between oviducts and uterus prevents eggs from reaching the uterus. These two procedures are trans-cervical, so any treated mares would first need to have been screened to ensure they are not pregnant. The result of such minimally invasive procedures that prevent pregnancy but do not harm the ovaries is that the mare would be sterile, although she would continue to have estrus cycles. Minimally-invasive mare sterilization methods are reviewed in more detail in Appendix XII.

2.4.3 Development of Unnamed Spring 78-40

The proposed development of Unnamed Spring 78-40 would include development of the spring, construction of a steel jack exclosure around the springhead to protect the water source from damage, collecting via spring box and piping the water approximately 2 miles down to 1-2 tire troughs in the valley bottom via a pipeline along the road. The exclosure would be approximately 1.06 acres in size and would protect riparian area around the spring source, as well as the spring source itself. Construction of the exclosure would be in conformance with 2015 Winnemucca RMP Objective FW 11: “Manage spring resources to protect the source integrity and hydrology to ensure availability for aquatic and terrestrial wildlife and other uses” and Action FW 11.2: “Fence spring sources and associated riparian-wetland areas being developed for livestock and wild horse and burro watering. Place watering facilities outside of the spring sources and associated riparian-wetland areas”. The pipeline would be buried within the road right-of-way in order to collocate surface disturbance, easily locate and repair any leaks that may occur over time, as well as minimize any disturbances associated with developing this water source. Developing Unnamed Spring 78-40 would serve to better distribute WH&B use in the Blue Wing Complex, reduce excessive WH&B use of Porter Spring, and provide additional year-round water within the complex, which will be particularly beneficial to WH&B during the winter months. Development would occur after any necessary archeological clearances are complete. If cultural resources are found within the area of potential effect, the proposed water development project would be relocated or redesigned so there are no negative impacts to those resources.

2.5 Alternative B
Alternative B is similar to Alternative A except that it would not include a permanently non-reproducing component (sterilized mares, geldings). This alternative would implement an HMAP with management strategy to include removal of excess WH&Bs to low end AML, population growth control using mare fertility control treatments (PZP vaccines, GonaCon-Equine vaccine or most current vaccine formulation), and sex ratio adjustments. Under this alternative, Unnamed Spring 78-40 would be developed in order to provide year-round water for WH&Bs, better distribute WH&Bs within the Complex, and reduce pressure on Porter Spring.

2.6 Alternative C
Under this alternative, the BLM would implement an HMAP with management strategy, gather and remove excess animals to within the AML range without fertility control, sex ratio adjustments, or permanently non-reproducing component (HMAP Table 3). Under this alternative, Unnamed Spring 78-40 would be developed in order to provide year-round water for WH&Bs, better distribute WH&Bs within the Complex, and reduce pressure on Porter Spring.

2.7 Management Actions Common to Alternatives A, B, and C
The primary gather techniques would be the helicopter-drive and water/bait trapping. The use of roping from horseback could also be used when necessary. Multiple, temporary gather sites (traps) would be used to gather WH&Bs both from within and outside the Complex. In addition to public lands, private property may be utilized for gather sites and temporary holding facilities (with the landowner's permission) if necessary, to ensure accessibility and/or based on prior disturbance. Use of private land would be subject to Standard Operating Procedures (SOPs) (Appendix IV) and to the written approval/authorization of the landowner.

Any trapping activities would be scheduled in locations and during time periods that would be most effective to gather sufficient numbers of animals to achieve management goals for the areas being gathered. The most efficient gather technique would be chosen as determined by the gather needs of the specific area.

Temporary holding sites could be in place for up to 90 days depending on length of gather. Bait or water trapping sites could remain in place up to one year. The exact location of the gather sites and holding sites may not be determined until immediately prior to the gather because the location of the animals on the landscape is variable and unpredictable.

The BLM would make every effort to place gather sites in previously disturbed areas, but if a new site needs to be used, a cultural inventory would be completed prior to using the new gather site. If cultural resources are encountered, the location of the gather/ holding site would be adjusted to avoid all cultural resources.

The BLM would make every effort to place gather sites in previously disturbed areas, but if a new site needs to be used, a special status plant survey would be completed prior to using the new gather site. If special status plants are encountered, the location of the gather/ holding site would be adjusted to avoid all special status plants. A special status plant survey would be completed prior to the construction of the exclosure, pipeline, and trough and the location of these features would be adjusted to avoid all special status plants found.

The contractor, together with the contracting officer's representative or project inspector (COR/PI), would examine proposed gather sites and holding corrals for noxious and invasive weed populations prior to construction. If noxious weeds are found, the location of the facilities would be moved. Vehicles and other equipment would be checked for plant material and cleaned before leaving weed infested areas and prior to entering/leaving a project area. All gather sites, holding facilities, and camping areas on public lands would be monitored for weeds during the next several years.

No gather sites would be set up on Greater sage-grouse leks, known populations of sensitive species, in riparian areas, in cultural resource sites, sacred sites, paleontological sites, Wilderness Study Areas (WSAs) or congressionally designated Wilderness Areas. All gather sites, holding facilities, and camping areas on public lands would be recorded with Global Positioning System equipment, given to the BLM Winnemucca District Invasive, Non-native Weed Coordinator, and then assigned for monitoring and any necessary treatment during the next several years for invasive, non-native weeds. All gather and handling activities (including gather site selections) would be conducted in accordance with SOPs in Appendix IV.

Activities in listed species habitat would be subject to Section 7 consultation under the Endangered Species Act with the level of consultation to be determined based upon the project site-specific proposed action. BLM would complete consultation prior to implementation of any specific action which may have an effect on a listed species.

Wildlife Stipulations (Common to all Alternatives, except No Action Alternative)

- If gather operations were to be conducted during the migratory bird breeding season (March 1 – August 31) a nest clearance survey would be conducted by BLM Biologist at trap, corral, and staging areas.
- Trap sites and corrals would not be located in active pygmy rabbit habitat or other sensitive habitat.
- Before construction begins on proposed trap sites, as well as the proposed exclosure, pipeline, and trough, Western Burrowing Owl surveys must be conducted.
- The proposed exclosure fence would comply with applicable wildlife fence standards (Fences – BLM Manual Handbook H-1741-1),
- Greater sage-grouse Required Design Features that are identified in Appendix X would be applied in Greater sage-grouse habitat.
- Corrals would not be constructed within 1 mile of an active or pending lek.
- Prior to gathers, BLM would coordinate with NDOW regarding locations of staging areas to address Greater sage-grouse concerns. The following timing restrictions would be adhered to the best of BLM's abilities while not impeding gather operations:
    - Helicopter and water trapping gather would not occur during the lek timing restriction of March 1 – May 15 to protect breeding Greater sage-grouse.
    - Helicopter gathers would not occur during the nesting timing restriction of April 1 – June 30 within 4 miles of an active or pending lek.
    - Water trapping operations would not occur during nesting timing restriction April 1 – June 30 within 1 mile of an active or pending lek.
    - Water trapping operations would not occur within Greater sage-grouse habitat at springs and seeps during brood-rearing timing restriction of May 1 – September 15 without a timing waiver.

2.7.1. Helicopter Drive Trapping

The BLM would utilize a contractor to perform the gather activities in cooperation with the BLM. The contractor would be required to conduct all helicopter operations in a safe manner and in compliance with Federal Aviation Administration (FAA) regulations including 14 CFR § 91.119. Helicopter landings would not be allowed in wilderness except in the case of an emergency.

Helicopter-drive trapping may be needed to meet management objectives to capture the highest percentage of WH&Bs possible. The appropriate gather method would be determined by the BLM based on the location, accessibility of the animals, local terrain, vegetative cover, and available sources of water and forage. Roping from horseback could also be used when necessary. Based on WH&B watering locations in this area, it is estimated that multiple trap sites may be used during trapping activities.

Helicopter drive trapping involves use of a helicopter to herd WH&Bs into a temporary trap. The BLM's then-current Comprehensive Animal Welfare Program (CAWP) and PIM 2021-002, and SOPs (current version is attached as Appendix IV), would be implemented to ensure that the gather is conducted in a safe and humane manner, and to minimize potential impacts or injury to the WH&Bs. Utilizing the topography, traps would be set in areas with high probability of WH&B access. This would assist with capturing excess WH&Bs residing nearby. Traps consist of a large catch pen with several connected holding corrals, jute-covered wings and a loading chute. The jute covered wings are made of fibrous material, not wire, to avoid injury to the WH&Bs. The wings form an alley way used to guide the WH&Bs into the trap. Trap locations are changed during the gather to reduce the distance that the animals must travel. A helicopter is used to locate and herd WH&Bs to the trap location. The pilot uses a pressure and release system while guiding them to the trap site, allowing them to travel at their own pace. As the herd approaches the trap the pilot applies pressure and a prada horse is released guiding the WH&Bs into the trap. Once WH&Bs are gathered, they are removed from the trap and transported to a temporary holding facility where they are sorted.

During helicopter drive-trapping operations, BLM would require that an Animal and Plant Health Inspection Service (APHIS) veterinarian or contracted licensed veterinarian is on-site or on call to examine animals and make recommendations to BLM for care and treatment of WH&Bs. BLM staff would be present on the gather at all times to observe animal condition, ensure humane treatment of WH&Bs, and ensure contract requirements are met.

2.7.2. Bait/Water Trapping

Bait and/or water trapping would be used as appropriate to gather WH&Bs efficiently and effectively. Bait and water trapping may be utilized, when WH&Bs are in an area where there is a limited resource (such as food or water). The use of bait and water trapping, though effective in specific areas and circumstances, is not timely, cost-effective, or practical as the primary or sole gather method for the Complex. However, water or bait trapping could be used as a supplementary approach to achieve the desired goals of the BLM in portions of the Complex. Bait and/or water trapping generally require a longer window of time for success than helicopter drive trapping. Although the trap would be set in a high probability area for capturing excess WH&Bs residing within the area and at the most effective time periods, time is required for the horses to acclimate to the trap and/or decide to access the water/bait.

Trapping involves setting up portable panels around an existing water source or in an active WH&B area, or around a pre-set water or bait source. The portable panels would be set up to allow WH&Bs to go freely in and out of the corral until they have adjusted to it. When the WH&Bs fully adapt to the corral, it is fitted with a gate system. The adaptation of the WH&Bs creates a low stress trapping method. During this acclimation period the WH&Bs would experience some stress due to the panels being setup and perceived access restriction to the water/bait source. See Water and Bait Trapping SOP Appendix IV.

Gathering excess WH&Bs using bait/water trapping could occur at any time of the year and traps would remain in place until the target numbers of animals are removed. As the proposed bait and/or water trapping in this area is a lower stress approach to gathering WH&Bs, such trapping can continue into the foaling season without harming the mares or foals.

2.7.3. Gather-Related Temporary Holding Facilities (Corrals)

Wild horses and burros that are gathered would be transported from the gather sites to a temporary holding corral. At the temporary holding corral WH&Bs would be sorted into different pens. Mares would be identified for fertility control and treated at the corrals for eventual return to the range. The WH&Bs would be provided good quality hay and water. At the temporary holding facility, a veterinarian, when present, would provide recommendations to the BLM regarding care and treatment of recently captured WH&Bs. Any animals affected by a chronic or incurable disease, injury, lameness, or serious physical defect (such as severe tooth loss or wear, club foot, and other severe congenital abnormalities) would be humanely euthanized using methods acceptable to the American Veterinary Medical Association (AVMA).

Herd health and characteristics data would be collected as part of continued monitoring of the WH&B herds Genetic diversity baseline data would be collected to monitor the genetic diversity of the WH&Bs within the Complex. Additional samples may be collected to analyze ancestry.

Gathered and removed WH&Bs would be transported to BLM ORCs where they would be prepared for adoption and/or sale to qualified individuals or transfer to ORPs or other disposition authorized by the WFRHBA.

2.7.4. Transport, Off-range Corrals, and Adoption Preparation

All gathered and removed WH&Bs would be transported to ORCs (formerly short-term holding facility) where they would be inspected by facility staff (and if needed by a contract veterinarian) to observe health conditions and ensure that the animals are being humanely cared for. WH&Bs removed from the range would be transported to the receiving ORC in a goose-neck stock trailer or straight-deck semi-tractor trailer. Trucks and trailers used to haul the WH&Bs would be inspected prior to use to ensure wild horses can be safely transported. WH&Bs would be segregated by age and sex when possible and loaded into separate compartments. Mares and their un-weaned foals may be shipped together. Transportation of recently captured WH&Bs is limited to a maximum of 10 hours.

Upon arrival, recently captured WH&Bs are off-loaded by compartment and placed in holding pens where they are provided good quality hay and water. Most WH&Bs begin to eat and drink immediately and adjust rapidly to their new situation. At the ORC, a veterinarian provides recommendations to the BLM regarding care, treatment, and if necessary, euthanasia of the recently captured wild horses. Any animals affected by a chronic or incurable disease, injury, lameness, or serious physical defect (such as severe tooth loss or wear, club foot, and other severe congenital abnormalities) would be humanely euthanized using methods acceptable to the AVMA. WH&Bs in very thin condition, or animals with injuries, are sorted and placed in hospital pens, fed separately, and/or treated for their injuries. Recently captured animals in very thin condition may have difficulty transitioning to feed. Some of these animals may be in such poor condition that it is unlikely they would have survived if left on the range. Similarly, some females may lose their pregnancies. Certain management techniques would be taken to help females make a quiet, low stress transition to captivity and domestic feed to minimize the risk of miscarriage or death.

After recently captured WH&Bs have transitioned to their new environment, they are prepared for adoption, sale, or transport to ORPs. Preparation involves freeze marking the animals with a unique identification number, vaccination against common diseases, castration, microchipping, and de-worming. At ORC facilities, a minimum of 700 square feet of space is provided per animal. Mortality at ORCs averages approximately 5% per year (GAO, 2008), and includes animals euthanized due to pre-existing conditions; animals in extremely poor condition; animals that are injured and would not recover; animals which are unable to transition to feed; and animals which are seriously injured or accidentally die during sorting, handling, or preparation. ORCs may be BLM-owned or contracted private facilities.

2.7.5. Adoption

Adoption applicants are required to have at least a 400 square foot corral with panels that are at least six feet tall for any ungentled horse two years old or older, and 4.5 feet tall for any burro. Applicants are required to provide adequate shelter, feed, and water. The BLM retains title to the horse or burro for one year and inspects the horse or burro and facilities during this period. After one year, the applicant may take title to the horse or burro, at which point the horse or burro becomes the property of the applicant. Adoptions are conducted in accordance with 43 CFR Subpart 4750.

2.7.6. Sale with Limitations

Buyers must fill out an application and be pre-approved before they may buy a wild horse. A sale-eligible wild horse or burro is any animal that is more than 10 years old or has been offered unsuccessfully for adoption at least three times. The application also specifies that buyers cannot sell the horse or burro to anyone who would sell the animals to a commercial processing plant. Sales of WH&Bs are conducted in accordance with the WFRHBA and congressional limitations.

2.7.7. Off-Range Pastures

Currently there are no ORPs for burros. When shipping wild horses for adoption, sale, or ORPs, the animals may be transported for up to a maximum of 24 hours. Immediately prior to transportation, and after every 24 hours of transportation, animals are off-loaded and provided a minimum of 8 hours on-the-ground rest. During the rest period, each animal is provided access to unlimited amounts of clean water and two pounds of good quality hay per 100 pounds of body weight with adequate space to allow all animals to eat at one time. Mares and sterilized stallions (geldings) are segregated into separate pastures. Although the animals are placed in ORP, they remain available for adoption or sale to qualified individuals; and foals born to pregnant mares in ORP are gathered and weaned when they reach about 8-12 months of age and are also made available for adoption. The ORP contracts specify the care that wild horses must receive to ensure they remain healthy and well-cared for. Handling by humans is minimized to the extent possible although regular on-the-ground observation by the ORP contractor and periodic counts of the wild horses to ascertain their well-being and safety are conducted by BLM personnel and/or veterinarians.

2.7.8. Euthanasia or Sale without Limitations

Under the WFRHBA, healthy excess WH&Bs can be euthanized or sold without limitation if there is no adoption demand for the animals. However, while euthanasia and sale without limitation are allowed under the statute, for several decades Congress has prohibited the use of appropriated funds for this purpose. If Congress were to lift the current appropriations restrictions, then it is possible that excess WH&Bs removed from the Complex could potentially be euthanized or sold without limitation consistent with the provisions of the WFRHBA.

Any old, sick, or lame WH&Bs unable to maintain an acceptable body condition (greater than or equal to a Henneke BCS of 3) or with serious physical defects would be humanely euthanized either before gather activities begin or during the gather operations as well as within ORCs. Decisions to humanely euthanize animals in field situations would be made in conformance with BLM policy (Washington Office Instruction Memorandum (WO PIM 2021-007 or most current edition). Conditions requiring humane euthanasia occur infrequently and are described in more detail in PIM 2021-007.

2.7.9. Public Viewing Opportunities

Opportunities for public observation of the gather activities on public lands would be provided, when and where feasible, consistent with WO IM No. 2013-058 or other current policy and the Visitation Protocol and Ground Rules for Helicopter WH&B Gathers within Nevada (Appendix V). As part of public viewing of the gather operations, BLM would establish observation locations that reduce safety risks to the public during helicopter gathers (e.g., from helicopter-related debris or from the rare helicopter crash landing, or from the potential path of gathered WH&Bs), to the WH&Bs (e.g., by ensuring observers would not be in the line of vision of WH&Bs being moved to the gather site), and to contractors and BLM employees who must remain focused on the gather operations and the health and well-being of the WH&Bs. As feasible, observation locations would be located near gather or holding sites, although safety, gather efficiency, terrain, and land status factor into how close observation locations would be. All observation locations would be subject to the same cultural resource requirements as gather and holding sites.

During water/bait trapping operations, spectators and viewers would be prohibited as it would impact the contractor's ability to capture WH&Bs. Only essential gather operation personnel would be allowed at the trap site during operations.

2.8 Alternatives Considered but Eliminated from further Consideration
The following alternatives to the helicopter drive and bait/water trapping method for the removal of WH&Bs to reach the established AML were considered but eliminated from detailed analysis for the reasons stated below.

2.8.1. Exclusively Field Darting Horses and Burros with ZonaStat-H (Native PZP) or GonaCon-Equine Vaccines
This alternative was eliminated from further consideration as the sole method of applying fertility control vaccine due to the difficulties inherent in darting WH&Bs in the Complex. Field darting of WH&Bs works in small areas with good access where animals are acclimated to the presence of people who come to watch and photograph them. The size of the Complex is very large (1,186,787 acres) and many areas do not have ready access. The presence of water sources on both private and public lands inside and outside the Complex would make it almost impossible to restrict WH&B access to be able to dart WH&Bs consistently. WH&B behavior limits their approachability/accessibility, so that the number of mares/jennies expected to be treatable via darting would be insufficient to control growth. BLM would have difficulties keeping records of animals that have been treated due to common and similar colors and patterns. This formulation of PZP ZonaStat-H also requires a booster given every year following treatment to maintain the highest level of efficacy, and booster-darted doses of GonaCon-Equine also have limited duration of effect (see Appendix XII). Annual darting of WH&Bs in large areas can be very difficult to replicate and would be unreliable. For these reasons, this alternative was determined to not be an effective or feasible method by itself for applying population controls to WH&Bs from the Complex. Darting is included as a potential tool for use under the Proposed Action in areas that may be deemed suitable in the future, and to be implemented in concert with the other methods detailed in the Proposed Action.

2.8.2. Control of Wild Horse and Burro Numbers by Fertility Control Treatment Only (No Removals)
An alternative to gather a significant portion of the existing population (95%) and implement fertility control treatments only, without removal of excess wild horses was modeled using a three-year gather/treatment interval over an 11-year period, in the *PopEquus* (1.0.2) software. The *PopEquus* (1.0.2) software currently does not have capabilities to model burro populations, so simulations were only run for the horse population. See Appendix VI for population modeling. Based on this modeling, this alternative would not result in attainment of the AML range for the Complex and the wild horse population would reach a projected population size of 1,259, using GonaCon-Equine (or 2,377 using PZP-22), adding to the current wild horse overpopulation, albeit at a slower rate of growth than an approach with no fertility control. Over the 10-year period modeled, 2,611 wild horses would need to be gathered if GonaCon-Equine is used (or 3,614 if PZP-22 is used), to allow for injection of vaccines for population control. It is important to understand that in these scenarios, the same wild horse may be gathered multiple times during the 10-year period.

It is expected that burro population growth rates would follow a similar trajectory as what population modeling showed for horses for this alternative, though wild burro population growth rates tend to be slightly lower on average than for wild horses (NAS 2013). A USGS PopEquus module for wild burros is not yet available for use in NEPA analyses. This alternative would not bring the WH&B population to within the established AML range, would allow the WH&B population to continue to grow even further in excess of AML, and would allow resource concerns to further escalate. Implementation of this alternative would result in high gather and fertility control costs without achieving a thriving natural ecological balance or resource management objectives. This alternative would not meet the purpose and need and therefore was eliminated from further consideration.

2.8.3. Chemical Immobilization

Chemical immobilization as a method of capturing WH&Bs is not a viable alternative because it is a very specialized technique and is strictly regulated. Currently the BLM does not have sufficient expertise to implement this method at scale and it would be impractical to use given the size of the Complex, access limitations and approachability of the WH&Bs. For these reasons, this method was eliminated from further consideration.

2.8.4. Use of Wrangler on Horseback Drive-trapping

Use of wranglers on horseback drive-trapping to remove excess WH&Bs can be somewhat effective on a small scale but due to the number of WH&Bs to be gathered, the large geographic size of the Complex, and lack of approachability of the animals, the exclusive use of this technique would be ineffective and impractical as a substitute for helicopter trapping. WH&Bs often outrun and outlast domestic horses carrying riders. Helicopter assisted roping is typically only used if necessary and when the wild horses are in close proximity to the gather site. For these reasons, this method was eliminated from further consideration.

2.8.5. Designate the HMAs to be Managed Principally for Wild Horse or Burro Herds Under 43 C.F.R. 4710.3-2.

The HMAs are designated in the Land Use Planning process for the long-term management of WH&Bs in conjunction with other multiple uses. The (BLM) Humboldt River Field Office does not administer any designated Wild Horse or Burro Ranges, which under 43 C.F.R. 4710.3-2 are "to be managed principally, but not necessarily exclusively, for wild horse or burro herds." There are currently only four designated Wild Horse or Burro Ranges on public lands and authority to designate such ranges resides with the Secretary of Interior or Nevada State Director. This alternative would involve no removal of WH&Bs and would instead address excess WH&B numbers through removal or reduction of livestock within the HMAs. In essence, this alternative would exchange use by livestock for use by WH&Bs. Because this alternative would mean converting the HMAs to wild horse and/or burro Ranges and modifying the existing multiple use relationships established through the land-use planning process, it would first require an amendment to the RMP, which is outside the scope of this analysis. Further, this alternative was not brought forward for analysis because it is inconsistent with the 2015 Winnemucca RMP and the WFRHBA which directs the Secretary to immediately remove excess WH&Bs where necessary to ensure a thriving natural ecological balance and multiple use relationship. This alternative is also inconsistent with the BLM's multiple use management mission under FLPMA. Changes to or the elimination of livestock grazing cannot be made through a WH&B gather decision. Furthermore, even with significantly reduced levels of livestock grazing within the gather area relative to the permitted levels authorized in the 2015 Winnemucca RMP, there is insufficient habitat for the current population of WH&Bs, as confirmed by monitoring data. As a result, this alternative was not analyzed in detail.

2.8.6. Raising the Appropriate Management Levels for Wild Horses and Burros

Monitoring and other historical data collected within the Complex does not indicate that an increase in AML is warranted at this time. On the contrary, such monitoring data confirms the need to remove excess

WH&Bs to reverse downward trends, promote improvement of rangeland health and ensure safety and health of WH&Bs. Severe range degradation would occur in the meantime and large numbers of excess WH&Bs would ultimately need to be removed from the range to achieve the AMLs or to prevent the death of individual animals under emergency conditions. This alternative was eliminated from further consideration because it is contrary to the WFRHBA which requires the BLM to manage the rangelands to prevent the range from deterioration associated with an overpopulation of WH&Bs. Raising the AML where there are known resource degradation issues associated with an overpopulation of WH&Bs does not meet the Purpose and Need to Restore a TNEB. Additionally, delay of a gather until the AMLs can be reevaluated is not consistent with the WFRHBA, Public Rangelands Improvement Act (PRIA), FLPMA, or the Winnemucca RMP.

2.8.7. Remove or Reduce Livestock Within the HMAs

This alternative would involve no removal of WH&Bs and would instead address excess WH&B numbers through removal or reduction of livestock within the HMAs. In essence, this alternative would simply exchange use by livestock for use by WH&Bs. This alternative was not brought forward for analysis because it is inconsistent with the Winnemucca RMP and the WFRHBA, which directs the Secretary to immediately remove excess WH&Bs.

Additionally, the proposal to reduce livestock would not meet the Purpose and Need for action identified in Section 1.2. Eliminating or reducing livestock grazing in order to shift forage use to WH&Bs would not be in conformance with the existing land use plans and is contrary to the BLM's multiple-use mission as outlined in FLPMA and would be inconsistent with the WFRHBA and PRIA. It was Congress' intent to manage WH&Bs as one of the many uses of the public lands, not a single use. Therefore, the BLM is required to manage s in a manner designed to achieve a thriving natural ecological balance between WH&Bs populations, wildlife, domestic livestock, vegetation, and other uses. Information about the Congress' intent is found in the Senate Conference Report (92-242) which accompanies the 1971 WFRHBA (Senate Bill 1116): "*The principal goal of this legislation is to provide for the protection of the animals from man and not the single use management of areas for the benefit of wild free-roaming horses and burros. It is the intent of the committee that the wild free-roaming horses and burros be specifically incorporated as a component of the multiple-use plans governing the use of the public lands.*"

Furthermore, simply re-allocating livestock AUMs to increase the WH&Bs AMLs would not achieve a thriving natural ecological balance. WH&Bs are unlike livestock which can be confined to specific pastures, limited to specific periods of use, and specific seasons-of-use to minimize impacts to vegetation during the critical growing season and to riparian zones during the summer months. WH&Bs are present year-round and their impacts to rangeland resources cannot be controlled through the establishment of a grazing system, such as for livestock. Thus, impacts from WH&Bs can only be addressed by limiting their numbers to a level that does not adversely impact rangeland resources and other multiple uses.

Livestock grazing can only be reduced or eliminated through provisions identified within regulations at 43 CFR Part 4100 and must be consistent with multiple use allocations set forth in LUP/RMPs. Such changes to livestock grazing cannot be made through a WH&Bs gather decision and are only possible if BLM first revises the LUPs to allocate livestock forage to WH&Bs and to eliminate or reduce livestock grazing. Because this alternative is inconsistent with the Winnemucca RMP, it would first require an amendment to the RMP, which is outside the scope of this EA.

2.8.8. Wild Horse and Burro Numbers Controlled by Natural Means

This alternative was eliminated from further consideration because it is contrary to the WFRHBA which requires the BLM to prevent range deterioration associated with an overpopulation of WH&Bs. The alternative of using natural controls to achieve a desirable AML has not been shown to be feasible in the past (NRC 2013).

Survival rates for WH&Bs on western USA public lands are high (Ransom et al. 2016). In some cases, adult annual survival rates exceed 95%. None of the significant natural predators from native ranges of the wild equids in Europe, Asia, and Africa — wolves, brown bears, and African lions — exist on the WH&B HMAs in the western United States. Mountain lions are known to predate on horses and burros, primarily foals, in a few herds, but predation contributes to demographically substantial foal mortality in only a handful of herds, and even in those the level of lion-caused mortality does not generally prevent herd growth (see Appendix XII).

Many WH&Bs herds grow at sustained high rates of 15-25% per year and are not a self-regulating species (NRC 2013). The NAS report (NRC 2013) concluded that the primary way that equid populations self-limit is through increased competition for forage at higher densities, which results in smaller quantities of forage available per animal, poorer body condition, and decreased natality and survival. It also concluded that the effect of this would be impacts to resource and herd health that are contrary to BLM management objectives and statutory and regulatory mandates. This alternative would result in a steady increase in the WH&Bs populations which would continue to exceed the carrying capacity of the range resulting in a catastrophic mortality of WH&Bs in the Complex, and irreparable damage to rangeland resources.

While some members of the public have advocated "letting nature take its course", allowing WH&Bs to die of dehydration and starvation would be inhumane treatment and would be contrary to the WFRHBA, which mandates removal of excess WH&Bs. The damage to rangeland resources that results from excess numbers of WH&Bs is also contrary to the WFRHBA, which mandates the Bureau to "*protect the range from the deterioration associated with overpopulation*", "*remove excess animals from the range so as to achieve appropriate management levels*", and "*to preserve and maintain a thriving natural ecological balance and multiple-use relationship in that area*".

The BLM's regulations at 43 CFR § 4700.0-6 (a) state, "Wild horses and burros shall be managed as self-sustaining populations of healthy animals in balance with other uses and the productive capacity of their habitat." As the vegetative and water resources are over utilized and degraded to the point of no recovery as a result of the wild horse overpopulation, wild horses would start showing signs of malnutrition and starvation. The weaker animals, generally the older animals, and the mares and foals, would be the first to be impacted. It is likely that a majority of these animals would die from starvation and dehydration which could lead to a catastrophic die off. The resultant population could be heavily skewed towards the stronger stallions which could contribute to social disruption in the Complex. Competition between wildlife and WH&Bs for forage and water resources would be severe. WH&Bs can be aggressive around water sources (see Appendix XII), and some wildlife may not be able to compete, which could lead to the death of individual animals. Wildlife habitat conditions would deteriorate as WH&B numbers above AML reduce herbaceous vegetative cover, damage springs and increase erosion, and could result in irreversible damage to the range. This degree of resource impact would likely lead to management of WH&Bs at a greatly reduced level if BLM is able to manage for WH&Bs at all on the Complex in the future after a catastrophic die off and irreversible habitat damage. For these reasons, this alternative was eliminated from further consideration. This alternative would not meet the Purpose and Need for this EA which it is to remove excess WH&Bs from within and outside the Complex and to reduce the WH&B population growth rates to manage WH&Bs within established AML ranges.

2.8.9. Gathering the Complex to Upper Range of AML

Under this Alternative, a gather would be conducted to gather and remove enough WH&Bs to achieve the upper range of the AML (currently 553 wild horses and 90 burros in the Blue Wing Complex). A post-gather population size at the upper range of the AML would result in AML being exceeded following the next foaling season. This would be unacceptable for several reasons. The AML represents "that 'optimum number' of wild horses which results in a thriving natural ecological balance and avoids a deterioration of the range." *Animal Protection Institute*, 109 IBLA 112, 119 (1989). The Interior Board of Land Appeals has also held that "Proper range management dictates removal of WH&Bs before the herd size causes damage to the rangeland. Thus, the optimum number of horses is somewhere below the number that would cause resource damage" *Animal Protection Institute*, 118 IBLA 63, 75 (1991).

The upper level of the AML established for the Blue Wing Complex represents the maximum population for which thriving natural ecological balance would be maintained. The lower level represents the number of animals that should remain in the complex immediately following a WH&B gather that brings the population back to AML in order to allow for a periodic gather cycle and to prevent the population from exceeding the established AML between gathers.

Additionally, gathering only to the upper range of AML, would result in the need to follow up with another gather by the next year and could result in continued overutilization of vegetation resources and damage to important wildlife habitats. Frequent gathers could increase the stress to WH&Bs, as individuals and as entire herds. Moreover, this alternative would not meet the Purpose and Need for this EA. For these reasons, this alternative was eliminated from further consideration.

3.0 AFFECTED ENVIRONMENT

3.1 Identification of Issues:

In addition to the public scoping that was conducted in May of 2024 (see section 1.5), internal scoping was conducted by an interdisciplinary (ID) team in March 2025, that analyzed the potential consequences of the Proposed Action and alternatives. Potential impacts to the following resources/concerns were evaluated in accordance with NEPA to determine if detailed analysis was required. Consideration of some of these items is to ensure compliance with laws, statutes or Executive Orders that impose certain requirements upon all Federal actions. Other items are relevant to the management of public lands in general, and to the Winnemucca District BLM in particular.

Table 4. summarizes which of the supplemental authorities of the human environment and other resources of concern within the Complex and gather area are present, not present, or not affected by the Proposed Action.

Table 4. Summary of Supplemental Authorities and Other Elements of the Human Environment

Resource/Concern	Issue(s) Analyzed? (Y/N)	Rationale for Dismissal from Detailed Analysis or Issue(s) Requiring Detailed Analysis
Air Quality	N	The air quality status for the project analysis area in Pershing, Churchill, Humboldt, and Washoe Counties is termed "unclassifiable" by the State of Nevada. No data is collected in these areas due to the expectation that annual particulate matter would not exceed national standards. The proposed action or alternatives would not affect air quality in Pershing, Churchill, Humboldt, or Washoe Counties, as it is a temporary action.
Areas of Critical Environmental Concern (ACEC)	N	There are no ACECs within the Blue Wing Complex
Cultural Resources	Y	See Section 3.13 Cultural Resources
Forest Health	N	Not present
Migratory Birds	Y	See Section 3.6 General Wildlife, Big Game, Migratory Birds
Livestock Grazing	Y	See Section 3.8 Livestock Grazing
Native American Religious and other Concerns	Y	See Section 3.14 Native American Religious Concerns

Resource/Concern	Issue(s) Analyzed? (Y/N)	Rationale for Dismissal from Detailed Analysis or Issue(s) Requiring Detailed Analysis
Wastes, Hazardous or Solid	N	Not present
Water Quality, Drinking/Ground	Y	See Section 3.4 Riparian/Wetland Areas. Gather sites would not be located near surface water sources. Groundwater unaffected.
Socioeconomics	Y	See Section 3.17 Socioeconomics
Floodplains	N	A portion of the western border of the Trinity Herd Area is bounded by the Humboldt River. Proposed activities would not affect river. No perennial water bodies in the proposed area.
Farmlands, Prime and Unique	N	Soils with a prime farmland classification are present within the project area, but would not be affected.
Species Threatened, Endangered or Proposed for listing under the Endangered Species Act	N	In the species list provided by Reno Fish and Wildlife Service, using IPAC, there are five species that are currently on the T&E species list. Rationale for dismissal from detailed analysis for each species is provided in Appendix IX.
Wetlands/Riparian Zones	Y	See Section 3.4 Riparian/Wetland Areas
Non-native Invasive and Noxious Species	Y	See Section 3.10 Noxious Weeds and Invasive Non-Native Species
Wilderness/WSA	Y	See Section 3.9 Wilderness Study Areas and Lands with Wilderness Characteristics. Wilderness Areas are not present.
Fire / Fuels	Y	See Section 3.18 Fire/Fuels
Lands with Wilderness Characteristics	Y	See Section 3.9 Wilderness Study Areas and Lands with Wilderness Characteristics
Recreation	Y	See Section 3.16 Recreation
Visual Resource Management	N	VRM Class Objectives I-IV exist within the gather area boundary. However, only the proposed spring development would result in permanent disturbance and structures. This would occur within classes II and III, but is not expected to have impacts due to the topography of the surrounding area and existing features already within the area of the proposed spring development (see Appendix XIV).
Human Health and Safety	Y	See Section 3.15 Public Health and Safety
Wild and Scenic Rivers	N	Not present
Special Status Species	Y	See Section 3.7 Special Status Plant and Animal Species
General Wildlife	Y	See Section 3.6 General Wildlife, Big Game, Migratory Birds
Fish	N	Present but not affected
Paleontology	N	There have been about 100 fossil finds within the project area. However, these finds are limited to mountainous areas and therefore would not be affected.
Wild Horses & Burros	Y	See Section 3.3 Wild Horses & Burros
Soils Resources	Y	See Section 3.12 Soils
Water Resources (Water Rights)	Y	See Section 3.5 for Water Quality (Surface and Ground). The proposed Action would not affect water rights, permitted or pending water uses.
Mineral Resources	N	There would be no modifications to mineral resources through the Proposed Action.

Resource/Concern	Issue(s) Analyzed? (Y/N)	Rationale for Dismissal from Detailed Analysis or Issue(s) Requiring Detailed Analysis
Vegetation Resources	Y	See Section 3.11 Vegetation

3.2 General Setting
The Blue Wing Complex is located in the Great Basin within the Basin and Range Physiographic Province, a region characterized by a series of generally north-trending mountain ranges separated by alluvial valleys. Valley bottoms within the Complex range from about 3450 to 4500 feet in elevation and mountain ranges have elevations from 5000 to over 8200 feet above mean sea level. In general, these ranges are composed of a complex assortment of sedimentary, metamorphic, and igneous rocks that range in age from Mesozoic to the present. Basins between the ranges are filled with sediments shed from surrounding mountain ranges and minor volcanic and ash flows. Vegetative types found within the Blue Wing Complex include juniper-sage types in the higher elevations, to sagebrush-grass types at moderate elevations, to shadscale-shrub and greasewood types in the valley bottoms. Average annual precipitation ranges from 7.77 inches to 4.87 inches in the valleys. Snowfall in the valleys ranges from 11.5 inches to 1.9 inches. Most of this precipitation comes during the winter and spring months in the form of snow, supplemented by localized thunderstorms during the summer months. Temperatures range from greater than 90 degrees Fahrenheit in the summer months to less than 20 degrees in the winter. The area is also utilized by domestic livestock and numerous wildlife species.

3.3 Wild Horses & Burros

Affected Environment
The Blue Wing Complex encompasses five Herd Management Areas (HMAs), five Herd Areas (HAs), and non-HMA areas where WH&Bs migrate back and forth. Refer to Map 1, Appendix I which displays the HMAs included within the Complex.

In July 2024, a WH&B gather was conducted throughout the Blue Wing Complex. During the gather 1,305 excess wild horses and 360 excess burros were captured. Three stallions were released back into the Blue Wing Complex, as well as 16 mares treated with GonaCon-Equine.

<u>Blue Wing Mountains HMA</u>
The HMAs and HAs in the Blue Wing Complex were established in 1971, but the BLM determined that it would manage them as a Complex in 1986. Since then, the BLM has managed WH&Bs in the Complex in accordance with the 1994 Final Multiple Use Decision, the 1999 Management Agreement, gather and population management plans, and the 2015 Winnemucca RMP. The HMA is nearly identical in size and shape to the original Herd Areas representing where wild horses were located in 1971. Currently, management of HMAs and WH&B populations within the Winnemucca District is guided by the 2015 Winnemucca District RMP. The current AML range for the Blue Wing Mountain HMA is 22-36 wild horses and 17-28 burros. The current estimated population is 10 horses and 28 burros.

Water available for use by WH&Bs within the Blue Wing HMA is limited to Tammi Spring- the only permanent water source in the HMA. Occasionally in heavy moisture years water would pool along the playa on the north end of the HMA that burros would sometimes utilize. If water is insufficient at this water source, WH&Bs must travel to other HMAs to find water. As water supplies become depleted at smaller sources, WH&Bs tend to concentrate around larger primary water sources causing negative effects to riparian resources. The negative effects of this have been observed especially near Porter Spring in the Seven Troughs HMA, evidenced by heavy trailing, soil compaction, and erosion. These water sources are monitored throughout the summer to make sure water is available for WH&Bs.

BLM recognizes that when WH&B density is low relative to available resources, WH&Bs can have some positive ecological effects, but these positive effects do not outweigh degradation that can result when WH&B numbers and impacts are high relative to available natural resources (See Appendix XII). Rangeland resources have been and are currently being impacted within the Blue Wing HMA due to the over-population of WH&Bs.

Use pattern mapping was conducted for the Blue Wing HMA in March 2025. The key forage species monitored at that time include: Squirreltail grass (*Elymus elymoides*), globemallow (*Sphaeralcea*), Bud sagebrush (*Picrothamnus desertorum*), and Shadscale (*Atriplex confertifolia*). Use pattern mapping shows WH&B utilization as 67% slight (1-20%) and 33% moderate (41-60%). During use pattern mapping, several survey points were noted to be lost to invasives (primarily cheatgrass), where perennial forage species were no longer present or too few to measure.

Kamma Mountains HMA

The Kamma Mountains HMA was designated for the long-term management of wild horses through the same processes as described for the Blue Wing HMA. The Kamma Mountains HMA boundary was adjusted to an existing fence line in the 2015 Winnemucca RMP; this fence line runs along the outer boundary of the HMA and does not restrict the movement of WH&Bs within the complex. The AML range for the Kamma Mountains HMA is 46-77 wild horses and 0 burros. The current estimated population is 77 wild horses.

The primary water source utilized by wild horses within the Kamma Mountains HMA is Rabbit Hole spring. Rabbit Hole springs is outside of the HMA to the south and is regularly utilized by horses. Etchart spring occasionally has water but is located on private land and could be fenced at any time and therefore become unavailable for use. These water sources are monitored throughout the summer to make sure water is available.

Use pattern mapping for the Kamma Mountains HMA was conducted in April 2025. The key forage species monitored at the time included: Squirreltail grass (*Elymus elymoides*), winterfat (*Krascheninnikovia lanata*), Bud sagebrush (*Picrothamnus desertorum*), and Shadscale (*Atriplex confertifolia*). Use pattern mapping showed WH&B utilization as 25% moderate (41-60%) and 75% of the points as heavy (61-80%); one of the sites measured was lost to invasives (mainly cheatgrass) where no forage species were present.

Seven Troughs Range HMA

The Seven Troughs Range HMA was designated for the long-term management of WH&Bs through the same processes described for the Blue Wing HMA. The boundary on the Seven Troughs Range HMA was adjusted on the east side to an existing fence through the 2015 Winnemucca RMP to remove checkerboard lands from the HMA. This fence runs along the eastern boundary of the HMA and does not restrict movement of WH&Bs within the complex. The AML range for the Seven Troughs Range HMA is 94-156 wild horses and 28-46 burros. The current estimated population is 161 horses and 46 burros.

The primary water sources utilized by WH&Bs in the Seven Troughs HMA are Cow Creek, Porter Spring, and Vernon well. Alson Spring on the north end of the HMA occasionally has available water and experiences some use. Burros would utilize waters in Wildcat Canyon as well, although use tends to vary seasonally. These water sources are monitored throughout the summer to make sure water is available. Unnamed Spring 78-40 is located within the Seven Troughs HMA; Developing this spring would serve to better distribute WH&B use in the Blue Wing Complex, reduce excessive wild horse and burro use of Porter Spring, and provide additional year-round water within the complex, which would be particularly beneficial to WH&Bs during the winter months. Porter Spring and Unnamed Spring 78-40 are the only water sources in the Complex that BLM currently has water rights to.

Utilization data was collected for the Seven Troughs Range HMA in October/November 2024. The key forage species monitored at that time include: Sandberg bluegrass (*Poa secunda*), Thurbers needlegrass (*Achnatherum thurberianum*), crested wheatgrass (*Agropyron cristatum)* and Squirreltail grass (*Elymus elymoides*). Current monitoring data collected using the Range Utilization Key Species Method over the last five years has indicated slight (1-20%), light (21-40%), moderate (41-60%) and heavy (61-80%) utilization. Use pattern mapping in February/March 2025 shows WH&B utilization as 40% slight (1-20%), 50% light (21-40%), and 10% moderate (41-60%). During use pattern mapping, many survey points were notably dominated by invasives (primarily cheatgrass).

Lava Beds HMA

The Lava Beds HMA was designated for the long-term management of WH&Bs through the same processes described for the Blue Wing HMA. The Lava Beds HMA boundary was adjusted to an existing fence line to serve as a physical boundary through the 2015 Winnemucca RMP- this fence runs along the northern boundary and does not restrict movement of WH&Bs within the complex. The AML range for the Lava Beds HMA is 89-148 wild horses and 10-16 burros. The current estimated population is 179 horses and 42 burros.

The primary water sources within the Lava Beds HMA that are utilized by WH&Bs are: Trego Hot Spring, Garrett Spring, and Maud Well across the northern portion of the HMA; Five Troughs and Sheephead Spring along the eastern edge of the HMA; and Twin Buttes in the southwest portion of the HMA. Garrett Spring has available water year-round, while the others can be intermittent. Sheep Troughs is primarily utilized by wild horses, while Twin Buttes is primarily used by burros. Burros consistently go between Twin Buttes Well and Porter Spring (in the Seven Troughs HMA), evidenced by heavy trailing. Maud Well experiences consistently heavy use in the northeast part of the Lava Beds HMA. The BLM does not have water rights to any of these water sources. As water supplies become depleted at other smaller water sources, WH&Bs tend to concentrate around these primary water sources causing negative effects to riparian resources. These water sources are monitored throughout the summer to make sure water is available for WH&Bs.

Utilization data was collected for the Lava Beds HMA in October/November 2024. The key forage species monitored at that time include: Sandberg bluegrass (*Poa secunda*), Thurbers needlegrass (*Achnatherum thurberianum*), Squirreltail grass (*Elymus elymoides*), and Indian ricegrass (*Achnatherum hymenoides*). While Indian ricegrass was monitored, not enough plants were found on the transect at the time to provide a statistically valid measurement of the species; lack of measurable key perennial grass species has been noted at several sites throughout the Shawave HMA over the last five years. Current monitoring data collected using Range Utilization Key Forage Plant Method over the last five years has indicated slight (1-20%), light (21-40%), moderate (41-60%) and heavy (61-80%) utilization. Use pattern mapping in March and April 2025 shows WH&B utilization as 16% slight (1-20%), 16% light (21-40%), 37% moderate (41-60%), and 26% heavy (61-80%). During use pattern mapping, many survey points were notably dominated by invasives (primarily cheatgrass).

Shawave Mountains HMA

The Shawave Mountains and Nightingale HMAs were designated for the long-term management of wild horses through the same processes described for the Blue Wing HMA. Though originally two separate HMAs, the Shawave Mountains and Nightingale HMAs were later combined in the 2015 Winnemucca RMP due to the interchange between the two HMAs. The 2015 Winnemucca RMP also adjusted the southern boundary of the Shawave Mountains HMA (combined) to remove checkerboard lands from the south end of the HMA. Some fences exist on the northern boundary of the HMA; however, gates are consistently left open, and some sections of fence are in disrepair and does not restrict movement of

WH&Bs within the complex. Currently, management of HMAs and wild horse populations within the Winnemucca District is guided by the Winnemucca District RMP. The AML range for the Shawave Mountains HMA is 82-136 wild horses. The current estimated population is 150 wild horses.

Water available for use by wild horses within the Shawave Mountains HMA is limited and is mainly located in the northern half of the HMA. Wild horses primarily use Tunnel Spring, Stonehouse Spring, Juniper Spring, and Cottonwood Spring. Of these water sources, Tunnel Spring experiences the most use. Granite Spring and Sage Hen Spring (both on the southern boundary of the HMA) provide some water but are both located on private lands and could become no longer available for use should landowners decide to fence their properties. These water sources are monitored throughout the summer to make sure water is available for wild horses.

Utilization data was collected for the Shawave Mountains HMA in October/November 2024. The key forage species monitored at that time include: Indian ricegrass (*Achnatherum hymenoides*), Sandberg bluegrass (*Poa secunda*), winterfat (*Krascheninnikovia lanata*), and Squirreltail grass (*Elymus elymoides*). Current monitoring data collected using Range Utilization Key Forage Plant and Landscape Appearance Methods over the last five years has indicated slight (1-20%), moderate (41-60%) and heavy (61-80%) utilization, with only one point showing less than 1% utilization over the last 5 years. While Indian ricegrass was monitored, not enough plants were found on the transect at the time to provide a statistically valid measurement of the species; lack of measurable key perennial grass species has been noted at several sites throughout the Shawave Mountains HMA over the last five years.

Blue Wing Complex

In July 2024, a WH&B gather was conducted throughout the Blue Wing Complex. During the gather 1,305 excess wild horses and 360 excess burros were captured. Three stallions were released back into the Blue Wing Complex, as well as 16 mares treated with GonaCon-Equine vaccine.

Population inventory flights have been conducted in the Complex every two to three years. These population inventory flights have provided information pertaining to population numbers, foaling rates, distribution, and herd health. A population inventory was conducted March of 2023 utilizing a direct count method and 1,497 wild horses and 355 burros were observed throughout the project area. The BLM conducted a population inventory flight in April 2025; statistical analysis of the 2025 flight data is still pending.

Wild horse body condition scores (BCS) within the Complex currently range from a score of 2-5 (Very thin/emaciated – Moderate) based on the Henneke Body Condition Chart and some animals at time of gather may have a lower BCS of 2-3 (Very thin – Thin). Genetic baseline data would be collected to monitor the genetic diversity of the WH&Bs within the project area. Samples may also be taken for ancestral analysis.

Monitoring data has identified WH&Bs as a contributing factor to decreasing rangeland health. The standards for rangeland health and most recent Land Health Assessment are summarized in Appendix VII. These standard determination documents, evaluations, and write-ups are available at the Humboldt River Field Office.

Population Modeling

Population modeling was completed for the proposed action and alternatives to analyze how the alternatives would affect the wild horse populations. The *PopEquus* (1.0.2) software currently does not have parameters for modeling wild burro populations, so simulations were run only for the wild horse population using the 2025 population estimate. Analysis included removal of excess wild horses with no fertility control, as compared to alternatives which consider removal of excess wild horses with fertility control and sex ratio adjustments. The No Action (no removal) Alternative was also modeled (Appendix VI). The primary objective of the modeling was to identify if any of the alternatives “crash” the population or cause extremely low population numbers or growth rates. The results of population modeling show that minimum population levels and growth rates would be within reasonable levels and adverse impacts to the population would not be likely under Alternatives A, B, and C. Graphic and tabular results are displayed in detail in Appendix VI.

Genetic Diversity

Genetic diversity monitoring has been conducted on WH&Bs in the Complex following previous gathers. Most recently, blood samples from three HMAs in the Complex were analyzed (Cothran 2008). Analysis included in the 2008 report found that observed heterozygosity for those three herds was 0.320, which is below the feral mean for blood-based genetic markers, but above the low threshold level that would signal cause for very high concern (BLM 2010). In contrast, microsatellite DNA-marker based analysis of genetic samples from Shawave Mountains HMA in 2003 (reported in NAS 2013) led to an observed heterozygosity estimate of 0.783, which is more than one standard error higher than the mean for DNA-based markers among feral horse herds (0.716). Cothran (2008) noted that the herd appeared to be of mixed origins, possibly with some Arabian type blood but most likely mainly of North American stock. He stated, “…there were no specific markers for Arabian type horses. Arab breeds tend to have low variability and the low variation of the complex may be the cause of this result” (Cothran 2008). Under an assumption that the individual sampled herds would be held at population sizes equal to AML, Cothran suggested that genetic diversity levels in those herds could decline rapidly, and suggested that the BLM consider adding horses from Shawave Mountains HMA or elsewhere. However, wild horse herd sizes in the Blue Wing complex have been substantially larger than AML for many years since 2004-2005, and it is expected that large herd sizes probably foster genetic admixture across the complex.

Under all action alternatives, WH&B introductions from other HMAs could be used if needed to augment observed heterozygosity, which is a measure of genetic diversity, the result of which would be to reduce the risk of inbreeding-related health effects. Introducing a small number of fertile animals every generation (about every 8-10 years) is a standard management technique that can alleviate potential inbreeding concerns (BLM 2010).

Since the Complex was established, the WH&Bs population has ranged from a low population of 478 total animals to a high of 4,633 as a high, to the current estimated population (as of March 1, 2025) of 609 wild horses and 116 burros or 725 total animals. There are fences that run along the outside borders of the Complex. There is one fence that runs along the western edge of the Selenite HA; the north end of this fence is in disrepair, and the southern portions of this fence experience a lot of UTV traffic and gates are often left open from recreators in the area, allowing WH&Bs to still enter/exit the HA.

Because of history, context, and periodic introductions, WH&Bs that live in the Blue Wing Complex should not be considered as truly isolated populations (NRC 2013). Rather, managed herds of WH&Bs should be considered as components of interacting metapopulations, connected by interchange of individuals and genes due to both natural and human-facilitated movements. These animals are part of a larger metapopulation (NRC 2013) that has demographic and genetic connections with other BLM-managed herds in Nevada, Utah, and beyond. This conclusion is also supported by multiple analyses in Cothran et al. (2024), which showed high levels of relatedness and interchange based on samples taken from Shawave Mountains HMA. WH&B herds in the larger metapopulation have a background of diverse domestic breed heritage, probably caused by natural and intentional movements of animals between herds. Under the proposed action, hair follicle samples would be collected during gathers, from at least 25 animals per species gathered, to assess the levels of genetic diversity of the herds in the complex. Analysis would determine whether management is maintaining acceptable genetic diversity (and avoiding excessive risk of inbreeding depression).

The 2013 National Academies of Sciences report included other evidence that shows that wild horses in the Shawave Mountains HMA (before it was combined with the Nightengale Mountains HMA) and in herds very close to the Complex are not genetically unusual, with respect to other wild horse herds. Specifically, Appendix F of the 2013 NRC report is a table showing the estimated 'fixation index' (Fst) values between 183 pairs of samples from wild horse herds. Fst is a measure of genetic differentiation, in this case as estimated by the pattern of microsatellite allelic diversity analyzed by Dr. Cothran's laboratory. Low values of Fst indicate that a given pair of sampled herds has a shared genetic background. The lower the Fst value, the more genetically similar are the two sampled herds. Values of Fst under approximately 0.05 indicate virtually no differentiation. Values of 0.10 indicate very little differentiation. Only if values are above about 0.15 are any two sampled subpopulations considered to have evidence of elevated differentiation (Frankham et al. 2010). Pairwise Fst values for Shawave Mountains samples were less than 0.05 with 121 other sample sets. These results, along with new analyses in Cothran et al. (2024), suggest that wild horse herds in and near the Blue Wing Complex were extremely similar to one-third to two-thirds of other BLM-managed herds, supporting the interpretation that Blue Wing Complex wild horses are components in a highly connected metapopulation that includes horse herds in many other HMAs. Pairwise Fst values for Blue Wing HMA wild burros indicated a higher level of differentiation than for horses in the complex; they had very little differentiation with three of 24 other sampled wild burro herds (NAS 2013). Overall, these results, along with new analyses in Cothran et al. (2024), support the interpretation that Blue Wing Complex WH&Bs are components in a highly connected metapopulation that includes horse and burro herds in many other HMAs. See Appendix XIII (proposed HMAP) for future management, monitoring, and implementation objectives associated with genetic diversity of WH&Bs in the Blue Wing Complex.

Environmental Effects

No Action Alternative- Under the No Action Alternative, no population growth suppression action or WH&B removals (gathers) would take place. The population of the WH&Bs within the Blue Wing Complex would continue to grow at the national average rate of increase seen in the majority of HMAs of 15 to 25% per year.

The WH&B population levels would not achieve AML or a TNEB, and excess concentrations of WH&Bs would continue to impact site specific areas throughout the Complex at this time. The animals would not be subject to the individual direct or indirect impacts as a result of a trapping operation. Over the short-term, individual animals in the herd would be subject to increased stress and possible death as a result of increased competition for water and/or forage as the population continues to grow even further in excess of the land's capacity to meet the WH&Bs' habitat needs. The areas currently experiencing heavy to severe utilization by WH&Bs would increase over time and degradation could become irreversible in areas where ecological thresholds are passed.

This alternative would be expected to result in increasing damage to rangeland resources throughout the Complex. Trampling and trailing damage by WH&Bs in/around riparian and impacts to rangeland resources would also be expected to increase, resulting in larger, more extensive areas of poor range condition, some of which might be unable to recover even after removal of excess WH&Bs. Competition for the available water and forage among WH&Bs, domestic livestock, and native wildlife would continue and further increase.

WH&Bs are long-lived species with survival rates estimated between 80 and 97% and may be the determinant of WH&B population increases (Garrott and Taylor 1990, Ransom et al. 2016). Predation and disease have not substantially regulated WH&B population levels within or outside the project area. Throughout the HMAs few predators exist to control WH&B populations. Some mountain lion predation may occur but does not appear to be substantial, as evidenced by the continued high growth rates in the herds. Coyotes are not prone to prey on WH&Bs unless the WH&Bs are young, or extremely weak. Other predators such as wolf or bear do not inhabit the area in high enough numbers to cause an effect on WH&B growth rates. Being a non-self-regulating species (NRC 2013), there would be a steady increase in WH&B numbers for the foreseeable future, which would continue to exceed the carrying capacity of the range. Individual WH&Bs would be at risk of death by starvation and lack of water as the population continues to grow annually. The WH&Bs would compete for the available water and forage resources, affecting mares and foals most severely. Social stress would increase. Fighting among stallions would increase as well as injuries and death to all age classes of animals as the stallions protect their position at scarce water sources. Significant loss of the WH&Bs in the Complex due to starvation or lack of water would have obvious consequences to the long-term viability of the herd. Allowing WH&Bs to die of dehydration and starvation would be inhumane treatment and would be contrary to the WFRHBA, which mandates removal of excess WH&Bs.

The damage to rangeland resources that results from excess numbers of WH&Bs is also contrary to the WFRHBA, which mandates the Bureau to "protect the range from the deterioration associated with overpopulation", "remove excess animals from the range so as to achieve appropriate management levels", and "to preserve and maintain a thriving natural ecological balance and multiple-use relationship in that area.". Once the vegetative and water resources are at critically low levels due to excessive utilization by an overpopulation of WH&Bs, the weaker animals, generally the older animals and the mares and foals, are the first to be impacted. It is likely that a majority of these animals would die from starvation and dehydration. The resultant population would be extremely skewed towards the stronger stallions which would lead to significant social disruption in the Complex. By managing the public lands in this way, the vegetative and water resources would be impacted first and to the point that they have limited potential for recovery, as is already occurring in some areas hardest hit by the excess WH&Bs. As a result, the No Action Alternative, by delaying the removal of excess WH&Bs from specific areas that are most impacted at this time, would not ensure healthy rangelands that would allow for the management of a healthy WH&B population, and would not promote a TNEB.

As populations increase beyond the capacity of the habitat, more bands of WH&Bs would also leave the boundaries of the Complex in search of forage and water, thereby increasing impacts to rangeland resources outside the HMA boundaries as well. This alternative would result in increasing numbers of WH&Bs in areas not designated for their use and would not achieve and TNEB

Proposed Action- The Proposed Action would decrease the existing overpopulation of WH&Bs in the course of successive helicopter drive trap and bait and water trapping operations over a period of ten years. Stallions would be selected for release with the objective of establishing a 60% male ratio out of the low-range AML herd size on the range. Some gelded horses that would otherwise be excess animals permanently removed from the range and sent to ORC for adoption/sales or ORP may be returned to the range and managed as a nonbreeding population of geldings so long as the geldings do not result in the population exceeding mid-range AML. Any mares that would be returned to the range would be treated with fertility control (PZP vaccines, GonaCon-Equine vaccine, or minimally invasive sterilization). The target population when the objectives of this alternative are reached is to manage a total population at approximately mid-range AML, or roughly 500 WH&Bs. The Proposed Action would not reduce all of the associated impacts to the WH&Bs and rangeland resources as quickly as the other alternatives because the herd would be maintained near mid-AML as opposed to low AML. Over the short-term, individuals in the herd would still be subject to increased stress and possible death as a result of continued competition for water and forage until the project area's population can be reduced to the AML range. The areas experiencing heavy and severe utilization levels by WH&Bs would likely still be subject to some excessive use and impacts to rangeland resources, those being concentrated trailing, riparian trampling, increased bare ground, etc. These impacts would be expected to continue until the project area's population can be reduced to the AML range and concentration of WH&Bs can be reduced.

Removal of excess WH&Bs would improve herd health. Decreased competition for forage and water resources would reduce stress and promote healthier animals. This removal of excess animals coupled with anticipated reduced reproduction (population growth rate) as a result of fertility control should result in improved health and condition of mares and foals as the actual population comes into line with the population level that can be sustained with available forage and water resources, and would allow for healthy range conditions (and healthy animals) over the longer-term. Additionally, reduced population growth rates would be expected to extend the time interval between large gathers and reduce disturbance to individual animals as well as to the herd social structure over the foreseeable future.

Bringing the WH&Bs population size back to low AML (which could increase to mid-range AML with the addition of some geldings) and slowing its growth rate once that level has been achieved would reduce damage to the range from the current overpopulation of WH&Bs and allow vegetation resources to start recovering, without the need for additional gathers in the interim. As a result, there would be fewer disturbances to individual animals and the herd, and a more stable WH&Bs social structure would be provided. Managing a self-sustaining population that includes some component of geldings would also allow BLM to manage the WH&Bs population at the mid-range of AML once the low AML has been achieved, without adversely impacting rangeland resources as a result of a more rapid population growth in excess of AML.

Impacts to individual animals may occur as a result of handling stress associated with the gathering, processing, and transportation of animals (for more detailed review see Appendix XII). The intensity of these impacts varies by individual animal and is indicated by behaviors ranging from nervous agitation to physical distress. Mortality to individual animals from these impacts is infrequent but does occur in 0.5% to 1% of wild horses gathered in a given gather (Scasta 2020). Other impacts to individual WH&Bs include separation of members of individual bands of WH&Bs and removal of animals from the population. Impacts associated with the capture and removal of excess WH&Bs include gather-related mortality, which averages approximately 1% of the captured animals but could be higher based on the circumstances of individual gathers (Scasta, 2020). Mortality averages about 5% per year associated with transportation, ORCs, adoption or sale with limitations and about 8% per year associated with ORPs. The mortality rates at short-term and long-term holding facilities are comparable to the natural annual mortality rate on the range of about 16% per year for foals (animals under age 1), about 5-10% per year for horses ages 1-10 years, and about 10-25% for animals aged 10-20 years (Ransom et al. 2016). Mortality may also be caused by hyperlipidemia (also called hyperlipemia). In horses and burros, hyperlipidemia is caused by a negative energy balance exacerbated by stress (stress hormones such as adrenaline and cortisol), pregnancy, lactation etc. When this occurs, animals may either deplete their glycogen stores and switch to using fatty acids from fat as energy or become less sensitive to insulin which causes the same switch to mobilizing fat into the bloodstream. Paradoxically, obesity as well as starvation can predispose animals to the disease. The inability to obtain and process energy from the new feed ration provided in corrals may also be caused by the stressful conditions of the gather, changing social structures, behavioral responses and adaptation to the new environment. These factors on top of the increased energy demands of pregnancy, lactation, roundup, shipping etc. are what trigger the disease.

In situations where forage and/or water are limited, mortality rates in the wild increase, with the greatest impact to young foals, nursing mares and older horses. Animals can experience lameness associated with trailing to/from water and forage, foals may be orphaned (left behind) if they cannot keep up with their mare, or animals may become too weak to travel. After suffering, often for an extended period, the animals may die. Before these conditions arise, the BLM generally removes the excess animals to prevent their suffering from dehydration or starvation.

Indirect impacts can occur after the initial stress event, and may include increased social displacement or increased conflict between stallions. These impacts are known to occur intermittently during WH&Bs gather operations. Traumatic injuries may occur; however, typical injuries involve bruises from biting and/or kicking, which do not break the skin.

Stallions selected for release would be released to increase the post-gather sex ratio to approximately 60% stallions, out of the low AML overall herd size. Stallions would be selected to maintain a diverse age structure, herd characteristics and body type (conformation). It is expected that releasing additional stallions to reach the targeted sex ratio of 60% males would result in smaller band sizes, larger bachelor groups, and some increased competition for mares (see Appendix XII). With more stallions involved in breeding it should result in a slightly higher genetic effective population size (Ne) relative to total herd size.

Fertility Control
BLMs Use of Contraception in Wild Horse Management
Expanding the use of population growth suppression to slow population growth rates and reduce the number of animals removed from the range and sent to Off-Range Pastures (ORPs) is a BLM priority. The WFRHBA of 1971 specifically provides for contraception and sterilization (section 3.b.1) as viable management approaches. No finding of excess animals is required for BLM to pursue contraception in WH&BSs. Contraception has been shown to be a cost effective and humane treatment to slow increases in WH&B populations or, when used with other techniques, to reduce WH&B population size (Bartholow 2004, de Seve and Boyles-Griffin 2013). All fertility control methods in wild animals are associated with potential risks and benefits, including effects of handling, frequency of handling, physiological effects, behavioral effects, and reduced population growth rates (Hampton et al. 2015). Contraception by itself does not remove excess WH&Bs from an HMA's population, so if a WH&Bs population is in excess of AML, then contraception alone would result in some continuing environmental effects of WH&B overpopulation (Appendix VI). Successful contraception reduces future reproduction. Limiting future population increases of WH&Bs could limit increases in environmental damage from higher densities of WH&Bs than currently exist. WH&Bs are long-lived, potentially reaching 20 years of age or more in the wild and, if the population is above AML, treated WH&Bs returned to the HMA may continue exerting negative environmental effects, as described in the PZP Direct Effects and GnRH Direct effects sections in Appendix XII, throughout their life span. In contrast, if WH&Bs above AML are removed when WH&Bs are gathered, that leads to an immediate decrease in the severity of ongoing detrimental environmental effects throughout their lifespan, as described above. See Appendix XII for a more detailed analysis on fertility control effects.

Mare Sterilization
Sterilizing mares has already been shown to be an effective part of feral horse management that reduced herd growth rates on federal lands (Collins and Kasbohm 2016). Herd-level birth rate is expected to decline in direct proportion to the fraction of sterile mares in the herd. A more detailed literature review of the effects of mare sterilization can be found in Appendix XII; only minimally-invasive mare sterilization methods are considered under any action alternatives here.

Gelding
Permanent sterilization techniques, while not reversible, may provide reproductive control on horses without the need for any additional handling of the horses as required in the administration of chemical contraception techniques. Castration (the surgical removal of the testicles, also called gelding or neutering) is a well-established surgical procedure for the sterilization of domestic and wild horses. See Appendix XII for a more detailed analysis on gelding effects. The procedure rarely leads to serious complications and seldom requires postoperative veterinary care. Gelding adult male horses results in reduced production of testosterone which directly influences reproductive behaviors. Although 20-30% of

domestic horses, whether castrated pre- or post-puberty, continued to show stallion-like behavior (Line et al. 1985), it is assumed that free roaming wild horse geldings would exhibit reduced aggression toward other horses and reduced reproductive behaviors. Gelding of domestic horses most commonly takes place before or shortly after sexual maturity, and age-at-gelding can affect the degree to which stallion-like behavior is expressed later in life.

Though castration (gelding) is a common surgical procedure, minor complications are not uncommon after surgery, and it is not always possible to predict when postoperative complications would occur. The most common complications are almost always self-limiting, resolving with time and exercise. Individual impacts to the stallions during and following the gelding process should be minimal and would mostly involve localized swelling and bleeding. A small amount of bleeding is normal and generally subsides quickly, within 2-4 hours following the procedure. Some localized swelling of the prepuce and scrotal area is normal and may begin between one to 5 days after the procedure. Swelling should be minimized through the daily movements (exercise) of the horse during travel to and from foraging and watering areas. Most cases of minor swelling should be back to normal within 5-7 days, more serious cases of moderate to severe swelling are also self-limiting and resolve with exercise after one to 2 weeks. Serious complications (eviscerations, anesthetic reaction, injuries during handling, etc.) that result in euthanasia or mortality during and following surgery are rare and vary according to the population of horses being treated. Normally one would expect serious complications in less than 5% of horses operated under general anesthesia, but in some populations these rates can be as high as 12% (Shoemaker 2004). These complications are generally noted within 3 or 4 hours of surgery but may occur any time within the first 7 days following surgery. If they occur, they would be treated in the same manner as at BLM facilities.

By including some geldings in the population and having a slightly skewed sex ratio with more males than females overall, the result would be that there would be a relatively lower number of breeding females in the population and, hence, a lower per-capita growth rate. The surgery would be performed by a veterinarian using general anesthesia and appropriate surgical techniques. The final determination of which specific animals would be gelded for release would be based on the professional opinion of the attending veterinarian in consultation with the Authorized Officer (see Gelding SOPs in Appendix III). When gelding procedures are done in the field, geldings would be released near a water source, when possible, approximately 24 to 48 hours following surgery. When the procedures are performed at a BLM-managed facility, selected stallions would be shipped to the facility, gelded, held in a separate pen to minimize risk for disease, and returned to the range within 30 days.

When and where they are visible, gelded animals could be monitored periodically for complications for approximately 7-10 days post-surgery and release. This monitoring would be completed either through aerial recon if available or field observations from major roads and trails. It is not anticipated that all the geldings would be observed but a goal would be to detect complications if they are occurring Research in a herd where some geldings were included along with fertile wild horses indicates that geldings will continue to move and use habitats similar to other wild horses, and that many may retain harems for several years after castration (King et al. 2022). Periodic observations of geldings could be recorded during routine resource monitoring work. Such observations could include but not be limited to band size, social interactions with other wild horses, distribution within their habitat, forage utilization and activities around key water sources. Periodic population inventories and future gather statistics may contribute to BLM's ongoing considerations about managing a portion of the herd as permanently non-reproducing animals is an effective approach to slowing the annual population growth rate and extending the gather cycle when used in conjunction with other population control techniques, while allowing more horses to remain on the range.

Helicopter Drive Trapping
The BLM has been conducting WH&B gathers since the mid-1970s and has been using helicopters for such gathers since the late 1970's. During this time, methods and procedures have been identified and refined to minimize stress and impacts to WH&Bs during gather implementation. Published reviews of agency practice during gathers and subsequent holding operations confirm that BLM follows guidelines to minimize those impacts and ensure humane animal care and high standards of welfare (GAO 2008, AAEP 2011, Greene et al. 2011, Scasta 2020). Refer to Appendix II, III, and IV for information on the methods that are utilized to reduce injury or stress to WH&Bs during gathers. The Comprehensive Animal Welfare Policy (CAWP) would be implemented to ensure a safe and humane gather occurs and would minimize potential stress and injury to WH&Bs.

In any given gather, gather-related mortality averages only about one half of one percent (0.5%), which is very low when handling wild animals. Approximately, another six-tenths of one percent (0.6%) of the captured animals, on average, are humanely euthanized due to pre-existing conditions and in accordance with BLM policy (GAO 2008, Scasta 2020). These data affirm that the use of helicopters and motorized vehicles has proven to be a safe, humane, effective, and practical means for the gather and removal of excess WH&Bs from the public lands. The BLM also avoids gathering WH&Bs by helicopter during the 6 weeks prior to and following the expected peak of the foaling season (i.e., from March 1 through June 30).

Individual, direct impacts to WH&Bs include the handling stress associated with the roundup, capture, sorting, handling, and transportation of the animals. The intensity of these impacts varies by individual, and is indicated by behaviors ranging from nervous agitation to physical distress. When being herded to trap site corrals by the helicopter, injuries sustained by WH&Bs may include bruises, scrapes, or cuts to feet, legs, face, or body from rocks, brush or tree limbs. Rarely, WH&Bs will encounter barbed wire fences and receive wire cuts. These injuries are very rarely fatal and are treated on-site until a veterinarian can examine the animal and determine if additional treatment is indicated.

Other injuries may occur after a horse has been captured and is either within the trap site corral, the temporary holding corral, during transport between facilities, or during sorting and handling. Occasionally, WH&Bs may sustain a spinal injury or a fractured limb but based on prior gather statistics, serious injuries requiring humane euthanasia occur in less than 1 horse per every 100 captured. Similar injuries could be sustained if WH&Bs were captured through bait and/or water trapping, as the animals still need to be sorted, aged, transported, and otherwise handled following their capture. These injuries can result from kicks and bites, or from collisions with corral panels or gates.

To minimize the potential for injuries from fighting, the animals are transported from the trap site to the temporary (or short-term) holding facility where they are sorted as quickly and safely as possible, then moved into large holding pens where they are provided with hay and water. Fatalities and injuries due to gathers are few, with direct gather related mortality averaging less than 1%. Most injuries are a result of the horse's or burro's temperament, meaning they do not remain calm and lash out more frequently.

Gathering WH&Bs during the summer months can potentially cause heat stress. Gathering WH&Bs during the fall/winter months reduces risk of heat stress, although this can occur during any gather, especially in older or weaker animals. Adherence to the SOPs and techniques used by the gather contractor or BLM staff would help minimize the risks of heat stress. Heat stress does not occur often, but if it does, death can result. Most temperature related issues during a gather can be mitigated by adjusting daily gather times to avoid the extreme hot or cold periods of the day. The BLM and the contractor would be pro-active in controlling dust in and around the holding facility and the gather corrals to limit the WH&Bs' exposure to dust.

Indirect individual impacts are those which occur to individual WH&Bs after the initial event. These may include miscarriages in mares, increased social displacement, and conflict in stallions. These impacts, like direct individual impacts, are known to occur intermittently during WH&B gather operations. An example of an indirect individual impact would be the brief 1-2 minute skirmish between older stallions which ends when one stallion retreats. Injuries typically involve a bite or kick with bruises which do not break the skin. Like direct individual impacts, the frequency of these impacts varies with the population and the individual. Observations following capture indicate the rate of miscarriage varies but can occur in about 1 to 5% of the captured mares, particularly if the mares are in very thin body condition or in poor health. A few foals may be orphaned during a gather. This can occur if the mare rejects the foal, the foal becomes separated from its mother and cannot be matched up following sorting, the mare dies or must be humanely euthanized during the gather, the foal is ill or weak and needs immediate care that requires removal from the mother, or the mother does not produce enough milk to support the foal. On occasion, foals are gathered that were previously orphaned on the range (prior to the gather) because the mother rejected it or died. These foals are usually in poor condition. Every effort is made to provide appropriate care to orphan foals. Veterinarians may administer electrolyte solutions or orphan foals may be fed milk replacer as needed to support their nutritional needs. Orphan foals may be placed in a foster home in order to receive additional care. Despite these efforts, some orphan foals may die or be humanely euthanized as an act of mercy if the prognosis for survival is very poor.

Through the capture and sorting process, WH&Bs are examined for health, injury, and other defects. Decisions to humanely euthanize animals in field situations would be made in conformance with BLM policy. BLM Euthanasia Policy IM-2021-007 is used as a guide to determine if animals meet the criteria and should be euthanized (refer to CAWP). Animals that are euthanized for non-gather related reasons include those with old injuries (broken or deformed limbs) that cause lameness or prevent the animal from being able to maintain an acceptable body condition (greater than or equal to BCS 3); old animals that have serious dental abnormalities or severely worn teeth and are not expected to maintain an acceptable body condition, and wild horses that have serious physical defects such as club feet, severe limb deformities, or sway back. Some of these conditions have a causal genetic component such that the animals should not be returned to the range; this prevents suffering and avoids amplifying the incidence of the deleterious gene in the wild population.

WH&Bs not captured may be temporarily disturbed and moved into another area during the gather operation. With the exception of changes to herd demographics from removals, direct population impacts have proven to be temporary in nature with most, if not all, impacts disappearing within hours to several days of release. No observable effects associated with these impacts would be expected within one month of release, except for a heightened awareness of human presence.

It is not expected that genetic diversity would be adversely affected by the Proposed Action. Available indications are that these populations contain high levels of genetic diversity at this time. The AML range of 361-638 in the Complex should provide for acceptable rates of genetic diversity maintenance (BLM 2010). If at any time in the future the genetic diversity in the Blue Wing Complex is determined to be relatively low, then a large number of other HMAs could be used as sources for fertile WH&Bs that could be transported into the area of concern to augment local genetic diversity levels.

By maintaining WH&B population size within the AML range, there would be a lower density of WH&Bs across the Complex, reducing competition for resources and allowing the WH&Bs that remain to use their preferred habitat. Maintaining population size near the established AML would be expected to improve forage quantity and quality and promote healthy, self-sustaining populations of WH&Bs in a thriving natural ecological balance and multiple use relationship on the public lands in the area. Deterioration of the range associated with WH&B overpopulation would be reduced. Managing WH&B populations in balance with the available habitat and other multiple uses would lessen the potential for individual animals or the herd to be affected by drought and would avoid or minimize the need for emergency gathers. All this would reduce stress to the animals and increase the success of these herds over the long-term.

Water/Bait Trapping

Bait and/or water trapping generally requires a long window of time for success. Although the trap would be set in a high probability area for capturing excess WH&Bs residing within the area and at the most effective time periods, time is required for the horses to acclimate to the trap and/or decide to access the water/bait.

Trapping involves setting up portable panels around an existing water source or in an active WH&B area, or around a pre-set water or bait source. The portable panels would be set up to allow wild horses to go freely in and out of the corral until they have adjusted to it. When the wild horses fully adapt to the corral, it is fitted with a gate system. The acclimatization of the WH&Bs creates a low stress trap. During this acclimation period the WH&Bs would experience some stress due to the panels being setup and perceived access restriction to the water/bait source.

When actively trapping WH&Bs, the trap would be checked on a daily basis. WH&Bs would be either removed immediately or fed and watered for up to several days prior to transport to a holding facility. Existing roads would be used to access the trap sites.

Gathering of the excess WH&Bs utilizing bait/water trapping could occur at any time of the year and would extend until the target number of animals are removed to relieve concentrated use by horses in the area, reach AML, to implement population control measures, and to remove animals residing outside HMA boundaries. Generally, bait/water trapping is most effective when a specific resource is limited, such as water during the summer months. For example, in some areas, a group of WH&Bs may congregate at a given watering site during the summer because few perennial water resources are available nearby. Under those circumstances, water trapping could be a useful means of reducing the number of WH&Bs at a given location, which can also relieve the resource pressure caused by too many WH&Bs. As the proposed bait and/or water trapping in this area is a low stress approach to gathering of WH&Bs, such trapping can continue into the foaling season without harming the mares or foals.

Impacts to individual animals would be similar to those for helicopter gathers and could occur as a result of stress associated with the gather, capture, processing, and transportation of animals. The intensity of these impacts would vary by individual and would be indicated by behaviors ranging from nervous agitation to physical distress. Mortality of individual WH&Bs from these activities is rare but can occur. Other impacts to individual WH&Bs include separation of members of individual bands and removal of animals from the population.

Indirect impacts can occur to WH&Bs after the initial stress event and could include increased social displacement or increased conflict between stallions. These impacts are known to occur intermittently during WH&B gather operations. Traumatic injuries could occur and typically involve bruises caused by biting and/or kicking. WH&Bs may potentially strike or kick gates, panels or the working chute while in corrals or trap which may cause injuries. These impacts, like direct individual impacts, are known to occur intermittently during WH&B gather operations. Since handling, sorting and transportation of WH&Bs would be similar to those activities under Helicopter drive trapping, the direct and indirect impacts would be expected to be similar as well. Past gather data shows that euthanasia, injuries and death rates for both types of gathers are similar (also see Appendix XII).

Transport, Off-range Corrals, Off-range Pastures, and Adoption Preparation

During transport, potential impacts to individual WH&Bs can include stress, as well as slipping, falling, kicking, biting, or being stepped on by another animal. Unless wild horses are in extremely poor condition, it is rare for an animal to die during transport.

Recently captured WH&Bs, generally mares, in very thin condition may have difficulty transitioning to feed. A small percentage of animals can die during this transition; however, some of these animals are in such poor condition that it is unlikely they would have survived if left on the range.

During the preparation process, potential impacts to WH&Bs are similar to those that can occur during transport. Injury or mortality during the preparation process is low but can occur.

Mortality at ORC facilities averages approximately 5% (GAO-09-77, Page 51), which includes animals euthanized due to a pre-existing condition, animals in extremely poor condition, animals that are injured and would not recover, animals that are unable to transition to feed; and animals that die accidentally during sorting, handling, or preparation.

ORPs, known formerly as long-term holding pastures, are designed to provide excess wild horses with humane, and in some cases life-long care in a natural setting off the public rangelands. There, wild horses are maintained in grassland pastures large enough to allow free-roaming behavior and with the forage, water, and shelter necessary to sustain them in good condition. Mares and sterilized stallions (geldings) are segregated into separate pastures except at one facility where geldings and mares coexist. About 37,000 wild horses that are in excess of the current adoption or sale demand (because of age or other factors such as economic recession) are currently located on private land pastures in western and midwestern states. The establishment of ORPs is subject to a separate NEPA and decision-making process. Located mainly in mid or tall grass prairie regions of the United States, these ORPs are highly productive grasslands compared to more arid western rangelands. These pastures comprise about 400,000 acres (an average of about 10-11 acres per animal). Of the animals currently located in ORP, less than one percent is age 0-4 years, approximately 49 percent are age 5-10 years, and about 51 percent are age 11+ years.

Potential impacts to wild horses from transport to adoption, sale or off-range pastures (ORP) are similar to those previously described. One difference is when shipping wild horses for adoption, sale or ORPs, animals may be transported for up to a maximum of 24 hours. Immediately prior to transportation, and after every 24 hours of transportation, animals are offloaded and provided a minimum of 8 hours on-the-ground rest. During the rest period, each animal is provided access to unlimited amounts of water and two pounds of good quality hay per 100 pounds of body weight with adequate space to allow all animals to eat at one time.

A small percentage of the animals may be humanely euthanized if they are in very poor condition due to age or other factors. Horses residing on ORP facilities live longer, on the average, than wild horses residing on public rangelands, and the natural mortality of wild horses in ORP averages approximately 8% per year, but can be higher or lower depending on the average age of the horses pastured there (GAO-09-77, Page 52).

Wild Horses and Burros Remaining/Released Back to the Complex following Gather Operations
The WH&Bs that are not captured may be temporarily disturbed and may move into another area during the gather operations. With the exception of changes to herd demographics and their direct population-wide impacts from a gather have proven, over the last 20 years, to be temporary in nature with most if not all impacts disappearing within hours to several days of when WH&Bs are released back into the HMAs.

No observable effects associated with these impacts would be expected within one month of release, except for a heightened awareness of human presence, and possible changes in specific band composition.

There is the potential for the WH&Bs that have been desensitized to vehicles and human activities to return to areas where they were gathered if released back into HMAs. The WH&Bs that remain in the Complex following the gather would maintain their social structure and herd demographics (age and sex ratios) as the proposed gathers would mainly be targeting specific individual or bands of horses. No observable effects to the remaining population from the gather would be expected.

Alternative B- Actions identified in the Proposed Action that are similar to Alternative B would include implementation of an HMAP, removal of excess WH&Bs, population growth control using mare fertility control treatments (PZP vaccines, GonaCon-Equine vaccine or most current vaccine formulation), sex ratio adjustments, managing a permanently non-reproducing component of the WH&Bs, and the development/exclosure of Unnamed Spring 78-40. Effects under Alternative B would be expected to be similar to the Proposed Action for these components, see analysis in Section 3.3 Wild Horses & Burros, Proposed Action for more details.

Alternative C- Actions identified in the Proposed Action that are similar to Alternative C include implementation of an HMAP, removal of excess WH&Bs, and the development/exclosure of Unnamed Spring 78-40. Effects under Alternative C would be expected to be similar to the Proposed Action for these components, see analysis in Section 3.3 Wild Horses & Burros, Proposed Action for more details.

Alternative C differs from both the Proposed Action and Alternative B by not including fertility control, sex ratio adjustments, or managing a permanently non-reproducing portion of the population.

Alternative C would be less effective at managing WH&Bs within the Complex at low AML than either the Proposed Action or Alternative B because there would no fertility control, sex ratio adjustments, or mare sterilization/gelding to help slow population growth.

Indirect impacts from gather events under Alternative C would happen more frequently under this alternative due to the population increasing at a normal rate, thus requiring more frequent gather/removal actions. Alternative C would address the need to remove excess WH&Bs while bringing the population on the range to the low AML (similar to the Proposed Action and Alternative B). This action would address attainment and maintenance of a TNEB through the gather and removal of excess animals only. Direct impacts to the WH&B population would be the decreased population to low AML resulting in reduced competition for scarce resources within the HMA such as water, forage, and space. Improved body condition should be experienced in the short term by the remaining WH&B population in the Complex. There would be increased opportunities for WH&Bs to utilize higher quality habitat related to a reduction in competition in these areas and to lessened pressure on the habitat itself. Reduced WH&Bs densities should result in less competition between bands resulting in fewer injuries and a reduced risk of disease outbreak, although for a lesser extent of time as would be expected under the Proposed Action and Alternative B.

Alternative C would directly impact the BLM's Wild Horse Program's ORC and ORP facilities. Currently the BLM is facing limited funding available to pay for the cost of holding excess WH&Bs. Due to national WH&Bs program constraints, the available funding and space at these facilities may be needed for other higher priority removals. This action would not address population control on the range by reducing population growth and would not slow population growth over the long term or result in greater intervals between gathers or fewer excess WH&Bs being removed and sent to short-term holding and long-term pasture facilities.

Cumulative Effects
No Action Alternative- Impacts to WH&Bs and their habitat within the Complex have resulted from past and present actions such as livestock grazing, road construction and maintenance, agriculture, OHV use and recreation, wildfires, powerlines and other right-of-way actions. The cumulative impacts from the No Action Alternative, in addition to past, present and reasonably foreseeable future actions (RFFAs) would result in continued use of WH&B habitat with the expected increase of WH&B populations within the Blue Wing Complex.

Under the No Action Alternative, the WH&B population within the Blue Wing Complex combined could exceed 1,500 within five years. Continued and expanded movement outside the HMAs would be expected as greater numbers of WH&Bs search for food and water for survival, thus impacting larger areas of public lands and threatening public safety as WH&Bs cross highways in search of forage. Heavy to Severe utilization of the available forage would continue to be expected and the water available for use would become increasingly limited. Ecological plant communities would continue to be damaged to the extent that they would no longer be sustainable, and the WH&Bs population would be expected to crash; this result would be expedited under drought conditions. As WH&B populations continue to increase within and outside the Complex, rangeland degradation intensifies on public lands. Also, as WH&B populations increase, concerns regarding public safety along highways increase as well as conflicts with private land. WH&Bs that reside along highways would continue to come on to the highways in many areas during the evenings or early mornings looking for forage and salt along the pavement, posing a hazard to motorists.

Emergency removals could be expected in order to prevent individual animals from suffering or death as a result of insufficient forage and water. These emergency removals are occurring annually and would be expected to increase as the WH&B population grows. During emergency conditions, competition for the available forage and water increases. This competition generally impacts the oldest and youngest horses as well as lactating mares first. These groups would experience substantial weight loss and diminished health, which could lead to their prolonged suffering and eventual death. If emergency actions are not taken when emergency conditions arise, the overall population could be affected by severely skewed sex ratios towards stallions as they are generally the strongest and healthiest portion of the population. An altered age structure would also be expected.

Cumulative impacts of the no action alternative would result in foregoing the opportunity to improve rangeland health and to properly manage WH&Bs in balance with the available forage and water and other multiple uses. Attainment of site-specific vegetation management objectives and Standards for Rangeland Health, and as a result TNEB would not be achieved. AML would not be achieved.

Proposed Action and Alternative B- The cumulative effects study area (CESA) includes the Blue Wing Complex and gather area. Impacts to WH&Bs and their habitat within the Complex have resulted from past and present actions such as livestock grazing, road construction and maintenance, agriculture, OHV use and recreation, wildfires, powerlines and other right-of-way actions. The cumulative impacts from the Proposed Action, in addition to past, present and RFFAs would be beneficial for WH&Bs, their habitat, and rangeland resources over the long-term. With a reduction of WH&B numbers, habitat and rangeland resources within the Complex would have the opportunity to improve.

With the removal of WH&Bs under these alternatives, utilization and grazing of vegetation at riparian areas would be expected to decrease, which would allow riparian areas and associated vegetation to slowly recover over time. Decreased utilization of upland vegetation would also be expected under these alternatives, which would in turn benefit permitted livestock, native wildlife, and WH&B population as forage (habitat) quality and quantity is improved over the current level. Benefits from a reduced WH&B population would include fewer animals competing for limited forage and water resources. Cumulatively, there would be more stable WH&B populations, healthier rangelands, healthier WH&Bs, and fewer multiple use conflicts in the area over the short and long-term. Over the length of the proposed action, continuing to manage WH&Bs within the established AML range would achieve a TNEB and multiple use relationship on public lands in the area.

The cumulative effects associated with the capture and removal of excess WH&Bs include gather-related mortality, which averages approximately 1% of the captured animals but could be higher based on the circumstances of individual gathers (Scasta 2020). Mortality averages about 5% per year associated with transportation, ORCs, adoption or sale with limitations and about 8% per year associated with ORPs. The mortality rates at short-term and long-term holding facilities are comparable to the natural annual mortality rate on the range of about 16% per year for foals (animals under age 1), about 5-10% per year for horses ages 1-10 years, and about 10-25% for animals aged 10-20 years (Ransom et al. 2016). In situations where forage and/or water are limited, mortality rates in the wild increase, with the greatest impact to young foals, nursing mares and older horses. Animals can experience lameness associated with trailing to/from water and forage, foals may be orphaned (left behind) if they cannot keep up with their mare, or animals may become too weak to travel. After suffering, often for an extended period, the animals may die. Before these conditions arise, the BLM generally removes the excess animals to prevent their suffering from dehydration or starvation.

In the future, application of population growth suppression techniques (i.e. PZP, PZP-22, GonaCon-Equine vaccine), adjustment of sex ratios, and managing a permanently non-reproducing component would be expected to slow total population growth rates, and to result in fewer gathers with less frequent disturbance to individual wild horses and the herd's social structure. However, return of WH&Bs back into the Complex could lead to decreased ability to effectively gather WH&Bs in the future as released WH&Bs learn to evade gather operations. The effect may be reduced gather effectiveness and the ability to capture a smaller portion of the population with each consecutive operation.

Alternative C- Cumulative effects of Alternative C would be expected to be similar to those of the Proposed Action and Alternative B. The cumulative impacts from Alternative C, in addition to past, present and RFFAs (as identified for the Proposed Action and Alternative B above) would be beneficial for WH&Bs, their habitat, and rangeland resources over the long-term. However, under Alternative C, benefits from reducing WH&B populations within the Complex and gather area would be shorter lived as gather events would happen more frequently under this alternative due to the population increasing at a normal rate. As identified in the environmental effects section, Alternative C would be less effective at managing WH&Bs within the Complex at low AML than either the Proposed Action or Alternative B because there would no fertility control, sex ratio adjustments, or mare sterilization/gelding to help slow population growth.

3.4. Riparian/Wetland Areas

Affected Environment

Riparian areas occupy a small but unique position on the landscape in the Complex. Riparian areas are important to water quality, water quantity, and forage. Riparian sites provide habitat needs for many species and support greater numbers and diversity of wildlife than any other habitat type in the western United States. Riparian areas at high elevations support cottonwood and aspen woodlands. Small riparian areas and their associated plant species occur throughout the HMAs near seeps, springs, and along sections of perennial drainages. Many of these areas support limited riparian habitat (forage) and water flows. At the present time, WH&B use of the majority of these areas is averaging heavy to severe use. Trampling and trailing damage by WH&Bs is evident at most locations; soil compaction and surface and rill erosion are evident. Some of the spring sources within the HMAs are minimally functioning because of factors such as over utilization and trampling effects. The current over population of WH&Bs is contributing to resource damage and decline in functionality of spring sources. Continued management of WH&Bs within the AMLs would expect to result in healthier vegetative communities. Hoof action on the soil around the springs would be lessened which should lead to decreased compaction and erosion. Improved vegetation around riparian areas would dissipate spring and stream energy associated with high flows and filter sediment, resulting in improvements of water quality.

Environmental Effects

No Action Alternative- With the No Action Alternative, WH&B populations would continue to increase within the HMAs and to expand beyond the HMA boundaries. Increased WH&Bs use within and outside the HMAs would present additional adverse impacts to riparian resources and their associated surface waters. Over the longer-term, as native plant health continues to deteriorate and plants are lost, soil erosion would increase. An opportunity to make progress toward achieving and maintaining riparian areas in properly functioning condition would be foregone as ever increasing numbers of WH&Bs continue to trample and degrade other riparian areas, springs and associated water sources. Riparian areas that are currently in a Functional at Risk with a Downward Trend state would be expected to decline to a Non-Functional state over time. Under the No Action Alternative, development and protection of Unnamed Spring 78-40 would not occur, existing use from WH&B would be expected to continue at this springhead, and riparian vegetation would not be able to recover as fast as it would under other alternatives.

Proposed Action- To avoid the direct impacts potentially associated with the gather operation, temporary gather sites and holding/processing facilities would not be located within riparian areas. The amount of trampling/trailing would be reduced. Utilization of the available forage within the riparian areas would also be expected to be reduced to within allowable levels. Over the longer-term, continued management of WH&Bs within the established AML would be expected to result in healthier, more vigorous vegetative communities. Hoof action on the soil around unimproved springs and stream banks would be lessened which should lead to increased stream bank stability and decreased compaction and erosion. Improved vegetation around riparian areas would dissipate stream energy associated with high flows and filter sediment that would result in some associated improvements in water quality. The alternative would make progress towards achieving and maintaining proper functioning condition at riparian areas. There would also be reduced competition among wildlife, WH&Bs, and domestic livestock for the available water. An opportunity to make progress toward achieving and maintain riparian areas in properly functioning condition would be foregone until reaching the mid-range of AML. Development of Unnamed Spring 78-40 and construction of exclosure around springhead would protect the riparian area from long-term impacts of wild horse and burro use and would reduce localized pressure on the spring.

Alternative B- Impacts from this alternative would be similar to the Proposed Action. This Alternative would be more effective at improving riparian areas than Alternative C.

Alternative C- Impacts from this alternative would be the similar to the Proposed Action. Overall, this alternative would be the least effective at improving riparian areas than the Proposed Action and Alternative B because there would be no fertility control, sex ratio adjustments, or mare sterilization/gelding to help slow population growth.

Cumulative Impacts

Proposed Action, Alternative B and Alternative C- Impacts to riparian/wetland areas and surface water quality within the Blue Wing Complex have resulted from past and present actions such as grazing, road construction and maintenance, agriculture, off-highway vehicle (OHV) use and recreation, mining and processing activities, aggregate operations, public land management activities, and wildland fire.

Impacts to riparian/wetland areas and surface water quality from RFFAs would be similar to those described above for past and present actions, as these activities are expected to continue into the future. Direct cumulative impacts to riparian/wetland areas and surface water quality would be marginal because part of the Proposed Action is to avoid riparian/wetland areas during the present and future WH&B gathers. However, the long-term incremental impact to these resources from the proposed action would be positive as the number of WH&Bs are decreased with this gather and over time with subsequent gathers and fertility control actions. This would result in improved surface water quality and reestablishment of riparian areas exhibiting increased stability and vigor. Long-term benefits of developing unnamed spring 78-40 would include reduced localized pressure on the springhead, protection of riparian habitat through maintaining the exclosure, and better distribution of WH&B use away from sensitive riparian habitat to troughs at the valley bottom.

No Action Alternative- Under the No Action Alternative, no incremental gather-associated impacts would occur to riparian/wetland areas and surface water quality, thus declining conditions would continue as horse populations increase. Under the No Action Alternative, development and protection of Unnamed Spring 78-40 would not occur, existing use from WH&B would be expected to continue at this springhead, and riparian vegetation would not be able to recover as fast as it would under other alternatives.

3.5 Water Quality (Surface and Ground)

Affected Environment
Hydrology in the gather area consists of springs and surface water in small drainages that are part of six hydrologically-defined geographic sub-basins, groundwater in shallow alluvium, and groundwater in bedrock. The gather area is located within portions of the following sub- basins as defined by the hydrologic unit codes (HUC)-8.

Table 5. HUCs within the Blue Wing Complex

Sub-basin Name	HUC-8
Lower Humboldt	16040108
Upper Quinn	16040201
Lower Quinn	16040202
Smoke Creek Desert	16040203
Pyramid-Winnemucca Lakes	16050103
Granite Springs Valley	16050104

Additional information about the surface water sub-basins can be found at the USGS website http://water.usgs.gov/wsc/index.html.

Other than approximately 10 miles of the eastern boundary of the Trinity Mountains Herd Area which borders the perennial Humboldt River, there are no perennial lakes, rivers, or streams in the proposed gather area. There are 697 identified water sources within the gather area. These sources include seeps, springs and wells. Although there are numerous water sources, they are generally small and ephemeral. Flow in streams typically occurs after brief and intense periods of precipitation or snowmelt. Surface drainages are dry the remainder of the year, with the exception of areas immediately adjacent or downstream from springs. During periods of drought, many of the springs may not be present.

Water quality data in lentic (non-flowing) water sources are limited. Persistence of surface water is highly variable annually depending on climatic variations. Grazing at springs and along the associated streams by large ungulates (livestock, WH&Bs) typically leads to decreases in water quality due to increased nutrient loading, water temperatures, bacterial contamination, and sediment loading. Native wildlife species also make contributions to bacterial loading. When faced with limited water sources, large ungulates and wildlife would also paw with their hooves in springs to try and acquire more water. The decreases in water quality result from surface disturbance associated with hoof action, removal of vegetation, trampling, compaction, and deposition of manure.

Environmental Effects

No Action Alternative- There would be no direct impacts. Indirect impacts would be increasing degradation to water quality as herd populations increase each year that a gather is postponed. Water quality would remain in a degraded state on heavily grazed spring sources and ephemeral streams due to removal of riparian vegetation, soil compaction, and deposition of manure. The increasing population of WH&Bs would exacerbate over-use of existing limited waters. Individual animals would travel farther in search of available water sources leading to an increased number of surface water sources being impacted. Under the No Action Alternative, development and protection of Unnamed Spring 78-40 would not occur, existing use from WH&B would be expected to continue at this springhead, and water quality would not improve as it would under other alternatives.

Proposed Action- Direct impacts to water quality occur when WH&Bs cross streams or springs as they are herded to temporary gather sites. These impacts would be temporary and relatively short-term in nature. Indirect impacts would be related to WH&Bs population size. Reduction of WH&Bs populations from current levels would decrease competition for available water which should lead to a reduction in hoof action (sediment), nutrients, and bacteria in surface waters. Achievement of the AML would also result in increased residual vegetation (increased stubble heights) that would decrease surface disturbance and increase vegetation cover, leading to improved water quality and availability.

Due to the limited availability of water quality data, quantifiable impacts are difficult to discern. Qualitative impacts (photographs) showing changes in spring conditions such as flow and surrounding riparian vegetation are often used instead. All action alternatives would result in identical types of direct and indirect impacts to water quality. The degree and timing of these impacts would vary under each alternative. Effects from direct impacts would likely be negligible relative to variations in the affected environment or would be of such short duration that they would not be measurable and would not last beyond the gather activities themselves. These effects include increased sediment loading to streams occurring when WH&Bs cross streams or springs as they are herded to temporary gather sites. Effects from indirect impacts would be related to population size. Use of water sources and riparian areas by WH&Bs during non-gather periods leads to increased sediment loading from hoof action and reduction of vegetation as well as the introduction of excess nutrients and bacteria from feces and urine. Loss of can also lead to increased surface water temperatures due to decreased shade.

Alternatives A through C would aim to reduce the total number of WH&Bs in the Complex which would reduce utilization pressure at all surface water sources. Development of unnamed Spring 78-40 would aid in better distributing WH&Bs use throughout the Complex. Reduced use is anticipated to allow regeneration of riparian vegetation which would lead to a restored hydrologic function over time. It is unknown, however, whether the proposed reduction in numbers would be sufficient to allow riparian functionality to recover. Riparian recovery would reduce sediment loading through reduced erosion and keep water temperatures low via increased shading.

Alternative B- Impacts from this alternative would be similar to the Proposed Action. This Alterative would be more effective at improving water quality than Alternative C.

Alternative C- Impacts from this alternative would be the similar to the Proposed Action. Overall, this alternative would be the least effective at improving water quality because there would be no fertility control, sex ratio adjustments, or mare sterilization/gelding to help slow population growth. This Alternative would be less effective at improving water quality than Alternatives A and B.

Cumulative Impacts
No Action Alternative- Cumulative effects to water resources and riparian zones would increase with WH&B population and compound effects from recreation, transportation, and wildfire.

Proposed Action, Alternative B and Alternative C- Reduction of the WH&B population would decrease the overall degradation of water resources and wetland and riparian zones and may increase their resilience to impacts from recreation, wildfire, and transportation. Short term impacts to the resource could occur during development of Unnamed Spring 78-40, but over the long-term development would better distribute pressure on the water resource and protect the resource from future impacts, improving conditions over time. Positive effects would increase after each gather and continue through the period of analysis as WH&B populations approach AML.

3.6 General Wildlife, Big Game, Migratory Birds

Affected Environment
General Wildlife
The U.S. Fish and Wildlife Service (USFWS) defines habitat as the abiotic and biotic setting that currently or periodically contains the resources and conditions necessary to support one or more life processes of a species (USFWS et al. 2020). Abiotic settings in the project area are the nonliving physical and chemical aspects of the environment like soil chemistry, climate and sunlight levels. The biotic settings in the project area include the living organisms like plants and animals. Plant communities within the Complex consist primarily of various shrubs and native and nonnative bunchgrasses (see Vegetation section 3.11 for further details).

Big Game
The Bluewing Complex and gather area contains big game habitat, including year-round, crucial winter, crucial summer, agricultural, and winter range habitat for pronghorn (*Antilocapra americana*) and mule deer (*Odocoileus hemionus*) (NDOW 2017). Additionally, mule deer summer range habitat is present.

Migratory Birds
Migratory birds are protected under the Migratory Bird Treaty Act of 1918 (MBTA; 16 U.S.C.A. §§ 703-708) and the Neotropical Migratory Bird Conservation Act of 2000. These acts apply to virtually all migratory birds, except non-native species introduced by humans. Golden eagles (*Aquila chrysaetos*) are also protected under the Bald and Golden Eagle Act of 1940. Numerous protected species of birds may use the project area either as residents or during spring and/or fall migration. Birds that could be found in the area include American avocet (*Recurvirostra americana*), black tern *(Chlidonias niger surinamenisis*), Cassin's Finch (*Haemorhous cassinii*), Long-eared Owl (*Asio otus*), and Northern Harrier (*Circus hudsonius*), Western burrowing owl (*Athene cunicularia*), (see list in Species list from Reno Fish and Wildlife Service Appendix IX). Golden eagles are also a BLM Special Status Species, which nests have been observed within the project area. Golden eagles may periodically forage in the project area to opportunistically to prey on small mammals and available carrion, especially during the winter.

Environmental Effects
No Action Alternative- Under the No Action Alternative, wildlife would not experience direct disturbance or displacement from gather events. However, competition between wildlife and WH&Bs for forage and water resources would persist and likely intensify as WH&B populations continue to exceed AML. As competition increases, some wildlife species may struggle to compete successfully, leading to

heightened stress and potential displacement or mortality over time. Research indicates that WH&Bs trample migratory bird nests at significantly higher rates than livestock (Mandema et al. 2013). Without management intervention, increasing WH&B populations would continue to contribute to the trampling of migratory bird nests. Additionally, the absence of an exclosure around the Unnamed Spring 78-40 would allow ongoing degradation of the riparian area by WH&Bs (Kaweck et al. 2018). Other potential positive and negative effects of WH&Bs on wildlife and wildlife habitat quality are analyzed in Appendix XII.

Proposed Action

General Wildlife

Individual animals may be disturbed or displaced during gather events. Within the area around proposed trap sites, mammals, reptile, and amphibians may temporarily flee during helicopter operations but are expected to return to normal activities post-disturbance. These impacts would be minimal, temporary, and short-term in nature. Overall, gather operations would not result in significant impacts to wildlife populations.

Removing WH&Bs would reduce competition for forage and water resources, benefiting wildlife as soon as the gather is completed. Over the long term, improved riparian and upland habitat conditions would enhance forage quantity and quality, while increasing the availability of surface water for wildlife.

Big Game

Proposed WH&Bs gathers within the Bluewing Complex and gather area, along with a proposed exclosure, pipeline, and trough within the Seven Troughs HMA, aim to manage WH&Bs populations while minimizing big game habitat impacts (See section 2.4 Proposed Action). The Bluewing Complex and gather area spans approximately 2.5 million acres, including about 508,360 acres of mule deer habitat (Agriculture: ~26,286 acres; Crucial Winter: ~41,551 acres; Crucial Summer: ~49,832 acres; Summer Range: ~31,889 acres; Winter Range: ~179,639 acres; and Year-Round Range: ~179,163 acres). Additionally, approximately 2,386,778 acres of pronghorn habitat are present (Agriculture: ~8,179 acres; Crucial Winter: ~199,644 acres; Crucial Summer: ~295,506 acres; Winter Range: ~238,555 acres; and Year-Round Range: ~1,614,034 acres).

Helicopter gather operations could occur between July 1 and February 28, avoiding the mule deer fawning season (May 15 – June 15) and pronghorn kidding season (April 1 – June 30). If a proposed trap site is placed within mule deer or pronghorn habitat, the placement of the corrals and infrastructure along with the gathering of WH&Bs would cause temporary disturbance, accounting for less than 0.1% of total of mule deer and pronghorn habitat. These impacts would be minimal, temporary, and short-term in nature. Overall, gather operations would not result in significant impacts to big game populations and habitat.

The proposed exclosure, pipeline, and trough would enclose approximately 1.07 acres and would be placed within pronghorn year-round habitat. Total temporary disturbance would be approximately 1.2 acres (including the exclosure perimeter, pipeline, and trough), accounting for less than 0.1% of year-round pronghorn habitat. The fence would prevent WH&Bs from accessing the spring source which has wet riparian and meadow vegetation. It would be expected that the WH&Bs would concentrate their watering activities at the proposed trough location. The proposed exclosure fence would comply with applicable wildlife fence standards (Fences – BLM Manual Handbook H-1741-1), allowing big game species to continue accessing the riparian area. The proposed exclosure is expected to benefit big game species by preventing WH&Bs access and protecting habitat that would otherwise be subject to continued use and potential degradation.

Migratory Birds

Proposed WH&Bs gathers within the Bluewing Complex and gather area, along with a proposed exclosure, pipeline, and trough within the Seven Troughs HMA, aim to manage WH&Bs populations while minimizing impacts on migratory bird habitat (see Section 2.4, Proposed Action). The Bluewing Complex and gather area, along with migratory bird habitat, span approximately 2.5 million acres. The proposed exclosure, pipeline, and trough are expected to temporarily disturb approximately 1.2 acres during construction, accounting for less than 0.1% of migratory bird habitat.

Short-term impacts may include the temporary displacement of migratory birds; however, avoiding construction in breeding and nesting areas during sensitive seasons would help minimize effects. The project would not alter nesting habitat for cliff- or structure-nesting birds, but ground and shrub nesters could lose some breeding areas. Construction of the trough from the proposed exclosure would occur in a pre-disturbed area. In addition, the pipeline that would be placed from the Unnamed Spring 78-40 to the trough would be placed next to a pre-existing road where there would be minimal habitat for shrub nesting birds. However, if construction of the proposed exclosure, pipeline, and trough occurs during the migratory bird nesting season (March 1 – August 31), a pre-construction clearance survey would be conducted by a BLM wildlife biologist.

Helicopter gather operations could occur between July 1 and February 28, overlapping with the last two months of the migratory bird nesting season (March 1 – August 31). Individual migratory birds may be disturbed or displaced during gather operations. Within the area around the trap site, birds may flush from nests during helicopter operations but are expected to return to normal activities post-disturbance. During gathers, bird nests may be trampled by WH&Bs; however, trampling can occur at any time of the year due to other wildlife and WH&Bs. If a trap site is placed within migratory bird habitat, it would cause temporary disturbance accounting for less than 0.1% of total migratory bird habitat. These impacts would be minimal, temporary, and short-term in nature. Overall, gather operations would not result in significant impacts to migratory bird populations and habitat.

Western burrowing owl habitat may be present within the approximate 2.5 million acres of the Bluewing Complex and gather area. These owls typically inhabit grasslands, shrublands, and open areas, relying on burrows created by other animals, such as prairie dogs or ground squirrels, for nesting and shelter. Specific habitat locations within the project area are not well-defined. No known resource conflicts or proposed critical habitat have been identified for the species, and it is unlikely to be impacted by the proposed activities and developments. However, before construction begins on proposed trap sites, as well as the proposed exclosure, pipeline, and trough, a BLM wildlife biologist would conduct a pre-clearance survey to ensure no burrows are present within a 300-foot buffer.

The use of previously disturbed areas would reduce impacts to migratory birds. Any new staging, corral, and trap sites with vegetation would be surveyed for nesting birds, if gather operations were to occur during the migratory bird breeding season.

Alternative B – Impacts from this alternative would be similar to the Proposed Action. This Alterative would be more effective at improving wildlife habitat than Alternative C.

Alternative C – Impacts from this alternative would be the similar to the Proposed Action. Overall, this alternative would be the least effective at improving habitat conditions for wildlife because there would be no fertility control, sex ratio adjustments, or mare sterilization/gelding to help slow population growth. This Alternative would be less effective at improving wildlife habitat conditions than Alternatives A and B.

Cumulative Impacts
Proposed Action and Alternatives B, and C- Impacts to wildlife habitat within the Complex have

resulted from past and present actions such as livestock grazing, road construction and maintenance, agriculture, OHV use and recreation, Powerlines and other right-of-way actions, and WH&Bs. The cumulative impacts from the Proposed Action, in addition to past, present and RFFAs would be beneficial for all wildlife and their habitat. With a reduction of WH&B numbers, habitat within the Complex would have the opportunity to improve. Impacts to vegetation at riparian areas would be reduced, allowing them to slowly recover with time. Breeding, forage, nesting, and security habitat for all species would improve over time.

No Action Alternative- The cumulative impacts from the No Action Alternative, in addition to past, present and RFFAs would result in continual degradation of habitat for all wildlife. WH&Bs would continue to be above AML and compete for resources with other wildlife and livestock. Breeding, foraging, nesting and security habitat for all species would continue to degrade.

3.7 Special Status Plant and Animal Species

Affected Environment

Special Status Animal Species

Special Status Animal Species include species which are Federally listed as threatened or endangered, proposed for listing, or are candidates for listing as threatened or endangered under the provisions of the Endangered Species Act (ESA); those designated by the BLM State Director as Bureau Sensitive are also considered special status species. BLM's policy is to manage public land to maintain, restore, or enhance populations and habitats of special status animal species (BLM 2003b, as maintained). Special Status Species with potential to occur in the project area are discussed in the following section.

Greater Sage-grouse

The 2015 Nevada and Northeastern California Greater Sage-Grouse *(Centrocercus urophasianus)* (GRSG) Record of Decision and Approved Resource Management Plan Amendment (ARMPA), including a change in habitat mapping (2021 GRSG Maps - Referencing the ARMPA). For the purposes of this document, impacts to GRSG habitat would be evaluated under the ARMPA. Under the ARMPA, this project is directly associated with and adjacent to Priority Habitat Management Area (PHMA), General Habitat Management Area (GHMA), and Other Habitat Management Area (OHMA) (See Map 3, Appendix 1). There is a total of 24 GRSG leks within the complex, 6 are historic and 18 are identified as unknown.

Mammals

California bighorn sheep (*Ovis canadensis*) have year-round habitat within the Bluewing Allotment (NDOW 2021). No known resource conflicts exist between bighorn sheep and WH&Bs in this allotment. Pygmy rabbits (*Brachylagus idahoensis*), habitat may be present within the Bluewing Complex and gather area. Pygmy rabbits are under USFWS review for potential ESA listing, with no known habitat or sightings reported. There are no known conflicts in the area with any of these species.

Reptile and amphibians

The northern leopard frog (*Lithobates pipiens*) occupies wetland and riparian habitats, there is potential habitat within the Bluewing Complex and gather area. This species depends on permanent or seasonal water sources for breeding and foraging. The Great Basin spadefoot (*Spea intermontana*) has a broad range of potential habitat within the Bluewing Complex and gather area. It relies on temporary pools and moist soil for breeding but can survive in arid environments by burrowing underground. Additionally, the northern rubber boa (*Charina bottae*) could be found within the Bluewing Complex and gather area, no sightings have been documented. No known resource conflicts have been identified for any of these species in the project area.

Special Status Plant Species
There are no known populations of federally listed threatened or endangered plant species within the Blue Wing Complex project area per the USFWS's Information for Planning and Consultation (IPAC) tool. While spatial data for BLM-designated sensitive plant species within the project area is limited, Nevada Department of Natural Heritage (NDNH) has data on expected populations, habitats, and locations of these species. There are 12 BLM-designated sensitive plant species expected to occur within the Blue Wing Complex and gather area per NDNH: Barneby stemflower (*Caulanthus barnebyi*), Lahontan milkvetch (*Astragalus porrectus*), oryctes (*Oryctes nevadensis*), Watson spinecup (*Oxytheca watsonii*), windloving buckwheat (*Eriogonum anemophilum*), winged milkvetch (*Astragalus pterocarpus*), Reese River phacelia (*Phacelia glaberrima*), Lemmon buckwheat (*Eriogonum lemmonii*), Crosby buckwheat (*Eriogonum crosbyae var. crosbyae*), Lahontan beardtongue (*Penstemon palmeri var. macranthus*), Nevada suncup (*Eremothera nevadensis*), obscure scorpionflower (*Phacelia inconspicua*). Total expected habitat for BLM-designated sensitive species within the Blue Wing Complex and gather area is approximately 233,417 acres, accounting for 9.4% of the Blue Wing Complex and gather area. However, Lahontan milkvetch expected habitat alone covers 225,086 acres, accounting for approximately 96.5% of all BLM-designated sensitive species within the complex. See Table 6 below for acres of sensitive species habitat (using NDNH data) within Blue Wing Complex and gather area.

Table 6. Special Status Plant Species within Blue Wing Complex and Gather Area

Common Name	Expected Habitat (acres)
Barneby stemflower	1,998
Crosby buckwheat	724
Lahontan beardtongue	856
Lahontan milkvetch	225,086
Lemmon buckwheat	1
Nevada suncup	31
obscure scorpionflower	< 1
Nevada Oryctes	1998
Reese River phacelia	31
Watson spinecup	< 1
windloving buckwheat	409
winged milkvetch	2,283
Total Habitat	233,417

Environmental Effects
No Action Alternative
Special Status Animal Species
Under the No Action Alternative, wildlife would not experience direct disturbance or displacement from gather operations. However, competition between wildlife and WH&Bs for forage and water resources would persist and likely intensify as WH&B populations continue to exceed AML. As competition increases, some wildlife species may struggle to compete successfully, leading to heightened stress and potential displacement or mortality over time. Research indicates that wild horses trample migratory bird nests at significantly higher rates than livestock (Mandema et al. 2013). Without management intervention, increasing WH&B populations would continue to contribute to the trampling of bird nests, including those of the GRSG. Additionally, the absence of an exclosure around the unnamed spring would allow ongoing degradation of the riparian area by WH&Bs (Kaweck et al. 2018). Wild horses are known

to disrupt sage-grouse (Muñoz et al. 2020) and wild horse population sizes above AML are associated with declines in Greater sage-grouse survival and population growth rates (Coates et al. 2021, Beck et al. 2024).

Special Status Plant Species
Under the No Action Alternative, no direct impacts to sensitive plant species from gather-related activities would occur. However, WH&B populations would remain over AML, leading to continued population growth and increasing pressures on sensitive plant habitats. The impacts from trampling, soil erosion, soil compaction, and grazing of associated vegetation would be expected to intensify as WH&B populations expand. This could result in a decline in plant vigor, reproductive success, and overall habitat suitability for sensitive species (Burdick, J., S. Swason, S. Tsocanos, and S. McCue 2021). Over time, excessive grazing and trampling from increased WH&B populations may make sensitive plant populations more vulnerable to external stressors such as drought, invasive species encroachment, or insect/disease pressure. Additionally, the loss of associated native vegetation could facilitate the spread of non-native or invasive species, further altering habitat conditions and potentially displacing sensitive plant species from their historical and potential range. In areas where WH&B pressures are most concentrated, long-term degradation could lead to the local extirpation of rare and sensitive plant populations.

Proposed Action
Greater Sage-grouse
Proposed WH&Bs gathers within the Blue Wing Complex and gather area, along with a proposed exclosure, pipeline, and trough within the Seven Troughs HMA, aim to manage WH&Bs populations while minimizing impacts to GRSG (See section 2.4 Proposed Action). The Bluewing Complex and gather area covers approximately 2.5 million acres, including about 153,120 acres of GRSG habitat (PHMA: ~9,508 acres; GHMA: ~15,475 acres; OHMA: ~128,137 acres). Helicopter gather operations could occur between July 1 and February 28, avoiding the lekking season (March 1 – May 15) and nesting season (April 1 – June 30). Proposed trap sites would not be placed within PHMA or GHMA, however, if the proposed trap sites are placed within GRSG OHMA habitat, it would result in temporary disturbance accounting for less than 0.1% of GRSG habitat. The proposed exclosure would enclose approximately 1.07 acres with a permanent fence and would be located more than 3.1 miles from the nearest lek. Additionally, approximately 0.62 acres of the proposed exclosure falls within OHMA. The pipeline, and trough would be constructed outside GRSG habitat. Utilizing previously disturbed areas would help reduce impacts on GRSG habitat. See Appendix X for Required Design Features to reduce impacts to GRSG habitat.

The BLM would avoid placing trap sites, holding corrals, or staging areas within GRSG strutting grounds. To minimize impacts on breeding, nesting, and brood-rearing birds, the BLM would implement the GRSG timing restrictions outlined in the Proposed Action to the greatest extent possible. To further reduce impacts during the late brood-rearing season, the BLM would assess the use of natural water sources for water bait trapping sites. If any of these stipulations cannot be met, the BLM would coordinate with NDOW. Temporary disturbances to GRSG may occur during winter gather operations.

Mammals
Proposed WH&B gathers within the Bluewing Complex and gather area, along with a proposed exclosure, pipeline, and trough within the Seven Troughs HMA, aim to manage WH&Bs populations while minimizing impacts to special status mammals (See section 2.4 Proposed Action). The Bluewing Complex and gather area, along with potential pygmy rabbit habitat spans approximately 2.5 million acres. The proposed exclosure, pipeline, and trough are expected to temporarily disturb approximately 1.2 acres during construction, accounting for less than 0.1% of pygmy rabbit habitat. Construction of the trough from the proposed exclosure would occur in a pre-disturbed area. In addition, the pipeline that

would be placed from the Unnamed Spring 78-40 to the trough would be placed next to a pre-existing road where there would be minimal habitat for pygmy rabbits. In addition, before construction begins on proposed trap sites, as well as the proposed exclosure, pipeline, and trough, a BLM wildlife biologist will conduct a pre-clearance survey to ensure no burrows are present within a 300-foot buffer.

Bighorn sheep inhabit the Bluewing Allotment (NDOW 2021). There is approximately 71,917 acres of year-round bighorn sheep habitat. Proposed trap sites, placed within bighorn sheep habitat, would cause temporary disturbance accounting for less than 0.1% of total bighorn sheep habitat. The proposed exclosure, pipeline, and trough would not be placed within mapped bighorn habitat.

During helicopter gather operations, individual animals may be disturbed or displaced during gather operations. Within the area around trap sites, large mammals may temporarily flee during helicopter operations but are expected to return to normal activities post-disturbance. These impacts would be minimal, temporary, and short-term in nature. Overall, gather operations would not result in significant impacts to pygmy rabbit or bighorn sheep populations and habitat.

Reptile and Amphibians

Proposed WH&Bs gathers within the Bluewing Complex and gather area, along with a proposed exclosure, pipeline, and trough within the Seven Troughs HMA, aim to manage WH&Bs populations while minimizing big game habitat impacts (See section 2.4 Proposed Action). The Bluewing Complex and gather area spans approximately 2.5 million acres, along with potential habitat for the Great Basin spadefoot and northern rubber boa. The proposed exclosure, pipeline, and trough are expected to disturb approximately 1.2 acres during construction, accounting for less than 0.1% of Great Basin spadefoot and northern rubber boa habitat.

Additionally, approximately 751,078 acres of potential northern leopard frog habitat are present within the Bluewing Complex and gather area. The proposed exclosure, pipeline, and trough would not be placed within mapped potential habitat for the northern leopard frog. However, proposed trap sites could be placed within northern leopard frog habitat, resulting in temporary disturbance accounting for less than 0.1% of total northern leopard frog habitat.

During helicopter gather operations, individual animals may be disturbed or displaced during gather operations. Within and around trap sites, reptile and amphibians may temporarily flee during helicopter operations but are expected to return to normal activities post-disturbance. These impacts would be minimal, temporary, and short-term in nature. Overall, gather operations would not result in significant impacts to reptile and amphibian populations and habitat.

BLM would not locate any proposed trap sites, holding corrals, or staging areas where sensitive animal and plant species are known to occur, so there would be no expected impacts from the placement of trap sites, holding corrals, or staging areas.

Under the Proposed Action, the removal of excess WH&Bs would cause habitat conditions to improve for all special status species; however, this alternative does not remove all WH&Bs. Development of Unnamed Spring 78-40 would provide additional opportunities for riparian habitat to improve and provide additional surface water that could benefit special status species.

Special Status Plant Species

The proposed action may result in short-term, localized impacts to sensitive plant species due to trampling and soil disturbance at temporary gather sites and holding locations. WH&B movements in these areas, as well as the placement of temporary corrals and holding facilities, may crush individual plants. However, these facilities are typically placed in previously disturbed areas, such as gravel pits, which minimizes the likelihood of affecting sensitive plant populations. These disturbed areas would be less than one acre in size, and no new roads would be created, limiting the extent of direct impacts. In the event gather sites would create new surface disturbance, a special status plant survey would be completed, and the gather/holding site would be placed to avoid any special status plants found.

The construction of the exclosure, pipeline, and trough would be expected to have no impact to sensitive plant species as the proposed location does not overlap any expected sensitive species populations/habitats per NDNH data. To reduce impacts to special status plants, a special status plant survey would be completed prior to construction and the placement of the exclosure, pipeline, and trough would avoid any special status plants found.

Achieving and maintaining the proposed WH&B AML would ultimately benefit sensitive plant species by reducing excessive grazing pressure and trampling within their habitats. This reduction in WH&B population and associated grazing pressure would allow sensitive plant communities to rebound, increasing plant vigor, reproductive success, and overall habitat quality (Burdick, J., S. Swason, S. Tsocanos, and S. McCue 2021). With fewer disturbances from WH&B overpopulation, sensitive plant species would be expected to experience less stress and greater resilience to external factors such as drought, insect/disease damage, wildfire, and competition from invasive species. Additionally, as plant communities recover, their diversity and abundance would improve, restoring ecological balance and enhancing ecosystem resilience. The reduction in WH&B populations would help reduce soil erosion and compaction, ensuring that sensitive plant habitats remain viable and capable of sustaining long-term growth and reproduction. See Section 3.11 for vegetation analysis and Section 3.12 for soils analysis.

Alternative B- Impacts from this alternative would be similar to the Proposed Action. Alterative would be more effective at improving special status species' habitat than Alternative C.

Alternative C- Impacts from this alternative would be the similar to the Proposed Action. Overall, this alternative would be the least effective at improving habitat conditions for special status species because there would be no fertility control, sex ratio adjustments, or mare sterilization/gelding to help slow population growth. This Alternative would be less effective at improving special status species' habitat conditions than Alternative A, and slightly less effective than Alternative B.

Cumulative Impacts

Proposed Action and Alternatives B and C- Impacts to special status species and their habitats within the Blue Wing Complex have resulted from past and present actions such as livestock grazing, road construction and maintenance, agriculture, wildfire, OHV use and recreation, powerlines and other right-of-way actions, and WH&Bs. These disturbances have contributed to habitat degradation, fragmentation, and an increased risk of non-native species invasion. The cumulative impacts from the Proposed Action, in combination with past, present, and RFFAs, would provide long-term benefits to sensitive plant species by mitigating these pressures and fostering ecosystem recovery.

The combined effects of the Proposed Action and other past, present, and future activities would allow sensitive plant communities to recover and enhance their resilience to future disturbances. Healthier, more diverse plant communities would be better equipped to withstand environmental stressors such as prolonged drought, increased wildfire severity, invasive species encroachment, and insect/disease outbreaks. Additionally, improvements in vegetative cover and soil stabilization would reduce erosion, increase water retention, and create more favorable conditions for the long-term survival of sensitive plant species.

No Action Alternative- The cumulative impacts from the No Action Alternative, in addition to past, present, and RFFAs, would result in continual degradation of habitat for special status species. With

WH&B populations remaining above AML, competition for forage resources would persist. This would exacerbate pressures on sensitive plant and animal species, leading to further habitat degradation. Breeding, foraging, nesting, and security habitat for all species would continue to deteriorate due to overgrazing, trampling, and the spread of invasive species. As a result, the resilience of special status plant communities and wildlife populations to external stressors such as drought, insect/disease pressure, and wildfire would be significantly reduced. Over time, habitat fragmentation and the loss of habitat connectivity would likely result in a decline in species' diversity and the potential extirpation of sensitive species from the area. The ongoing degradation of these habitats would also diminish ecosystem function, reducing the long-term viability of the Blue Wing Complex as habitat for special status species.

3.8 Livestock Grazing

Affected Environment

The Blue Wing - Seven Troughs, Coal Canyon-Poker, Desert Queen, Humboldt Sink, Humboldt Valley, Jackson Mountains, Majuba, Ragged Top and Rye Patch Allotments are managed for livestock grazing. Portions of these allotments also overlap with the HMAs, HAs or the gather area boundary in its entirety. The Blue Wing - Seven Troughs allotment and the HMAs within the allotment are managed concurrently with livestock and WH&Bs. The Allotment Map in Appendix I shows grazing allotments in the gather area. Table 7. HMA Acres within Allotments, Table 8. HA Acres within Allotments and Table 9. Gather area Acres within Allotments/Non HMA & HA identifies the amount of overlap between grazing allotments and the gather area. As shown, allotments acreages do not correspond with HMA, HA or gather area acreages, as these areas do not share identical boundaries.

Table 7. HMA Acres within Allotments

Allotment	**Allotment Acres** (Public & Private)	**HMA Acres** (Public & Private)	**% Allotment overlapped by HMA**
Blue Wing- Seven Troughs	1,376,287	597,229	43%
Total:	***1,376,287***	***597,229***	***43%***

Table 8. HA Acres within Allotments

Allotment	**Allotment Acres** (Public & Private)	**HA Acres** (Public & Private)	**% Allotment overlapped by HA**
Blue Wing- Seven Troughs	1,376,287	309,946	23%
Coal Canyon- Poker	176,132	63,464	36%
Desert Queen	297,751	93,449	31%
Majuba	280,270	136,681	48%
Ragged Top	162,496	65,302	40%
Rye Patch	67,238	27,513	41%
Humboldt Valley	222,554	86,093	39%

Total:	***2,582,728***	***782,448***	***30%***

Table 9. Gather area within Allotments/Non HMA & HA[1]

Allotment	**Allotment Acres** (Public & Private)	**Gather Area Acres** (Public & Private)	**% Allotment overlapped by Gather Area**
Humboldt Sink	190,728	49,029	26%
Jackson Mountains	374,175	30,136	8%
Humboldt House	60,659	36,139	60%
Total:	***625,562***	***115,304***	***18%***

[1]Portions of these allotments are identified as being within the gather area boundary due to their proximity to the HMAs and HAs. No gather operations are planned within these allotments other than to retrieve any WH&Bs that may disperse from planned gather operations located within the 7 main allotments identified in Tables 7 and 8. Therefore, no further discussion of these allotments is needed in the analysis of this EA.

There are a total of 13 livestock operators (permittees) currently authorized to graze livestock in these allotments annually. The total permitted use for these permittees is a combined total of 45,831 Permitted use and 32,121 Active use[5] Animal Unit Months (AUMs) yearly in the 6 allotments (including on non-HMA lands). An AUM is the amount of forage needed to sustain one cow or its equivalent for one month (43 CFR 4100). All of these allotments consist of various pastures that are grazed seasonally following established grazing systems; however, the season of use may vary (by one to two weeks) annually based upon forage availability, drought conditions and other management criteria.

The level of livestock grazing authorized for the allotments within the Complex and gather area is identified in management actions within the WD RMP. Since the issuance of the 2015 WD RMP, there have been several management decisions that have guided the multiple use management of the allotments in the gather area. The allotment specific FMUDs established the AML for WH&Bs in the allotments in the gather area. Table 10. illustrates the total permitted livestock AUMs compared to the current authorized grazing use.

Table 10. Livestock use by allotment (AUMs authorized)

Allotment	**Total Permitted AUMs**	**Actual Use 2022[1]**	**Actual Use 2023[1]**	**Actual Use 2024[1]**	**Estimated Actual Use 2025[2]**
Blue Wing / Seven Troughs	32,228	12,683	14,212	18,631	16,148

[5] Permitted use AUMs is the total forage allocated by, or under the guidance of, an applicable land use plan for livestock grazing in an allotment under a permit or lease which includes both active and suspended AUMs. Active use AUMs is the current authorized use, including livestock grazing and conservation use. Active use may constitute a portion, or all, of permitted use. Active use does not include temporary nonuse or suspended use of forage within all or a portion of an allotment.

Allotment	Total Permitted AUMs	Actual Use 2022[1]	Actual Use 2023[1]	Actual Use 2024[1]	Estimated Actual Use 2025[2]
Coal Canyon - Poker	3,144	3,082	3,082	3,082	3,082
Desert Queen	4,323	2,189	2,277	3,717	80
Majuba	3,325	2,322	2,515	2,260	1,814
Ragged Top[3]	varies	1,031	1,273	1,256	330
Rye Patch	2,811	1,674	1,385	1,981	781
Humboldt Valley	2,905	2,946	2,982	3,008	1,569
Total	**49,635**	**25,927**	**27,726**	**33,935**	**23,862**

[1] Based on paid bills or submitted actual use for each grazing fee year (March 1st to February 28th).
[2] Planned use for 2025 is subject to change as operators have been adjusting livestock number throughout the year. These numbers do not reflect potential fall and winter use.
[3]All AUMs authorized on this particular allotment are through Exchange of Use (EOU) and AUMs fluctuate yearly based on leased land.

Grazing Allotments

Blue Wing – Seven Troughs Allotment

The current grazing system for the Blue Wing – Seven Troughs allotment was implemented through a Final Multiple Use Decision (FMUD) in 1994 but was appealed by the cattle grazing permittee. In June of 1999 a judge's order was issued and a grazing system was put in place specific to the cattle permittee. None of the sheep permittee's appealed the FMUD so grazing use for them was set in the original 1994 Decision. Season of use for the allotment is year round with a rotation system for the cattle permittee that is broken out into five use areas; Granite, Selenite, Lava Beds, Shawave/Nightingale and Seven Troughs. One livestock operator runs cattle on the allotment with a total authorized grazing preference of 25,864 AUMs (14,058 active and 11,806 suspended AUMs). Three livestock operators run sheep on the allotment with a total authorized grazing preference of 6,364 AUMs (6,258 active and 106 suspended AUMs). The allotment has a decent amount of private land which the livestock users do receive AUMs through (EOU)[6]. There are a total of five grazing use areas in the Blue Wing – Seven Troughs allotment, but only one use area is outside either an HMA or HA (Granite use area). Livestock season of use in the use areas within the HMAs and HAs is approximately 04/15-10/14 for cows and 11/01-03/31 for sheep. Note Grazing Permittees in the Blue Wing/Seven Troughs Allotment (which overlaps all of the HMAs in the Complex) are, and have been for multiple years, voluntarily running lower Animal Unit Months (AUMs) than permitted, due to excess WH&Bs (See Table 10).

Coal Canyon – Poker Allotment

The current grazing system for the Coal Canyon – Poker allotment was implemented through an

[6]Exchange-of-use grazing agreements may be issued to a livestock operator who owns or controls private lands that are unfenced and intermingled with public lands in the same allotment that they are authorized to graze. These agreements may increase the AUMs they are authorized to harvest when utilizing their BLM grazing permits on federal land. The agreements shall contain appropriate terms and conditions required under § 4130.3 that ensure the orderly administration of the range as well as be in harmony with the management objectives for the allotment and compatible with the existing livestock operations.

Allotment Management Plan (AMP) in 1971, season of use for the allotment is year round with a two pasture rest rotation system and a winter, summer, spring use area for the cattle permittees and a use area system for the sheep which is mainly winter use. Three livestock operators run livestock on the allotment (two cattle, one sheep producer) with a total authorized grazing preference of 3,144 AUMs, (3,144 active and 0 suspended AUMs). The allotment has a fair amount of private land which the livestock users receive AUMs through EOU. The allotment has a total of three pasture use areas, Poker pasture (west of I-80), Coal Canyon pasture (east of I-80) and river bottom pasture. Only the Poker pasture is a part of the Complex gather and includes portions of the Trinity Range HA. No HMA is present within the Coal Canyon-Poker allotment. Every other year the Poker pasture is rested. Sheep use is only authorized in the Coal Canyon pasture which is not a part of the Complex gather. Use when cattle are in the Poker pasture every other year is 11/01 to 07/15.

Desert Queen Allotment

The current grazing system for the Desert Queen allotment was implemented through the 1982 Management Framework Plan, season of use for the allotment is year round, but the bulk of the AUMs associated with grazing are used in the winter through spring. There currently is no specified or designated grazing system for the allotment. Permittees usually spread livestock out based on forage availability. Three livestock operators run cattle on the allotment with a total authorized grazing preference of 4,323 AUMs (3,355 active and 968 suspended AUMs). The allotment has a substantial amount of private land which the livestock users receive AUMs through EOU. The allotment is split into two sides due to Interstate 80 with the northern side of the allotment having the southern portion of the Truckee Range HA in it. The southern side of the allotment is outside of the Complex gather area. Forage production is greater to the north of I-80 versus the southern side.

Majuba Allotment

The current grazing system for the Majuba allotment was implemented through the MFP in 1982, season of use for the allotment is October through the end of June, but the bulk of the AUMs associated with grazing are used in the winter through spring. No rotation system has been established for the allotment but the permittee do their best to move livestock around the allotment during their particular season of use. Three livestock operators (one cattle, two sheep producers) run livestock on the allotment with a total authorized grazing preference of 3,325 AUMs (3,325 active and 0 suspended AUMs). The allotment has a substantial amount of private land which the livestock users receive AUMs through EOU. The allotment has no designated pastures or use areas. All of the Antelope Range HA is located within the allotment and a small portion of the Trinity Range and Seven Troughs HAs are located in the southern portion of the allotment, while a small portion of the Eugene Mountains HA is located on the east side of the allotment.

Ragged Top Allotment

The Ragged Top allotment is unique and different from all the other grazing allotments in the Winnemucca District; at the present time it does not have a grazing system or any BLM AUMs associated with it. All grazing that occurs on the allotment in the form of EOU from two sheep producers. The two livestock operators run sheep on the allotment with a total authorized EOU of 1,470 AUMs for the 2025/26 grazing season. Depending on their grazing leases these numbers could change yearly. Grazing occurs in the winter and early springs from 12/01 to 03/14. About half of the Trinity Range HA is situated in the northern half of the allotment.

Rye Patch Allotment

The current grazing system for the Rye Patch allotment was implemented through an Allotment Management Plan, season of use for the allotment is primarily winter through spring. Three livestock operators (two cattle and one sheep producer) run livestock on the allotment with a total authorized grazing preference of 2,811 AUMs (1,981 active and 830 suspended AUMs). The allotment has a total of two grazing pastures. The west Rye Patch pasture is within the Trinity Range HA and is the only pasture in the allotment included in the Complex. Cattle grazing occurs in the winter and early spring from 11/01 to 04/30 and the sheep grazing occurs in the late summer from 08/06 to 08/31.

Humboldt Valley

The current grazing system for the Humboldt Valley allotment was implemented through the MFP in 1982. No rotation system has been established for the allotment but the permittee do their best to move livestock around the allotment during their particular season of use along with changing their grazing patterns from one year to the next to avoid grazing the same area at the same time every year. Four livestock operators run cattle on the allotment with a total authorized grazing preference of 2,910 AUMs (2,905 active, 5 suspended). Cattle grazing occurs from 03/01 to 7/15 and 10/24 to 2/28. The allotment has a substantial amount of private land which the some of the livestock users receive AUMs through EOU. The allotment has no designated pastures or use areas. Most of the Eugene Mountains HA is located in the southern portion of the allotment.

All of the 7 grazing allotments within the Complex gather area have multiple livestock water developments (e.g., wells, troughs and dirt reservoirs) that have been authorized by the BLM and are maintained under a cooperative agreement with the livestock operators who are held responsible for the maintenance and upkeep. There are also a handful that are developed on private property in and near both HMAs and HAs as well as areas outside of these boundaries. These water developments are important sources for livestock, WH&Bs and wildlife. In the past, these developed water sources have also been insufficient to maintain WH&Bs in excess of AML. Privately developed range improvements outside of HMAs are being increasingly used by WH&Bs. Livestock are currently experiencing direct competition by WH&Bs for available forage and water, both within the HMAs as well as outside the HMA boundaries in areas that are not designated for WH&B management.

Environmental Effects

No Action Alternative- Under the No Action Alternative, there would be continued competition with excess numbers of WH&Bs for limited water and forage resources. Uncontrolled WH&B population growth would lead to degradation of rangelands and forage resources which would reduce the respective grazing allotment potential to support livestock grazing. As WH&B numbers continue to increase, livestock grazing within the allotments located in the Blue Wing Complex may necessitate yearly requests by the BLM or continued voluntary reductions by the permittee for livestock to slow the deterioration of the range to the greatest extent possible.

Proposed Action- Past experience has shown that WH&B gather operations have few direct impacts to cattle and sheep grazing. Livestock located near gather activities would be temporarily disturbed or displaced by the helicopter and the increased vehicle traffic during the gather operation. Typically, livestock would move back into the area once gather events conclude. Under the Proposed Action, competition between livestock and WH&Bs for water and forage resources would be reduced over time. Forage availability and quality would improve over time as the WH&B population is reduced to low AML. These effects would be extended by population growth control measures.

The proposed development of Unnamed Spring 78-40 is expected to have a minor effect on livestock grazing in the immediate area as it would simply move the location of the water approximately 1.75 miles away from current developed livestock water at Porter Springs. Cattle have been observed watering at Unnamed Spring 78-40 when surface water is available, but Porter Springs (a developed Range Improvement Project) is only approximately 0.25 miles away and a much larger source of water for livestock. Creating a developed water source at the proposed water development location could eventually distribute livestock in the area as the next reliable developed livestock water source currently from Porter Springs is Vernon Well, approximately 5 miles to the east on the other side of the Seven Troughs Range Mountains.

Alternative B –Impacts would be similar to those of the Proposed Action.

Alternative C – Impacts would be similar to those of the Proposed Action, but to a lesser extent.

Cumulative Impacts

Impacts to livestock grazing within the Blue Wing Complex have resulted from past and present actions such as disturbances from road construction and maintenance, agriculture, wildfire, OHV use and recreation, powerlines and other right-of-way actions, and WH&B management. These disturbances have contributed to changes in vegetation communities, habitat degradation, fragmentation, and an increased risk of non-native species invasion.

The cumulative impacts from the Proposed Action of managing WH&Bs at different population levels and different reproductive rates over time, in combination with past, present, and RFFAs, would have varying effects on livestock grazing and their shared use of resources.

When WH&Bs populations are managed to low AML, long-term benefits to rangeland resources and vegetation would be expected to occur by reducing pressures and fostering ecosystem recovery. Livestock grazing operations with the Complex and gather area would benefit from reduced WH&B population sizes and reduced competition between these two uses. Multiple use relationship between WH&B management and livestock grazing would be expected to improve.

The combined effects of the Proposed Action and other past, present, and future activities would allow vegetation communities to recover and enhance their resilience to future disturbances. Healthier, more diverse plant communities would be better equipped to withstand environmental stressors such as prolonged drought, increased wildfire severity, invasive species encroachment, and insect/disease outbreaks. Additionally, improvements in vegetative cover and soil stabilization would reduce erosion, increase water retention, and create more favorable conditions for the long-term survival of rangeland resources, which would in turn benefit livestock grazing.

No Action Alternative- Under the no action alternative, WH&B populations would continue to increase. This continually increasing competition for available forage and water resources would lead to increased resource utilization and increased likelihood of rangeland degradation. Where site-specific vegetation management objectives are not being achieved, they would likely continue to not meet objectives. Where objectives are being met, it is possible they would change to not achieve vegetation management objectives. Opportunities to improve rangeland resources and vegetation, by bringing the WH&B population to AML and reducing resource competition and utilization, would be more challenging to achieve.

Proposed Action and Alternative B- Under the Proposed Action, WH&B populations would be maintained at or near AML for the longest amount of time, compared to Alternative C. This would reduce excess pressure from WH&Bs on the shared forage and water resources. Over time this would likely aid in the increased potential for meeting vegetation management objectives and allow for the multiple use management of livestock grazing.

Alternative C- The cumulative effects of Alternative C would be similar to the Proposed Action and Alternative B, but they would not be as long lasting because the reproductive rates of the WH&B would not be reduced or controlled.

3.9 Wilderness Study Areas and Lands with Wilderness Characteristics

Affected Environment

3.9.1 Wilderness Study Areas (WSA)

The BLM's management policy is generally to continue resource uses on lands identified as WSAs in a manner that maintains the area's suitability for preservation as wilderness until Congress determines whether the areas should be designated as wilderness or released from further study. Actions occurring within WSAs must meet the non-impairment standard, or fall under one of the few exceptions (BLM Manual 6330). The non-impairment standard requires the proposed action to be temporary and prevents the action from creating new surface disturbance.

The Selenite Mountains and Mt. Limbo WSAs occur within the Blue Wing Complex (See Map 4 in Appendix I). These WSAs total approximately 56,816 acres and are located primarily in the Selenite and Lava Beds HAs and within the Shawave Mountains HMA (See Table 11).

Table 11. HMA/HA acreage within Wilderness Study Areas

Wilderness Study Area	Total Acres	HMA / HA	% of WSA in HMA or HA
Selenite Mountains	31,955	Lava Beds HA Selenite HA	11% 89%
Mt. Limbo	24,861	Shawave Mountains HMA Selenite HA	1% 99%

The Selenite WSA is mainly comprised of three landforms: 1) the main ridge axis, 2) the narrow fringing desert piedmont on the northwest side and 3) the footslope on the southeast side. Activities that affect the area's naturalness include rangeland management and a number of vehicle ways (permitted vehicle travel routes). The area is not conducive to outstanding opportunities for solitude around the periphery of the WSA. Solitude characteristics increase towards the center of the WSA, particularly near Selenite Peak. The WSA does provide outstanding opportunities for primitive and unconfined recreation. WH&B viewing is considered one type of recreational activity in the area.

Mt. Limbo WSA provides outstanding opportunities for solitude based on the area's granitic ridge crest section and rocky outcrops. Vegetation provides a small amount of screening for visitors. Outstanding opportunities for primitive and unconfined recreation exist. Like the Selenite WSA, WH&B viewing is considered a recreational activity in the area.

For a complete description of the WSAs, including detailed information of wilderness characteristics, refer to the Nevada Wilderness Study Area Notebook (April 2001).

3.9.2 Lands with Wilderness Characteristics

The BLM is required by FLPMA to maintain, on a continuing basis, an inventory of all public lands and their resources and other values, which includes wilderness characteristics. Lands with wilderness characteristics (LWC) are defined by the Wilderness Act of 1964 as land that "(1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value."

In accordance with BLM Manual 6310 *Wilderness Characteristics Inventory,* an inventory identifies any unit of land with at least 5,000 roadless acres or otherwise meeting criterion (3), then determines if that unit meets criteria (1) and (2). Lands meeting all these criteria are considered to have wilderness characteristics. Based on wilderness inventory data (BLM 1979, 2024), the Blue Wing Complex and proposed gather area overlaps 23 areas that meet LWC criteria. These LWC units cover 270,858 acres, which is approximately 11% of the Blue Wing Complex and Gather Area. See Map 5 in Appendix I for locations.

Environmental Effects
No Action Alternative – Under the No Action Alternative, no direct impacts to WSAs or LWC units would occur. However, indirect impacts to the naturalness of these areas could be affected through the continued population growth of WH&Bs. The WSAs currently receive slight-moderate use by WH&B during certain times of the year. Increasing WH&B populations would be expected to further degrade the condition of vegetation and soil resources within the WSAs and LWC units. The sight of heavy horse trails, trampled vegetation and areas of high erosion would continue to detract from a visitor's experience within WSAs and/or LWC units.

Proposed Action – Impacts to opportunities for solitude could occur during gather operations due to the possible noise of the helicopter and increased vehicle traffic around the WSAs and LWC units. Those impacts would be temporary and would cease when gather operations conclude. No surface impacts within the WSAs are anticipated to occur during gather operations since all gather sites and holding facilities would be placed outside WSAs. The non-impairment standard for WSAs would be met due to the proposed action being temporary and non-surface disturbing. Wilderness characteristics of naturalness would remain at or near the current condition. Under the Proposed Action, naturalness of WSAs and LWC units would likely see more improvement over time since WH&B populations would be gathered in increments and growth rates would be less under this alternative.

Alternative B – Impacts from this alternative would be similar to the Proposed Action. This Alterative would be more effective at improving the naturalness characteristic of WSAs and LWC units than Alternative C.

Alternative C – Impacts from this alternative would be the similar to the Proposed Action. Overall, this alternative would be the least effective at improving the naturalness characteristic of WSAs and LWC units because there would be no fertility control, sex ratio adjustments, or mare sterilization/gelding to help slow population growth. This Alternative would be less effective at improving the naturalness characteristic than Alternative A, and slightly less effective than Alternative B.

Cumulative Impacts
Impacts to WSAs and LWC units from past actions such as road development/improvement, grazing, range improvements, recreation and OHV use have been accounted for through the development of the 2001 Nevada WSA Notebook and LWC inventories. Impacts from present and future actions are similar and should be limited to outside of the WSA boundary.

LWC units within the Winnemucca District are managed to meet multiple use and sustained yield objectives (WD RMP LWC 1.1). LWC units may have impacts from past, present, and future actions. WH&B gather operations have occurred in the past and would likely continue into the reasonably foreseeable future. Impacts of these operations usually have temporary negative impacts to solitude during operations but have long term beneficial effects to naturalness.

No Action Alternative- The cumulative impacts from the No Action Alternative, in addition to past, present, and RFFAs would have no temporary negative impacts to solitude during operations but would have negative impacts to naturalness.

Proposed Action, Alternative B and Alternative C - The cumulative impacts from the Proposed Action, in addition to past, present and reasonably foreseeable future actions would have temporary negative impacts to solitude during operations but would have beneficial impacts to naturalness.

3.10 Noxious Weeds and Invasive Non-Native Species

Affected Environment
Noxious and invasive weed species are aggressive, nonnative, ecologically damaging, undesirable plants, which displace native plant communities; therefore, reducing biodiversity, forage quality, wildlife habitat, and overall health and resilience of the ecosystem. Because of their aggressive nature, noxious and invasive weeds can readily invade, outcompete, and displace established plant communities following ground-disturbing activities. In addition, new populations can become established when the seeds hitchhike on equipment, vehicles, and people.

Nevada has listed 47 non-native invasive plant species that require control; see Appendix VIII, Noxious Weed List. These weeds usually occur in a variety of habitats including road side areas, rights-of-way, wetland meadows, as well as undisturbed upland rangelands. Hoary cress (*Cardaria draba*), medusahead (*Taeniatherum caput-medusae*), scotch thistle (*Onopordum acanthium*), Canada thistle (*Cirsium arvense*), Russian knapweed (*Acroptilon repens*), and perennial pepperweed (*Lepidium latifolium*) have been chemically treated within the gather area.

In general, noxious and invasive plant species are disturbance-driven, early successional species. Infestations of exotic annual forbs and grasses are present primarily in areas with an altered disturbance regime, such as areas that have been previously overgrazed or have burned from wildfire. Exotic forb species include clasping pepperweed (*Lepidium perfoliatum*), tumble mustard (*Sisymbrium altissimum*), halogeton (*Halogeton glomerata*), and Russian thistle (*Salsola tragus*). Cheatgrass (*Bromus tectorum*), an invasive annual, has become the dominant grass in the gather area (Peterson 2006). This species can be spread in wild horse feces (King et al. 2019). Cheatgrass dominance increases on fan piedmonts, generally ranging from 11 to 30 percent cover. Cheatgrass cover decreases on the lake plains (greasewood sites), generally ranging from 0 to 10 percent. Higher elevations cheatgrass cover is generally 0 to 5 percent. However, the entire project area has not been inventoried for the presence of invasive non-native species, and it is not feasible to do so given the large size of the project area.

Environmental Effects
No Action Alternative- Under the No Action Alternative, no impacts from WH&B gather events would occur, and WH&B populations would remain over AML. Impacts associated with WH&B use above AML (such as overgrazing and increased hoof action) would result in the continued proliferation of noxious and invasive weeds, as these species colonize newly disturbed sites, outcompeting and displacing native plant communities.

Proposed Action and Alternatives B and C- The proposed gather events could contribute to increased spread of existing noxious and invasive species in the short term. The disturbance associated with gather events would create favorable conditions for early successional species. Furthermore, the human presence during gather activities could also contribute to the spread of weeds, primarily through seed transport by vehicles and equipment. However, adoption of best management practices and standard operating procedures outlined in the Winnemucca District RMP would mitigate these short-term risks. The contractor, together with the contracting officer's representative or project inspector (COR/PI), would examine proposed gather sites and holding corrals for noxious and invasive weed populations prior to construction. If noxious weeds are found, the location of the facilities would be moved. Vehicles and other equipment would be checked for plant material and cleaned before leaving weed infested areas and prior to entering/leaving a project area. All gather sites, holding facilities, and camping areas on public lands would be monitored for weeds during the next several years. Despite short-term risks, the long-term reduction in WH&B numbers and the subsequent recovery of the native vegetation would result in fewer disturbed sites that would be susceptible for non-native plant species to invade. By reducing WH&B populations to AML, the proposed action would help improve rangeland health over time. Since there is an inverse correlation between rangeland health and the prevalence of noxious and invasive weeds, healthier rangelands would be more resilient to weed pressure, limiting the establishment and spread of invasive species in the long term.

Cumulative Impacts
Proposed Action, Alternative B and Alternative C- Past and present disturbances within the Blue Wing Complex and gather area, including wildfire, livestock grazing, road and infrastructure development, OHV use, recreation, agriculture, and WH&B use, have contributed to the establishment and spread of noxious and invasive weed species. These disturbances have led to increased soil exposure, loss of native vegetation, and recurring ecological disruptions, all of which provide openings for invasive species to establish and expand. In particular, large-scale wildfires have favored cheatgrass dominance, creating a positive feedback loop where increased fire frequency further suppresses native perennials and facilitates the expansion of invasive annual grasses.

While the Proposed Action would help mitigate some of these pressures over time by reducing WH&B populations to AML, thereby lessening chronic overgrazing and trampling, these benefits would not fully counteract the broader trend of invasive species expansion driven by decades of land use changes, altered fire regimes, and persistent disturbances. Short-term soil disturbance from gather events may also create localized opportunities for invasive species. Adoption of best management practices (BMPs) and Standard Operating Procedures (SOPs)—such as pre-gather weed inspections, equipment cleaning protocols, and post-gather monitoring—would help reduce these risks. However, given the extent of ecological alterations, invasive species are likely to remain a persistent challenge, and achieving historical rangeland conditions is likely not feasible.

While achieving historical rangeland conditions is likely not feasible given the extent of ecological alterations, long-term reductions in WH&B populations would help stabilize native plant communities, improve rangeland resilience, and slow the establishment and spread of invasive species. Healthier, less-disturbed rangelands would have greater resistance to future invasions and better capacity to recover from disturbances such as wildfire, drought, and continued land use pressures.

No Action Alternative- Under the No Action Alternative, WH&B populations would remain above AML, exacerbating existing pressures on native plant communities. Combined with past, present, and reasonably foreseeable future disturbances—including wildfire, livestock grazing, road and infrastructure development, OHV use, recreation, WH&B use, and agriculture—the No Action Alternative would sustain conditions that promote disturbance and thus the expansion of noxious and invasive weeds. WH&B overpopulation would continue to displace native vegetation, increase soil disturbance, and create openings for invasive species to establish and spread. In particular, disturbed and degraded sites would remain vulnerable to further cheatgrass expansion, perpetuating a cycle of increased fire frequency, reduced abundance and diversity of vegetation, and declining ecosystem function. Over time, the cumulative effects of ongoing disturbances without reducing WH&B populations would lead to a continued expansion of invasive species, reducing native vegetation, wildlife habitat, livestock forage, and overall rangeland health.

3.11 Vegetation

Affected Environment

The vegetative plant communities within the Blue Wing Complex and gather area vary from salt desert shrub communities at lower elevations to big sagebrush/bunch grass communities at higher elevations. Typical species at lower elevations include shadscale saltbush (*Atriplex confertifolia*), bud sage (*Picrothamnus desertorum*), winter fat (*Krascheninnikovia lanata*), black greasewood (*Sarcobatus vermiculatus*), squirreltail (*Elymus elymoides*), and Sandberg's bluegrass (*Poa secunda*). Species typical in mid to higher elevations include Basin big sagebrush (*Artemsia tridentate tridentata*), Wyoming big sagebrush (*Artemsia tridentata wyomingensis*), mountain big sagebrush (*Artemisia tridentata vaseyana*), low sagebrush (*Artemisia arbuscula*), bitterbrush (*Purshia tridentata*), rabbitbrush (*Chrysothamnus spp.*), Utah juniper (*Juniperus osteosperma*), bluebunch wheatgrass (*Pseudoroegneria spicata*), basin wildrye (*Leymus cinereus*) and long leaf phlox (*Phlox longifolia*). The Blue Wing Complex and gather area contains 54 different ecological site descriptions (ESDs), as mapped by USDA. Dominant ESDs include Gravelly Loam 4-8 P.Z, Loamy 4-8 P.Z, Droughty Loam 8-10 P.Z., Stony Slope 4-8 P.Z, Droughty Claypan 8-10 P.Z., and Gravelly Claypan 8-10 P.Z., accounting for 61.2% of the project area. See section 3.10 for noxious and invasive species analysis.

Increasing utilization and trailing due to excess WH&Bs is occurring in the Blue Wing Complex and gather area and is reducing vegetative cover and vigor, particularly in those areas immediately adjacent to water sources. The reduction of vegetative cover and increased trampling, resulting from higher WH&B numbers, has led to increased soil compaction, erosion, reduced organic matter content, and accelerated run off. WH&Bs are uneven grazers, meaning that they do not always graze an area in its entirety before moving on to another. Areas where they do graze have been noted to have a lower abundance of cover grasses, lower shrub cover, lower total vegetative cover, lower species richness, and less continuous shrub canopy (Beever and Herrick 2006).

Environmental Effects

No Action Alternative- Under the no action alternative, no direct impacts to vegetation resources from gather events would occur. WH&B populations would remain over AML and populations levels would continue to grow. The impacts to vegetation through grazing or trampling would increase proportionally to WH&B population levels, leading to deteriorations in plant vigor, diversity, abundance, reproductive success, and overall ecosystem resilience and stability (Burdick, J., S. Swason, S. Tsocanos, and S. McCue 2021). These impacts would make plant communities more susceptible to external stressors such as drought or insect/disease damage. Although overgrazing can singularly lead to plant mortality, it is a more likely outcome when compounded by multiple negating factors. Loss of desirable forage species would lead to increases in less desirable species and it would continue to shift vegetative communities away from the site's historic and potential condition. Over time, forage resources would become less available, impacting WH&B herd health, and WH&Bs would be more susceptible to disease and drought.

Proposed Action- The proposed action is expected to have a temporary effect on vegetative resources including trampling of vegetation by WH&Bs at gather sites and holding locations; and crushing of vegetation by vehicles, temporary corrals, and holding facilities. Gather corrals and holding facility locations are usually placed in previously disturbed sites (e.g. gravel pits) which are easily accessible to livestock trailers and standard equipment and that use existing roads. No new roads would be created. Short term impacts to vegetation as a result of the proposed action would be minor, localized, and temporary. Vegetation would be expected to rebound and fully recover within subsequent growing seasons. Noxious and invasive species are analyzed in Section 3.10.

A small amount of vegetation would be removed (approximately 1.2 acres) from permanent surface disturbance from the exclosure construction and trough placement. There would be temporary surface disturbance from the proposed pipeline, which would result in approximately 2.6 acres of vegetation removal. However, after the pipeline is installed, vegetation would be expected to grow back. These impacts are expected to be temporary, minor, and localized given the relatively small affected area. While the vast majority of the affected vegetation would be expected to rebound and fully recover within subsequent growing seasons, there would be permanent surface disturbance at location of exclosure boundaries and trough. However, the footprint of this permanent disturbance is negligible and would therefore have no impact to overall rangeland health and functionality. The riparian vegetation around the spring source would be expected to grow back once the exclosure is in place because WH&B access to the spring would be restricted.

Achieving and maintaining the established AML would benefit the vegetation by reducing the effects of excess grazing pressure and trampling on the forage resources. The long-term effects of the proposed action would help maintain and improve vegetation health, vigor, diversity, and composition by reducing WH&B populations, creating conditions for vegetation to grow, recover, and reproduce.

Alternative B- Impacts from this alternative would be similar to the Proposed Action. This alternative would be more effective at improving vegetation and associated habitat than Alternative C.

Alternative C- Impacts from this alternative would be the similar to the Proposed Action. Overall, this alternative would be the least effective at improving vegetative communities because there would be no fertility control, sex ratio adjustments, or mare sterilization/gelding to help slow population growth. This Alternative would be less effective at improving vegetation and associated habitat conditions than Alternative A and Alternative B.

Cumulative Impacts

Proposed Action, Alternative B and Alternative C- Impacts to vegetation within the Blue Wing Complex and gather area have resulted from past and present actions such as livestock grazing, road construction and maintenance, agriculture, wildfire, OHV use and recreation, powerlines and other right-of-way actions, and WH&B use. These disturbances have contributed to habitat degradation and an increased risk of non-native species invasion. The cumulative impacts from the Proposed Action and Alternatives, in combination with past, present, and RFFAs, would provide long-term benefits to vegetative communities by mitigating these pressures and fostering ecosystem recovery.

The combined effects of the Proposed Action and Alternatives, and other past, present, and future activities would allow vegetative communities to recover and enhance their resilience to future disturbances. Healthier, more diverse plant communities would be better equipped to withstand environmental stressors such as prolonged drought, increased wildfire severity, invasive species encroachment, and insect/disease outbreaks. Additionally, improvements in vegetative cover would reduce erosion, increase water retention, and create more favorable conditions for the long-term survival of plant communities within the Blue Wing Complex and gather area.

No Action Alternative- The cumulative impacts from the No Action Alternative, in addition to past, present, and RFFAs, would result in continual degradation of vegetative resources. With WH&B populations remaining above AML, competition for forage resources would persist. Vegetative resources would continue to deteriorate due to overgrazing, trampling, and the spread of invasive species. As a result, the resilience of plant communities to external stressors such as drought, insect/disease pressure, and wildfire would be significantly reduced. The ongoing degradation of these habitats would also diminish ecosystem function, reducing the long-term abundance, diversity, and resilience of vegetation within the Blue Wing Complex.

3.12 Soils

Affected Environment
The majority of soils contained in the Blue Wing Complex and gather area are cold desert soils developed under low precipitation with low organic matter content – Aridisols, Entisols, and Mollisols are dominant soil orders. Many Aridisols and Entisols are fine textured – sandy soil types – with severe wind and water erosion potential when disturbed. These soils typically have a mesic or frigid temperature regime and aridic soil moisture regime. Mollisols are relatively more productive soils with higher organic matter and clay content, making them somewhat less susceptible to erosion. Isolated patches of productive hydric soils are present near water resources. Loss of topsoil from these cold desert soils leads to severe reductions in soil organic matter content, available moisture, and overall productivity, resulting in the inability to support native plant populations. Given the large size of the Blue Wing Complex and gather area, a detailed soil report for the project area is not feasible. However, detailed information for these soils can be found in applicable U.S. Department of Agriculture soil survey publications and are available at https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx.

Environmental Effects
No Action Alternative- Under the No Action Alternative, soils would continue to have WH&B use and as WH&B populations increase, heavy trailing and trampling around water sources and foraging areas would occur (Burdick, J., S. Swason, S. Tsocanos, and S. McCue 2021). Continued WH&B use would limit topsoil development, displacing native plant communities and degrading soil processes. Soils would be more susceptible to erosion and compaction, while moisture holding capacity, aggregate stability, and organic matter content would decrease. Degradation of soil health may reduce associated vegetation abundance and diversity. See 3.7 for Special Status Plant and Section 3.11 for vegetation analysis.

Proposed Action- Under the Proposed Action, project implementation would stay on existing roads, washes and horse trail areas, and would disturb relatively small areas used for gathering and holding operations. WH&Bs may be concentrated for a limited period of time in traps. Areas of concentrated WH&B use would have increased soil compaction and erosion. Due to the limited time period of this disturbance, soil impacts are expected to be minor and temporary. Surface disturbance and compaction would be expected at exclosure, pipeline, and trough construction sites. Given the small footprint of these sites, impacts would be negligible. The Proposed Action would result in WH&B being managed within AML, WH&B population growth rates would lessen, and WH&B use would be better distributed across the resource which would result in improved soil conditions over time.

Alternative B- Impacts from this alternative would be similar to the Proposed Action. This alterative would be more effective at improving soil processes than Alternative C.

Alternative C- Impacts from this alternative would be the similar to the Proposed Action. Overall, this alternative would be the least effective at improving soil conditions because there would be no fertility control, sex ratio adjustments, or mare sterilization/gelding to help slow population growth. This Alternative would be less effective at improving soil processes than Alternative A and Alternative B.

Cumulative Impacts
Proposed Action, Alternative B and Alternative C- Impacts to soils within the Blue Wing Complex and Gather Area have resulted from past and present actions such as grazing, road construction and maintenance, OHV use and recreation, mining and processing activities, aggregate operations, public land

management activities, and wildland fire.

Impacts to soils from RFFAs would be similar to those described above for past and present actions, as these activities are expected to continue. Direct cumulative impacts from the Proposed Action would include the short-term incremental impact of disturbance and compaction from hoof action around WH&B corrals, and development of unnamed spring 78-40 including laying of pipeline for water distribution. The Proposed Action and Alternatives would provide long-term benefits to soil resources by mitigating pressures and fostering ecosystem recovery. The combined effects of the Proposed Action and other past, present, and future activities may improve soil health and associated vegetation abundance and diversity. The long-term incremental impact to soil resources would be positive as the number of WH&Bs are decreased with gather events over time, and localized pressures around springs are distributed. This would result in improved soil structure and biological function including decreases in compaction, erosion, and aggregate instability and increases in organic matter content, available moisture, and soil organism habitat.

No Action Alternative- The cumulative impacts of the No Action Alternative, in combination with past, present, and reasonably foreseeable future activities—such as wildfire, noxious and invasive species encroachment, livestock grazing, road and infrastructure development, OHV use, recreation, agriculture, and WH&B overpopulation—would contribute to the continued degradation of soil health across the landscape. Decades of disturbance from these activities have led to increased soil compaction, erosion, and runoff as well as reduced organic matter, aggregate stability, and soil organism habitat. As WH&B populations remain above AML and continue to grow, the intensity of overgrazing and trampling impacts would increase, exacerbating soil degradation. Areas around water sources, foraging zones, and WH&B travel corridors would continue to experience heavy trailing and trampling, further limiting topsoil and soil structure development. Over time, the continued disturbance combined with WH&B overpopulation would result in further soil degradation, reducing the land's ability to support healthy vegetation and ecosystem function.

3.13 Cultural Resources

Affected Environment

A range of prehistoric and historic sites are located within the Blue Wing Complex and adjoining territory. The Complex contains a complex array of cultural resources representing the remains of human habitation dating from perhaps 10,000 years ago to recent historic times. In addition to the vast depth of time represented by these resources, a wide breadth of prehistoric and historic behaviors are also indicated including hunting and gathering, trade and exchange, mining, ranching, and transportation. While archaeologists have studied some aspects of these activities, many more are not well understood.
The evaluation of known archaeological sites indicates that many contain information that can be used to address questions that can aid in our understanding of these lesser-known aspects of past human behavior. Further inventory would undoubtedly reveal the existence of many more properties of important research value. In most cases, these sites are the only sources of information available to archaeologists in their efforts to understand the past and are, thus, valuable non-renewable resources. Many of the cultural sites in the gather area were initially recorded decades ago. Many additional sites remain to be discovered and recorded in the future. All National Register of Historic Places eligible or unevaluated sites would be avoided under all alternatives.

Environmental Effects

No Action Alternative- Indirect impacts to cultural resources resulting from WH&Bs trampling as described above would increase as populations continue to grow and concentrate at riparian areas. These impacts to cultural resources would occur more frequently and with greater intensity as herd sizes increase.

Proposed Action- Direct impacts to cultural resources would not be anticipated because gather sites, temporary holding facilities, and bait/water traps would be placed in previously disturbed areas, previously inventoried areas with no cultural resources, or would be inventoried for cultural resources prior to construction. Any location where cultural resources are encountered would not be utilized unless the trap or holding site configuration could be repositioned to avoid impacts to cultural resources. In addition, no traps, holding facilities or staging areas would be located along or adjacent to segments of the California National Historic Trail and the Applegate National Historic Trail rated as Class I, II, or III.

Areas in the vicinity of permanent and intermittent water sources (i.e., riparian areas) have the highest potential for cultural resources. Since WH&Bs concentrate in these areas, soils are likely to be compacted, increasing runoff and subsequently increasing erosion. This has the potential to disturb surface and subsurface deposits containing cultural resources. By reducing the population growth rate and bringing the population back to AML over an extended period of time, the Proposed Action would lead to a reduction of indirect impacts to cultural resources in riparian areas over time. Development of Unnamed Spring 78-40 would be confined to existing areas of disturbance (i.e. road right of way). Modifications requiring disturbance outside the existing area of disturbance would require a site- specific cultural resource clearance. If cultural resources are found within the area of potential effect, the proposed water development project would be relocated or redesigned so there are no negative impacts to those resources.

Alternative B- Impacts would be similar to the Proposed Action.

Alternative C- Impacts would be similar to the Proposed Action.

Cumulative Impacts

Cumulative Impacts

Impacts to cultural resources within the Complex have resulted from past and present actions such as grazing, range improvements, fire suppression activities, road construction/maintenance and accompanying gravel pits, OHV use and recreation, looting, and WH&Bs. Achieving and maintaining WH&Bs at AML under any of these alternatives would improve environmental conditions in riparian areas, which in turn, would decrease potential impacts to cultural resources. Since there would be a slight improvement to the ecological condition of these areas over time, the health and vigor of certain plants used by Native Americans may improve accordingly.

No Action Alternative- Under the No Action Alternative, impacts to cultural resources from OHV use, range improvements, fire suppression activities, or looting, would continue to increase damage to cultural resources. WH&Bs populations would not be managed, leading to over grazing and exacerbation of natural erosional processes, which, in turn, could impact cultural sites.

Proposed Action, and Alternative B and Alternative C- The cumulative impacts from the Proposed Action and Alternatives, in addition to past, present and RFFAs would be beneficial for cultural resources. Development of unnamed spring 78-40 would be conducted in such a way so as to avoid short-term impacts to cultural resources. Over the long-term, constructing an exclosure as part of the spring development would serve to protect any cultural resources in the riparian area from future disturbance from a variety of activities.

3.14 Native American Religious Concerns

Affected Environment

The Blue Wing Complex and gather area lies within the traditional territory of Northern Paiute and the Western Shoshone peoples. Tribal consultation is ongoing and responses to these contacts are pending.

Environmental Effects

No Action Alternative- There would be no new direct impacts under this alternative. WH&B populations above AML would continue to impact plants and springs through forage use, trampling of riparian areas and water use. This would substantially reduce the regeneration of riparian vegetation, including plants used by Native Americans, and would lead to accelerated erosion and deteriorated hydrologic function over time. The Vegetation and Wetlands and Riparian Zones sections in this document provide additional information on these topics.

Proposed Action- Indirect impacts to plants in riparian zones used by Native Americans for medicinal and other purposes, and impacts to springs considered sacred by Native Americans, would be reduced slightly as WH&B populations are brought within AML. Development of unnamed spring 78-40 would provide localized protections to plants within the proposed exclosure. Reduced use of riparian zones by WH&Bs is anticipated to allow regeneration of riparian vegetation which would lead to decreased erosion and restored hydrologic function over time. The reduction of WH&B populations from current levels would decrease sediment, nutrients, and bacteria in surface waters and would result in increased residual vegetation—potentially plants traditionally used by Native Americans. There would be potential for an immediate reduction of impacts to plants and springs due to initial and subsequent gathers and removals of WH&BSs over time. Fertility control measures in conjunction with multiple gathers and removals under the Proposed Action would reduce impacts to plants and springs over the life of the project.

Alternative B- Impacts would be similar to the Proposed Action.

Alternative C- Impacts would be similar to the Proposed Action.

Cumulative Impacts

Impacts to Native American Religious Concerns within the Complex have resulted from past and present actions such as homesteading, livestock grazing, mineral extraction, lands and realty actions, mining, recreation, WH&Bs, WSA designation, and wildfire.

No Action Alternative- Under the No Action Alternative, impacts from mining, OHV use, livestock grazing, or wildfire activity, along with past, present, and RFFAs would continue to degrade resources important to Native Americans. WH&B populations would not be managed within AML and substantial increases in WH&B numbers would lead to over grazing, possibly exacerbating natural erosional processes which could impact resources important to Native Americans.

Proposed Action- Indirectly, the WH&B population management goals outlined under the Proposed Action would result in decreased impacts to vegetation and springs important to Native Americans. Since there would be a slight improvement to the ecological condition over time, the health and vigor of certain plants used by Native Americans would improve accordingly.

Alternative B- Impacts under this alternative would be similar to those of the Proposed Action.

Alternative C- Impacts under this alternative would be similar to those of the Proposed Action and Alternative B, but to a lesser extent.

3.15 Public Health and Safety

Affected Environment
Many members of the public travel to public lands to observe BLM's gather events in Nevada. Public observers have ranged in number from 1 individual to 25 individuals depending on the day and location of the gather activities. At these numbers, BLM has determined that the current level of public visitation to gather operations falls below the threshold of an "open air assembly" under 14 CFR § 91.119.
The BLM is committed to allowing access by interested members of the public to the fullest possible degree without compromising safety or the success of operations. To minimize risks to the public from helicopter operations, a gather Contractor is required to conduct all helicopter operations in a safe manner, and to comply with FAA regulations 14 CFR § 91.119 and BLM IM No. 2010-164. The Blue Wing Complex Gather Observation Protocol found in Appendix V. The Blue Wing Complex Gather Observation Protocol provides the public with the opportunity to safely observe gather operations.

Environmental Effects
No Action Alternative- There would be no gather related safety concerns for BLM employees, contractors or the general public as no gather activities would occur under the No Action Alternative.

Proposed Action, Alternative B and Alternative C- Public safety for the BLM and contractor staff is always a concern during gather operations and is addressed through the implementation of Blue Wing Complex Gather Observation Protocol (Appendix V) that has been used in recent gathers to ensure that the public remains at a safe distance and does not impede gather operations. Appropriate BLM staffing (public affair specialists and law enforcement officers) would be present to assure compliance with visitation protocols at the site. These measures minimize the risks to the health and safety of the public, BLM staff and contractors, and to the WH&Bs themselves during the gather operations.

When the helicopter is working close to the ground, the rotor wash of the helicopter is a safety concern for members of the public by potentially causing loose vegetation, dirt, and other objects to fly through the air, and can strike or land on anyone in close proximity and can cause decreased vision. Should a helicopter crash or have a hard landing it is possible that pieces of the helicopter can travel significant distances through the air, which can strike or land on anyone in close proximity. All helicopter operations must therefore be in compliance with distance restrictions set forth in 14 CFR § 91.119.

During the herding process, WH&Bs would try to flee if they perceive that something or someone suddenly blocks or crosses their path. Fleeing WH&Bs can go through wire fences, traverse unstable terrain, and go through areas that they normally do not travel in order to get away, all of which can lead them to injure people by striking or trampling them if they are in the animal's path.

Disturbances in and around the gather and holding corral have the potential to injure the government and contractor staff who are trying to sort, move and care for the WH&Bs by causing them to be kicked, struck, and possibly trampled by the animals trying to flee such disturbance. Such disturbances also have the potential to harm members of the public if they are in too close a proximity to the WH&Bs. The implementation of Blue Wing Complex Gather Observation Protocol (Appendix V) would ensure the safety of the public, BLM staff and contractors, and WH&Bs themselves during the gather operations.

Alternative B- Impacts would be similar to the Proposed Action.

Alternative C- Impacts would be similar to the Proposed Action.

Cumulative Impacts
No impacts to public health and safety have been identified from past, present, or RFFAs; therefore, cumulative impacts to public health and safety are not expected.

3.16 Recreation

Affected Environment

Recreation resources that exist in the area are mainly dispersed outdoor recreation and permitted recreation events such as Off Highway Vehicle (OHV) races, land sailing, rocket launching, and guided hunting. Other recreation uses include wildlife and WH&B viewing, photography, rock hounding, OHV use, hunting, boating, fishing, and camping. Recreation use levels range from low in winter, moderate in the summer, and peak in the spring and fall.

The Blue Wing Complex and gather area falls within:

- Four Nevada Department of Wildlife (NDOW) hunt units: 034, 035, 041, and 042 (see Appendix I, map 8). From August through November there are three big game hunting seasons (NDOW 2017): Mule Deer, Big Horn Sheep, and Pronghorn Antelope. From October through February is the upland game season for Chukar, Hungarian partridge, and quail. From September through December is the upland game season for blue and ruffed grouse.
- The Nightingale Special Recreation Management Area (SRMA) (see Appendix I, map 6). Per the 2015 Winnemucca RMP, the primary management strategy is to target the undeveloped recreation-tourism market demand for distinctive types of dispersed recreation in an open an undeveloped setting. Within the SRMA there are five Recreation Management Zones (RMZ): Zone 1 - Selenite Mountains/Mount Limbo Wilderness Study Areas (WSA), Zone 2 - Blue Wing and Shawave Mountains, Zone 3 - Blue Wing and Winnemucca Lake playa areas, Zone 4 - Porter Springs, and Zone 5 – primarily the area between the other zones.
- Portions of the Black Rock Desert – High Rock Canyon Emigrant Trails National Conservation Area and the California National Historic Trail.
- Rye Patch State Recreation Area managed by the State of Nevada.

Environmental Effects

No Action Alternative- No direct impacts would occur under this alternative. However, without any management actions, indirect impacts to recreational values would continue to intensify.

Proposed Action- Activities associated with WH&B gathers would impact recreational opportunities directly and indirectly. Timing of the gathers would determine the amount of impact to visitors as visitation levels vary throughout the year. Tourism revenues to the local community from recreationists would follow this trend as well. Hunters would be directly impacted by wildlife movements if the gather occurs during their hunts. Recreationists within the Complex during WH&Bs gather events may experience direct impacts from the sights and sounds of the helicopter, vehicles, traps, temporary corrals, and staging areas associated with the proposed action. These direct impacts would be expected to be temporary in nature and only during active gather events.

For some time following a gather, the ability to view/photograph WH&Bs might be reduced since WH&Bs could have a heightened response to human presence. Even though the density of WH&Bs in the area would be reduced, it could still be possible to view/photograph WH&Bs. The degree and timing of indirect impacts would vary under each alternative. The Proposed Action would aim to bring the total number of WH&Bs in the Complex back to within AML, which would reduce competition with wildlife for forage. Reduction of forage competition could improve wildlife populations size and health, which could indirectly benefit recreating hunters within the Complex over the life of the project. Recreationists may also be indirectly impacted at camping locations from excess WH&Bs. Therefore, management of WH&Bs within AML could improve the camping experience for recreationists within the Complex over the life of the project.

Alternative B - Recreation impacts would be similar to the Proposed Action.

Alternative C- Recreation impacts would be similar to the Proposed Action.

Cumulative Impacts
Per the 2015 Winnemucca RMP, the Nightengale SRMA and associated RMZs are managed to the undeveloped recreation-tourism market demand for distinctive types of dispersed recreation in an open an undeveloped setting. Past, current, and RFFAs within the Complex that have affected recreation include livestock grazing, WH&Bs, mining activities, changes in land and road access (from fences or other permitted activities), current NDOW wildlife management activities, and wildfires. Specifically, livestock grazing and WH&B use has caused impacts near waterways and campsites which indirectly impacts recreationists visiting the Complex and gather area. Wildfires within the Complex and gather area remove vegetation supporting wildlife that has supported hunting activities.

No Action Alternative- This alternative, along with the past, present, and RFFAs, would incrementally increase impacts to recreational resources through continued grazing, population increase of WH&Bs, and future wildfires.

Proposed Action, Alternative B and Alternative C- Reducing WH&Bs could reduce impacts to recreational activities; however, the impacts caused by livestock, the remaining WH&Bs, and other RFFAs would be expected to continue to impact recreational activities. Although there are minimal impacts of multiple-use activities to recreation within the Complex, these impacts would not be expected to be significantly different than the current activities impacting recreation.

3.17 Socioeconomics
Socioeconomics considerations include the value placed on the Blue Wing Complex WH&Bs that may contribute to the economy. At this time there are no registered guided tours or known sales of commercial pictures being sold to increase the value to the communities from the WH&Bs that reside within or outside the Blue Wing Complex. It is acknowledged that some people that drive through the general area may stop and view or photograph the WH&Bs contributing to the Complex's intrinsic value.

There can also be a negative impact on socioeconomics. These impacts may effect wildlife enthusiasts that hunt, photograph, and guide big game that have abandoned use of the area due to the poor condition from the overpopulation of WH&Bs. Although grazing permits have not been recently reduced as a direct result of the overpopulation of WH&Bs, the strain of excess WH&Bs on the land, as well as impacts from recent drought and fires, have cumulatively put a strain on many agricultural related businesses in the area.

It is not possible to quantify the revenue or losses attributable to the Blue Wing Complex WH&Bs. It is recognized that for local industries the excess WH&Bs cause a negative impact to resources and to many businesses that rely on healthy range conditions, and healthy wildlife in the area. It is also recognized that any revenue brought by tourism, and photography of WH&Bs in the Complex is unknown.

3.18 Fire/Fuels

Affected Environment
The Complex and gather area is located in areas that are dominated by vegetation consisting of Sagebrush ecological sites, Salt Desert Scrub and Greasewood communities (see Vegetation 3.11 for a detailed

description). Maintaining a balance of grazing animals and controlling the timing and amount of forage that is consumed each year by wildlife, livestock, and WH&Bs is crucial to maintaining healthy upland plant communities within the Complex. Appropriate grazing levels by large ungulates has been associated with the known effect of reducing the cover, density, and volume of fuels, particularly fine fuels, on the landscape (Schmelzer et al., 2014). In turn, this reduces the probability and severity of catastrophic wildfires. Within the shrub and grasslands of the Complex and surrounding areas, the fuel reducing benefits are known. Research has identified that grazing by many global herbivore species, including but not limited to horses, aids in the reduction of fuel loading and the impact of grazing by herbivores, including livestock, have long been recognized (Rouet-Leduc, 2021; Davies et al., 2010).

Year-round heavy grazing on upland vegetation from all ungulates reduces the overall amount of fuels available for wildfires but heavy grazing does not allow upland sites to recover from past disturbances and those areas are in danger of trending downward in ecological health and increasing in annual invasive grasses (Davies et al., 2024). Additionally, plant communities and sagebrush ecosystems that have been impacted in the past by wildfires and historic livestock grazing are vulnerable to losing more of their native perennial grass component when grazed at higher than moderate utilization levels (less than 60%) (USFS, 2017).

Excess grazing pressure shifts plant communities toward annuals versus perennials. This shift can result in increased fuels in the wet growing season years and that fuel load can persist to cause big fires in subsequent years. In the big growth years, the number of animals needed to control fuels is not sustainable in the normal or especially dry years. In the abundant fine-fuels years, the dispersal of animals causes minimal impact to fuels. To use animals to control fuels and reduce fire size, animals must be controlled to create fuel breaks. This is not possible with free-roaming WH&Bs.

Past and present fire history data within the Complex and gather area is characterized by relatively low occurrence with few large fires. This is characteristic of its rural location and sparse vegetation types. There have been 342 reported ignitions for a total of 578,599 acres over the last 45 years. The median fire size is 515 acres across the Winnemucca District and within the Bluewing Complex and gather area the median fire size has been 1,322 acres. The largest fire being the Poker Brown fire in 1999 at 231,398 acres. Over the last 25 years there have been no fires over 250,000 acres.

Environmental Effects

No Action Alternative- The No Action Alternative could be expected to result in a continued decrease of the overall availability of fuels, particularly fine fuels, within the Complex and surrounding area in the short term. However, it would result in a continued increase in the number of WH&Bs above AML, which would have compounding impacts upon upland vegetation composition and the potential for future fires. The continued overgrazing of the landscape could be expected to decrease the native grass component and increase the invasive non-native species across the landscape which would reduce the resistance and resiliency of the landscape to disturbance such as wildfires. The increase in invasive non-native species would promote a more frequent and intense fire cycle that would further reduce native species across the landscape.

Proposed Action- Scientific literature has continued to affirm that even though grazing reduces fuel loading, proper grazing management is critical for the advancement of land health characteristics (Copeland et al., 2023). Soil health, hydrologic function, and biotic integrity are all impacted differently depending on the location, timing, duration, and intensity of grazing management (Hennig et al., 2021). Properly managed grazing is critical to achieve reductions in fuel loads while curbing the expansion of invasive annual grasses, promoting native perennial species, and protecting sensitive riparian habitats. Research continues to indicate that a variable season of use contributes to site resiliency while repeated early-season, high intensity use, contributes to the degradation of rangelands and the expansion of annual grasses (Copeland et al., 2023; Davies et al., 2015; Davies et al., 2024). Moderate fall grazing of uplands has also been identified with the reduction of invasive annual grasses and the promotion of native perennial species (Copeland et al., 2023; Davies et al., 2010).

While the BLM is mandated to manage WH&Bs, the day-to-day movement of WH&Bs on the range is inherently unmanaged from a livestock management perspective (Davies & Boyd, 2019). With the exception of fencing, WH&Bs graze whatever location they want to, for whatever timing and duration they want to, and whatever intensity (amount) they want to. It is not possible to limit WH&B grazing so as to cause localized, targeted grazing in the same way that targeted livestock grazing has been used in some places to reduce fuel loads in a specific locale. In some natural systems, predation may restrict the location, timing, and duration of WH&B grazing, through what has been termed the 'landscape of fear.' However, WH&Bs face very limited predation in most herds, with relatively high population growth rates as a result (Garrott, 2018).

Under the Proposed Action, the numbers of WH&Bs would be reduced, and maintained at AML, which would result in a short-term increase in the volume of fine fuels throughout the Complex. This would be due to a reduction in total amount of forage consumed year-round by the WH&Bs on the Complex and surrounding areas. The increase of fuels available, especially during the late summer months, could result in a theoretical increase in wildfires. Conversely, the removal of excess WH&Bs may reduce the long-term increase in areas dominated by annual invasive grasses (cheatgrass). Reducing the amount of future area potentially dominated by annual invasive grasses and would theoretically reduce the amount and frequency of future fires.

Alternative B- Impacts of Alternative B would be similar to those of the Proposed Action.

Alternative C- Impacts of Alternative C would be similar to those of the Proposed Action.

Cumulative Impacts

No Action Alternative- Impacts to fuels within the Blue Wing Complex and gather area have resulted from past and present actions such as livestock grazing, road construction and maintenance, agriculture, wildfire, OHV use and recreation, powerlines and other right-of-way actions, and WH&B use. These disturbances have contributed to an increased risk of non-native species invasion, leading to reduced resistance and resiliency of the landscape to wildfires. Past, present, and RFFAs under the No Action Alternative would include a continued downward in ecological health and increase in annual invasive grasses associated with grazing pressure from excess WH&B populations. While this may reduce fine fuels over the short-term, a reduction of native understory species and an increase in non-native invasive species over the long term would be expected to lead to a shift towards a more frequent and intense fire regime, as favored by non-native invasive species such as cheatgrass.

Proposed Action- Impacts under the Proposed Action, in addition to past, present, and RFFAs, would promote appropriate grazing across the landscape while WH&B populations are managed within AML. This would be expected to increase fine fuels in the short term but would also lead to an increase in native understory species. This would increase the landscapes resistance to disturbance and resilience to change following disturbance, therefore maintaining a healthier landscape long term.

Alternative B- Impacts of Alternative B would be similar to those of the Proposed Action.

Cumulative Impacts of Alternative C- Impacts of Alternative C would be similar to those of the Proposed Action.

4.0 Cumulative Effects
Cumulative impacts are impacts on the environment which result from the incremental impact of the action when added to other past, present, and RFFAs regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. The area of cumulative impact analysis is the Blue Wing Complex and gather area. (Map 1, Appendix I).

According to the 1994 BLM *Guidelines for Assessing and Documenting Cumulative Impacts*, the cumulative analysis should be focused on those issues and resource values identified during scoping that are of major importance. Accordingly, the issues of major importance that are analyzed are maintaining rangeland health and achieving and maintaining AMLs.

Past, Present, and Reasonably Foreseeable Future Actions (RFFAs)
The past, present, and RFFAs applicable to the assessment area are identified as the following:

Project -- Name or Description	Status (x)		
	Past	Present	Future
Issuance of multiple use decisions and grazing permits for ranching operations through the allotment evaluation process and the reassessment of the associated allotments.	X	X	X
Livestock grazing	X	X	X
Land Use Authorizations and Right of Ways	X	X	X
Wild horse and burro gathers	X	X	X
Mineral exploration / Mining, geothermal exploration/abandoned mine land reclamation	X	X	X
Recreation	X	X	X
Range Improvements (including fencing, wells, and water developments)	X	X	X
Wildlife guzzler construction	X	X	X
Invasive weed inventory/treatments	X	X	X
Wild horse and burro management: issuance of multiple use decisions, AML adjustments and planning	X	X	X
Fuels reduction treatment projects (Chaining, tree shrub removal)	X	X	X

Any future proposed projects within the Blue Wing Complex would be analyzed in an appropriate environmental document following site specific planning. Future project planning would also include public involvement.

Past Actions
In 1971 Congress passed the Wild Free-Roaming Horses and Burros Act which placed wild and free-roaming WH&BSs, that were not claimed for individual ownership, under the protection of the Secretaries of Interior and Agriculture. In 1976 the Federal Land Policy and Management Act (FLPMA) gave the Secretary the authority to use motorized equipment in the capture of wild free-roaming horses as well as continued authority to inventory the public lands. In 1978, the Public Range Improvement Act (PRIA) was passed which amended the WFRHBA to provide additional directives for BLM's management of wild free-roaming horses on public lands.

Past actions include establishment of WH&Bs HMAs, establishment of AML for WH&BSs, wild horse and burro gathers, vegetation treatment, mineral extraction, oil and gas exploration, livestock grazing and recreational activities throughout the area. Some of these activities have increased infestations of invasive plants, noxious weeds, and pests and their associated treatments.

Blue Wing Complex

Integrated WH&B management has occurred in the Blue Wing Complex. Nine gathers have been completed in the past 25 years on part or all of the HMAs and HAs in the Complex, as well as parts of gather area that are not managed for WH&Bs, and future gathers would be scheduled on a 4- or 5- year gather cycle. Approximately 4,900 WH&Bs have been removed from the Complex in the last 25 years; populations are thriving and have not been negatively impacted.

Adjustments in livestock season of use, livestock numbers, and grazing systems were made through the allotment evaluation/multiple use decision process, as well as a 1999 Management Agreement.

The Sierra Front-Northwestern Great Basin Resource Advisory Council (SFNGB-RAC) Standards and Guidelines for Rangeland Health have been the basis for assessing rangeland health in relation to management of wild horse and livestock grazing within the Winnemucca District. Adjustments in numbers, season of use, grazing season, and allowable use have been based on the evaluation of progress made toward achieving the standards.

Several oil and gas exploration wells have been drilled across the CESA however none of these wells have gone into production. The Winnemucca RMP/EIS summarized the history of oil and gas exploration on pages 3-124 to 3-125.

Historical mining activities have occurred throughout the CESA.

Present Actions

Today the Blue Wing Complex has an estimated population of at least 609 wild horses and 116 wild burros (based on the 2025 population estimate). Resource damage is occurring in portions of the Complex due to excess animals. Current BLM policy is to conduct removals targeting portions of the WH&B population based upon age, and allowing the correction of any sex ratio problems that may occur. Further, the BLM's policy is to conduct gathers in order to facilitate a four-year gather cycle and to reduce population growth rates where possible. Program goals have expanded beyond establishing a "*thriving natural ecological balance*" by setting AML for individual herds to now include achieving and maintaining healthy and stable populations and controlling population growth rates.

Though authorized by the WFRHBA, current appropriations and policy prohibit the destruction of healthy animals that are removed or deemed to be excess. Only sick, lame, or dangerous animals can be euthanized, and destruction is no longer used as a population control method. A recent amendment to the WFRHBA allows the sale of excess wild horses that are over 10 years in age or have been offered unsuccessfully for adoption three times. BLM is adding additional long-term grassland pastures in the Midwest and West to care for excess wild horses for which there is no adoption or sale demand.

The BLM is continuing to administer grazing permits and authorize grazing within the CESA. Within the proposed gather area sheep and cattle grazing occurs on a yearly basis. Wildlife use by large ungulates such as elk, deer, and antelope is also currently common in the CESA.

The focus of WH&B management has also expanded to place more emphasis on achieving rangeland health as measured against the RAC Standards. The Sierra Front-Northwestern Great Basin Resource Advisory Council (SFNGB-RAC) Standards and Guidelines for Rangeland Health are the current basis for assessing rangeland health in relation to management of wild horse and livestock grazing within the Winnemucca District. Adjustments to numbers, season of use, grazing season, and allowable use are based on evaluating achievement of or making progress toward achieving the standards.

There are 70 active geothermal leases totaling 203,380.85 acres. Currently in the Blue Wing Complex gather area, there are eight active mining and exploration operations totaling approximately 33,743.55 acres (Churchill Quarry Lime Deposit, Colado Mine, Florida Canyon Mine, Wildcat Exploration, Echo Canyon Mine and Hycroft Mine). Currently, 41 notice level exploration operations have been acknowledged as described in surface management regulations at 43 CFR 3809. There are 9,615 active mining claims. Approximately There are 26 Community Pits and Free Use Permit gravel pits totaling approximately 671.5 acres located within the Complex. Additionally, there are 55 Nevada Department of Transportation (NDOT) Mineral Material Sites totaling 4,937 acres. Surface disturbance is required to be reclaimed as soon as practical.

Reasonably Foreseeable Future Actions

In the future, the BLM would manage WH&Bs within HMAs that have suitable habitat for an AML range that maintains adequate levels of genetic diversity, age structure, and targeted sex ratios. Current policy is to express all future wild horse AMLs as a range, to allow for regular population growth, as well as better management of populations rather than individual HMAs. The Winnemucca BLM District completed the *Winnemucca Proposed Resource Management Plan/Final Environmental Impact Statement* (RMP/EIS, 2015) released in August 2013 which analyzed AMLs expressed as a range and addressed wild horse management on a programmatic basis. Future WH&B management in the BLM's Winnemucca District would focus on an integrated ecosystem approach with the basic unit of analysis being the watershed. The BLM would continue to conduct monitoring to assess progress toward meeting rangeland health standards. WH&BSs would continue to be a component of the public lands, managed within a multiple use concept.

As the BLM achieves AML on a national basis, gathers should become more predictable due to facility space. Fertility control should also become more readily available as a management tool, with treatments that last between gather cycles reducing the need to remove as many WH&BSs and possibly extending the time between gathers. The combination of these factors should result in an increase in stability of gather schedules and longer periods of time between gathers.

The proposed gather area contains a variety of resources and supports a variety of uses. Any alternative course of WH&B management has the opportunity to affect and be affected by other authorized activities ongoing in and adjacent to the area. Future activities which would be expected to contribute to the cumulative impacts of implementing the Proposed Action include: future WH&B gathers, continuing livestock grazing in the allotments within the area, geothermal leasing, mineral exploration, new or continuing infestations of invasive plants, noxious weeds, and pests and their associated treatments, and continued native wildlife populations and recreational activities historically associated with them. The significance of cumulative effects based on past, present, proposed, and RFFAs are determined based on context and intensity. In the event of Proposed Activities occurring on or near mineral resource locations, proponents are to be notified.

Impacts Conclusion

Past actions regarding the management of WH&Bs have resulted in the current WH&B population within the Blue Wing Complex. WH&B management has contributed to the present resource condition and WH&B herd structure within the gather area.

The combination of the past, present, and RFFAs, along with the Proposed Action, should result in more stable and healthier WH&B populations, healthier rangelands (vegetation, riparian areas and wildlife habitat), and fewer multiple-use conflicts within the HMAs.

Most past and all present and RFFAs have noxious and invasive weed prevention stipulations and required weed treatment requirements associated with each project. This in combination with the active Winnemucca District Weed Management Program would minimize the spread of weeds throughout the watershed.

5.0 Mitigation Measures and Suggested Monitoring

The BLM has already incorporated design features into the Proposed Action and alternatives, which have been developed over time with the BLM's experience of managing WH&Bs. These design features are listed as SOPs (Appendix II, III, and IV) and represent the "best methods" for reducing impacts associated with gathering, handling, and transporting wild horses and collecting herd data. Hair follicle samples would be collected to continue monitoring genetic diversity levels in WH&Bs from the Blue Wing Complex, with additional samples would be collected during future gathers (in 10-15 years) to determine trend. The same samples may also be analyzed for genetic ancestry analysis. If monitoring indicates that genetic diversity (as measured in terms of observed heterozygosity) is not being adequately maintained (BLM 2010), 3-4 young mares / jennies from HMAs in similar environments may be added every generation (every 8-10 years) to avoid inbreeding depression and to maintain acceptable genetic diversity.

Riparian areas are the most sensitive (reactive to changes in management) part of the land and are central to wildlife, water quality, human recreation, and to the welfare of WH&Bs. If AML is at the right level, when populations are at AML and when livestock grazing with animal movement would otherwise enable plant growth and recovery (Wyman et al. 2006, Swanson et al. 2015, Maestas et al. 2023), the at-risk riparian areas should and need to improve. The improving trend is most important and most monitorable along the greenline using multiple indicator monitoring (MIM) (Burton et al. 2011, Burdick et al. 2021). The benefit of MIM is the large number of degrees of freedom along the greenline that has consistent potential to grow riparian stabilizer species in the perennially moist soil. This riparian greenline method is perhaps the most important resource monitoring needed on the Complex and the locations where this improving trend with AML should happen should be called out.

Ongoing resource monitoring, including climate (weather), and forage utilization, population inventory, and distribution data would continue to be collected. However, there are no separate mitigation measures necessary, as all reasonable means of reducing adverse environmental impacts have already been incorporated into the Proposed Action and alternatives as design features.

6.0 Consultation and Coordination

Public hearings are held annually regarding the use of motorized vehicles, including helicopters and fixed-wing aircraft, in the management of WH&BSs. During these meetings, the public is given the opportunity to present new information and to voice any concerns regarding the use of the motorized vehicles. The BLM hosted its annual public hearing on the use of motorized vehicles in the management of WH&BSs on May 23, 2024, via Zoom. The stream was also hosted live on BLM.gov/live. Twenty-three public comments were provided via audio, with more than 60 written comments sent via email. Most were not in support of the use of helicopters and the gathering of excess WH&Bs. Their comments were entered into the record for this hearing. Standard Operating Procedures were reviewed in response to these concerns and no changes to the SOPs were indicated based on this review.

The use of helicopters and motorized vehicles has proven to be a safe, effective, and practical means for the gather and removal of excess WH&Bs from the range. Since 2006, Nevada has gathered over 40,000 animals with a total mortality of 1.1% (of which 0.5% was gather related), which is very low when handling wild animals. BLM also avoids gathering WH&Bs prior to or during the peak of foaling and does not conduct helicopter removals of WH&Bs during March 1 through June 30.

Coordination between the Winnemucca District BLM and Nevada Department of Wildlife (NDOW) is ongoing. As required by the GRSG Land Use Plan Amendment (2015), NDOW has received the Greater sage-grouse form, RDF's, and tracking form. BLM would continue to coordinate with NDOW in regard to staging, trapping, and corral locations during gather events to minimize impacts to wildlife.

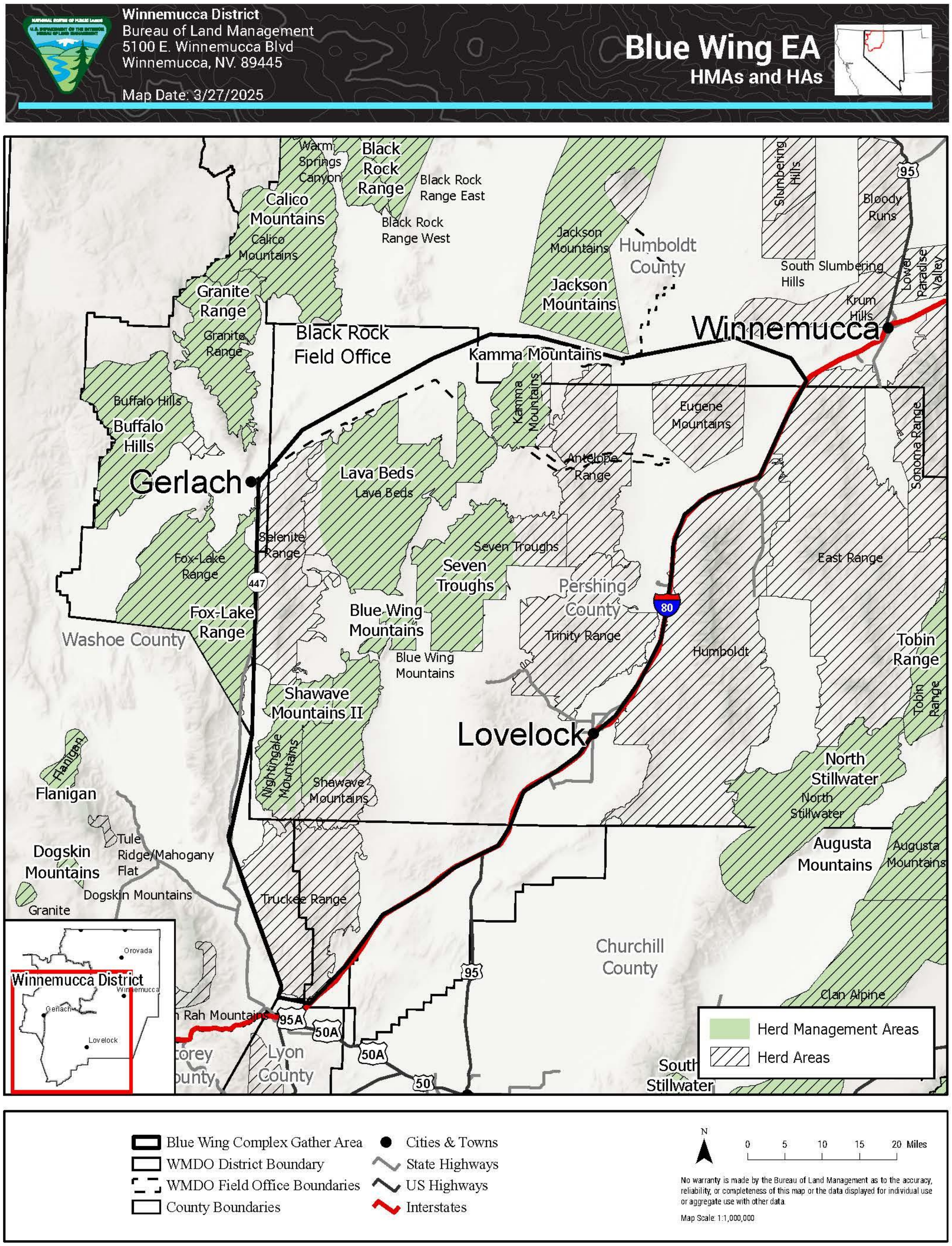
In the event of gather activities occurring on or near mineral resource locations, proponents are to be notified.

7.0 List of Preparers

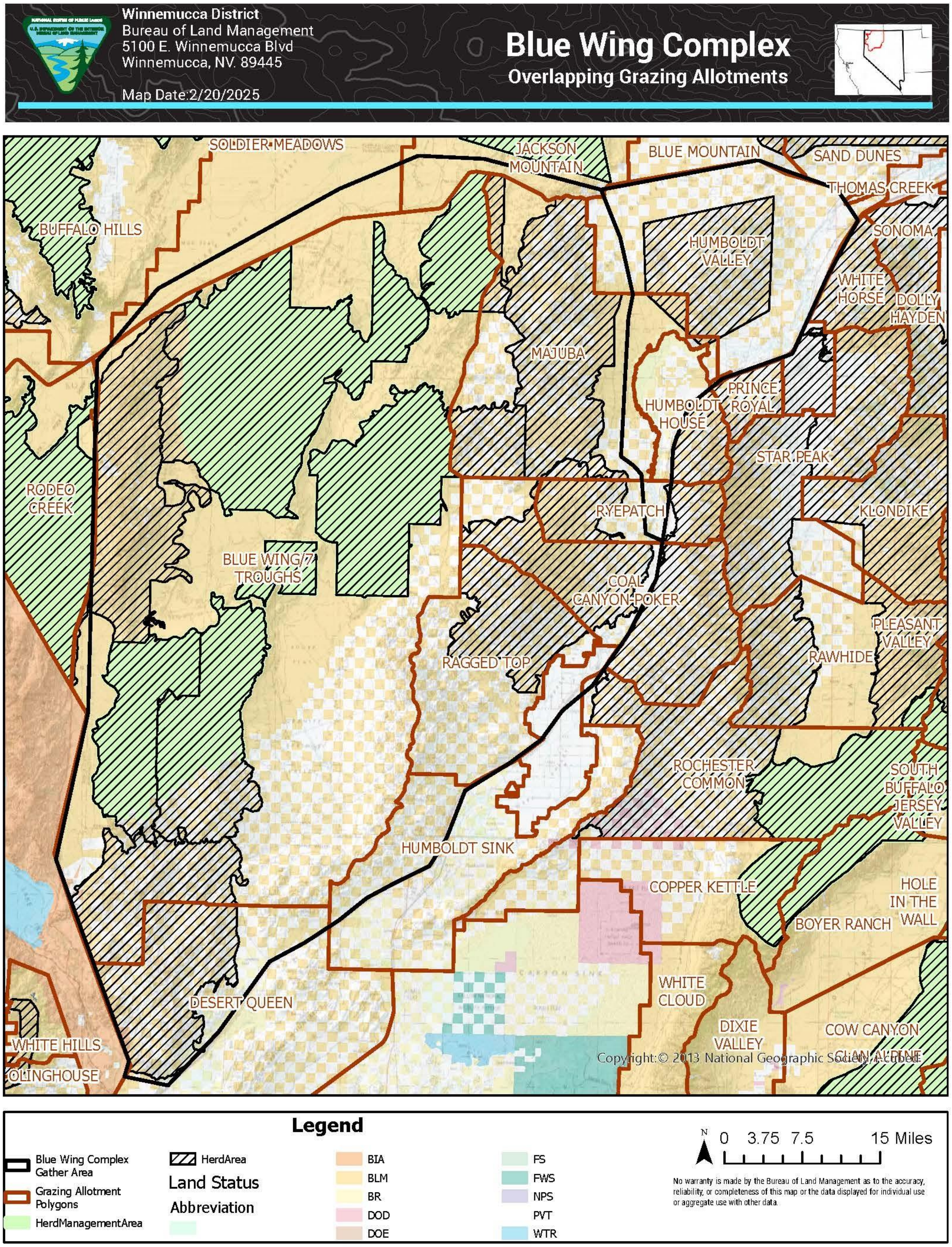
Winnemucca District Office		
Name	**Title**	**Responsible for the Following Section(s) of this Document**
Brianna Brodowski	Wild Horse Specialist	Project Lead/ Wild Horse Specialist
Kathy Torrence	Planning & Environmental Coordinator	NEPA
Kate Lozano	Wildlife Biologist	Wildlife, Migratory Birds, T&E species, Special Status Animal Species
Kristina Shaarda	Land Law Examiner	Solid and Fluid Minerals
Matthew Fockler	Socioeconomic specialist	social and economic values
Susan Grande	Assistant Field Manager	Land Use Authorizations
Adam Harrison	Supervisory Range Technician	Fire/fuels
Steven Townley	Outdoor Recreation Planner	Wilderness, WSA, Recreation, Visual Resource Management
Will Wagner-Ertz	Natural Resource Specialist	Special Status Plant Species, Soils, botany, noxious weeds, farmlands
Luis Ramirez	Hydrologist	Water, Wetlands, and Riparian
Wes Barry	Rangeland Management Specialist	Livestock Grazing Vegetation
Rich Keller	Geologist	Geology, Minerals
Susan Grande	Assistant Field Manager for Cultural, Lands, and Recreation	Lands and Realty
Alex Potts	Safety and Occupational Health Specialist	Public Health and Safety
Benjamin Neuhold	Archeologist	Cultural Resources
Garin Greyeyes	Tribal Liaison and Native American Coordinator	Native American Religious Concerns

APPENDIX I- MAPS

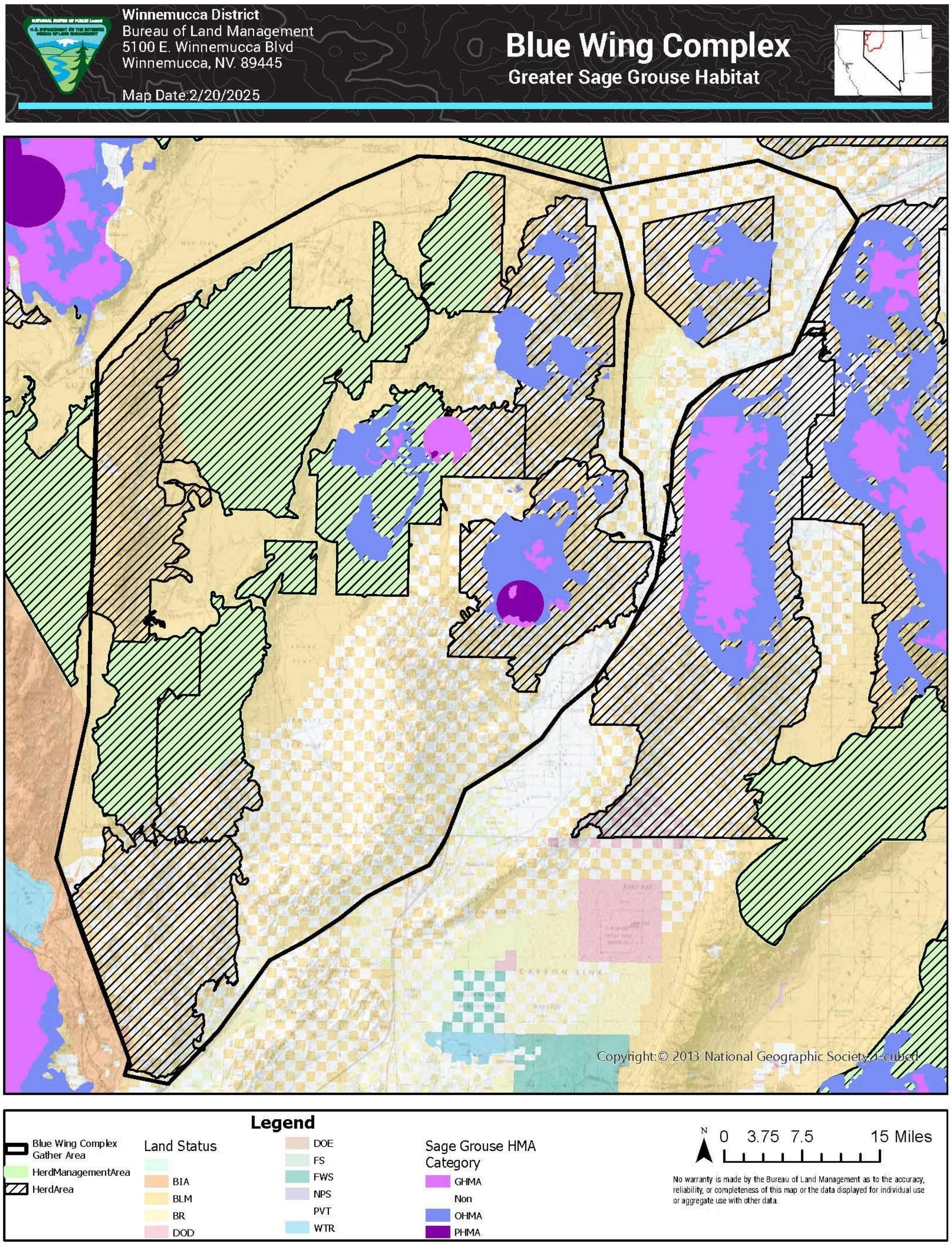
Map 1. Blue Wing Complex HMAs and HAs



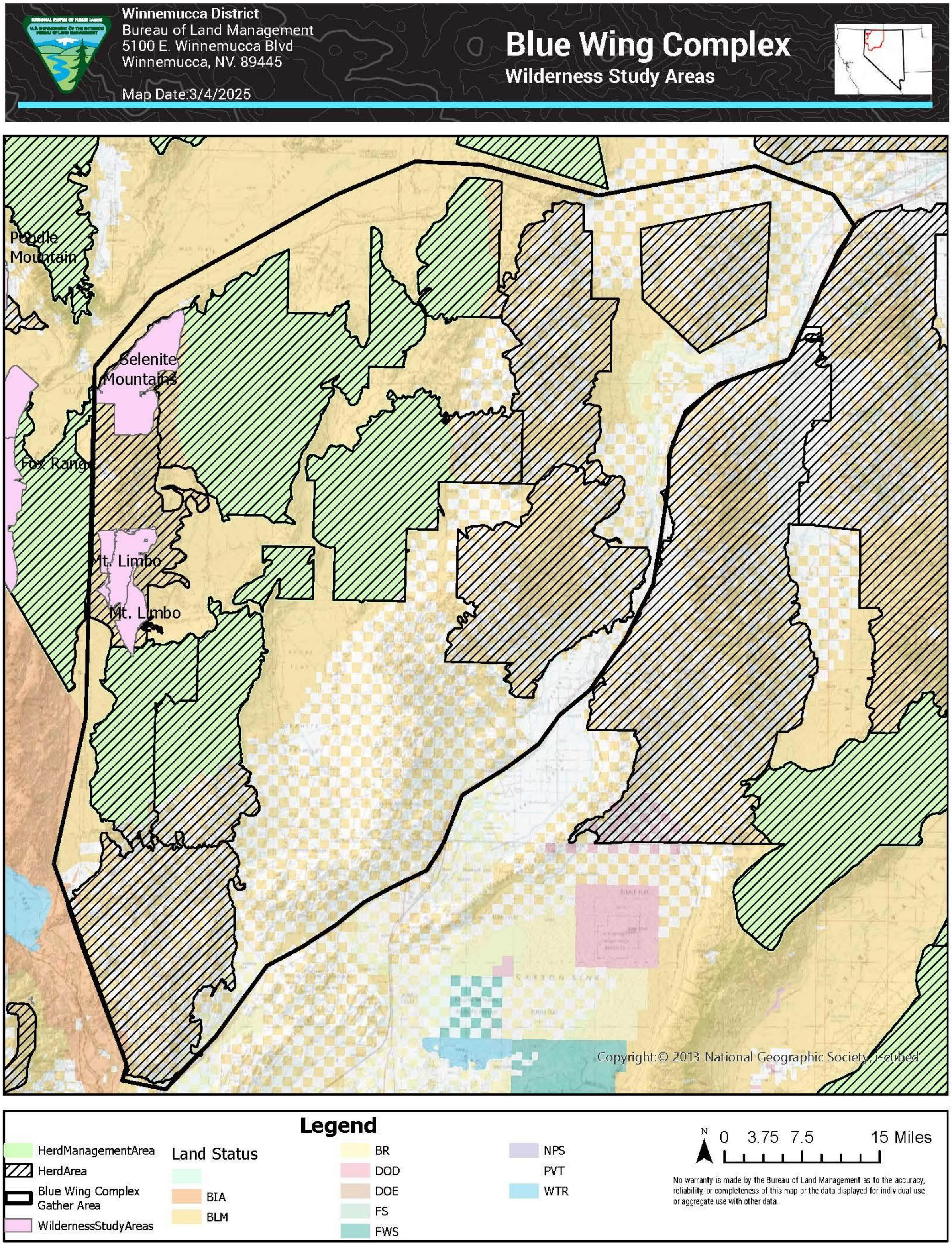
Map 2. Grazing allotments that overlap the Blue Wing Complex



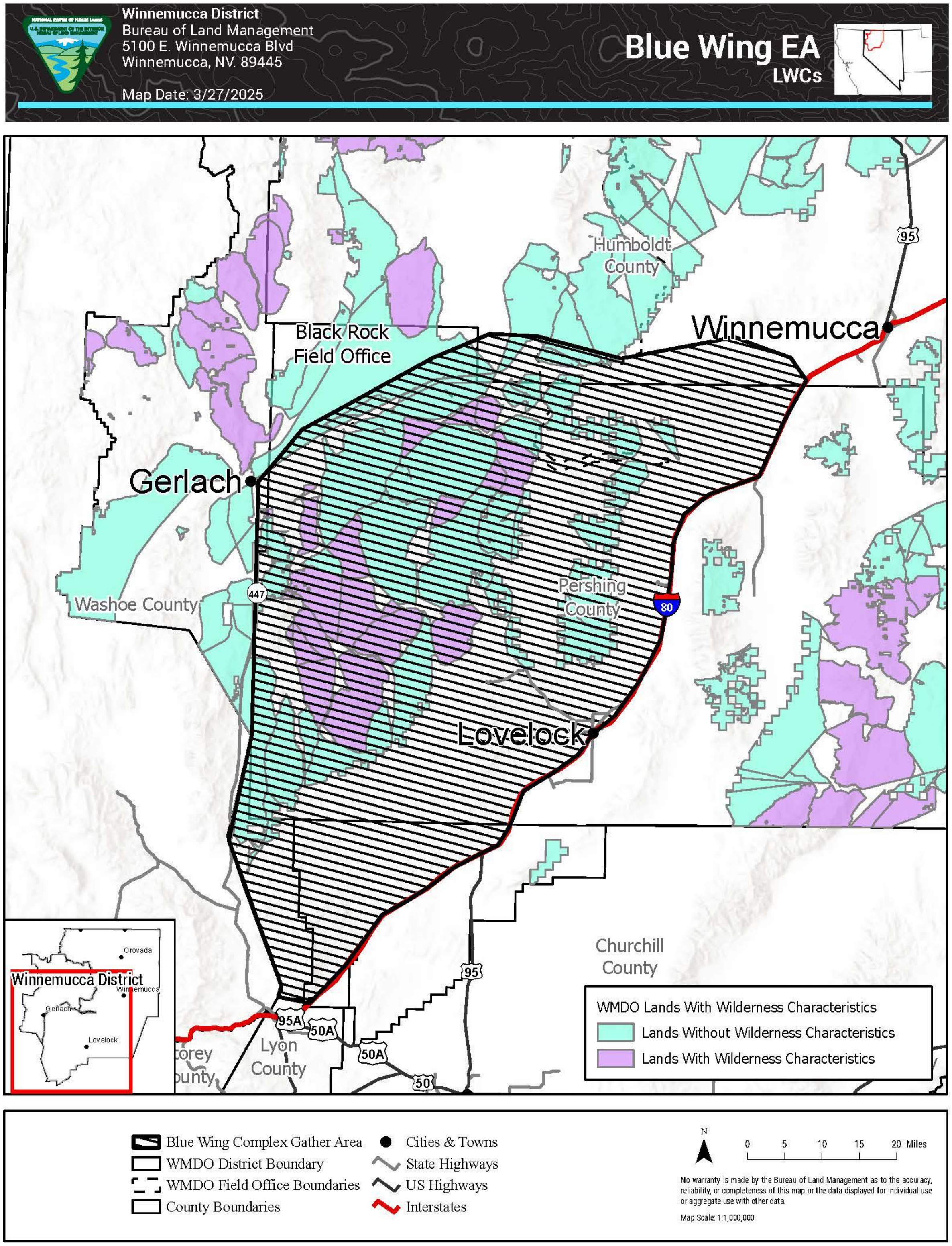
Map 3. Greater Sage Grouse Habitat overlapping with Blue Wing Complex



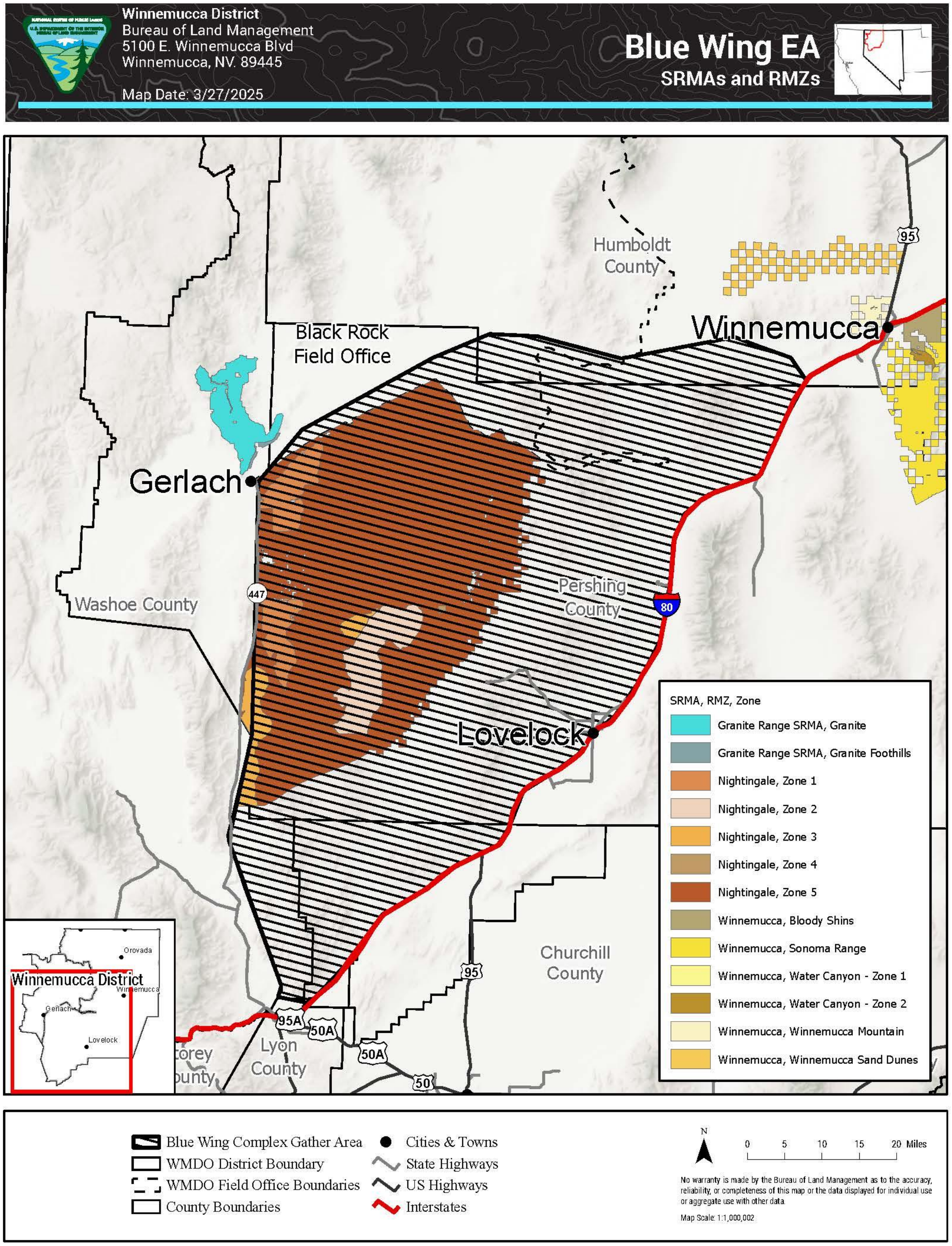
Map 4. Blue Wing Complex with overlapping Wilderness Study Areas.



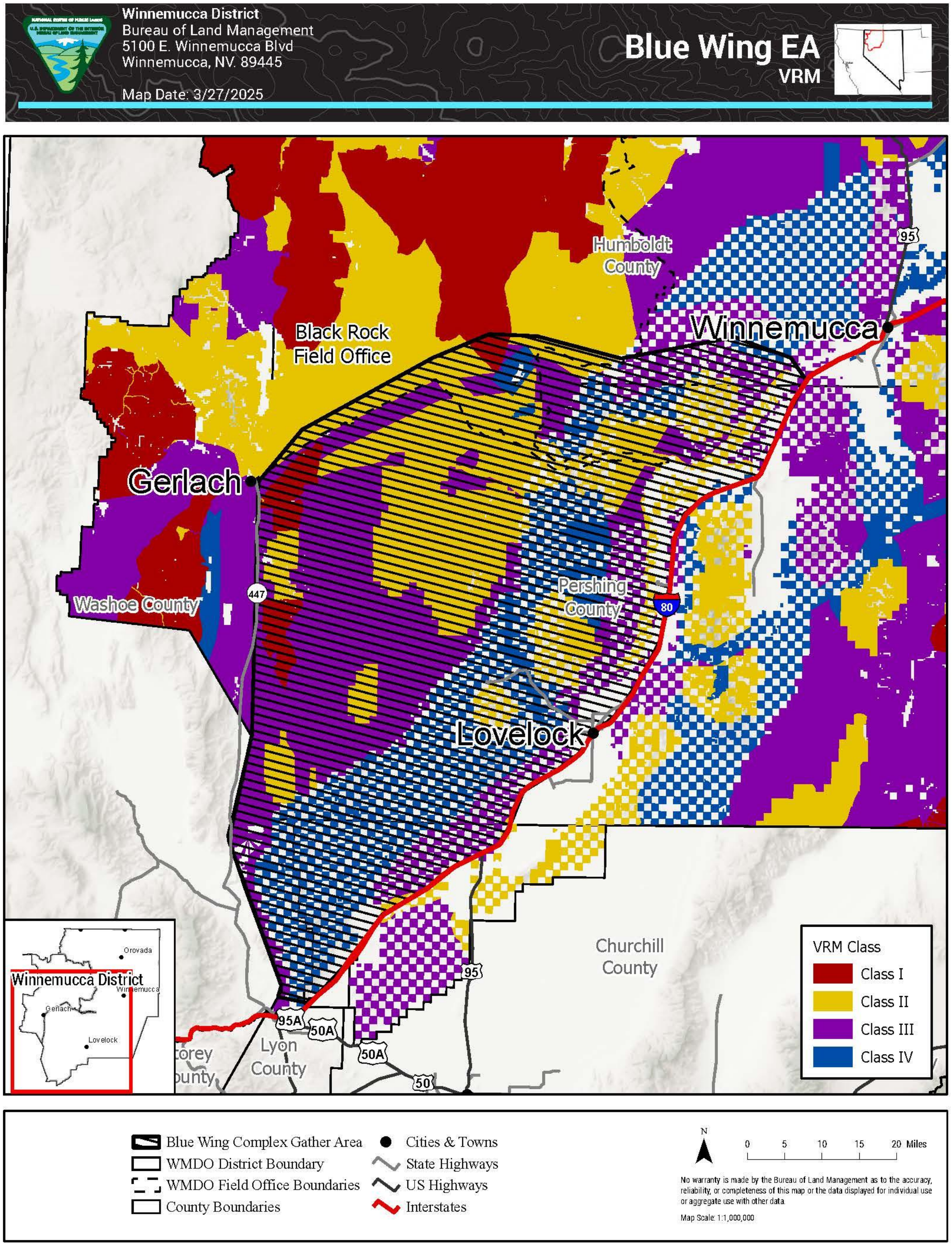
Map 5. Lands With Wilderness Characteristics



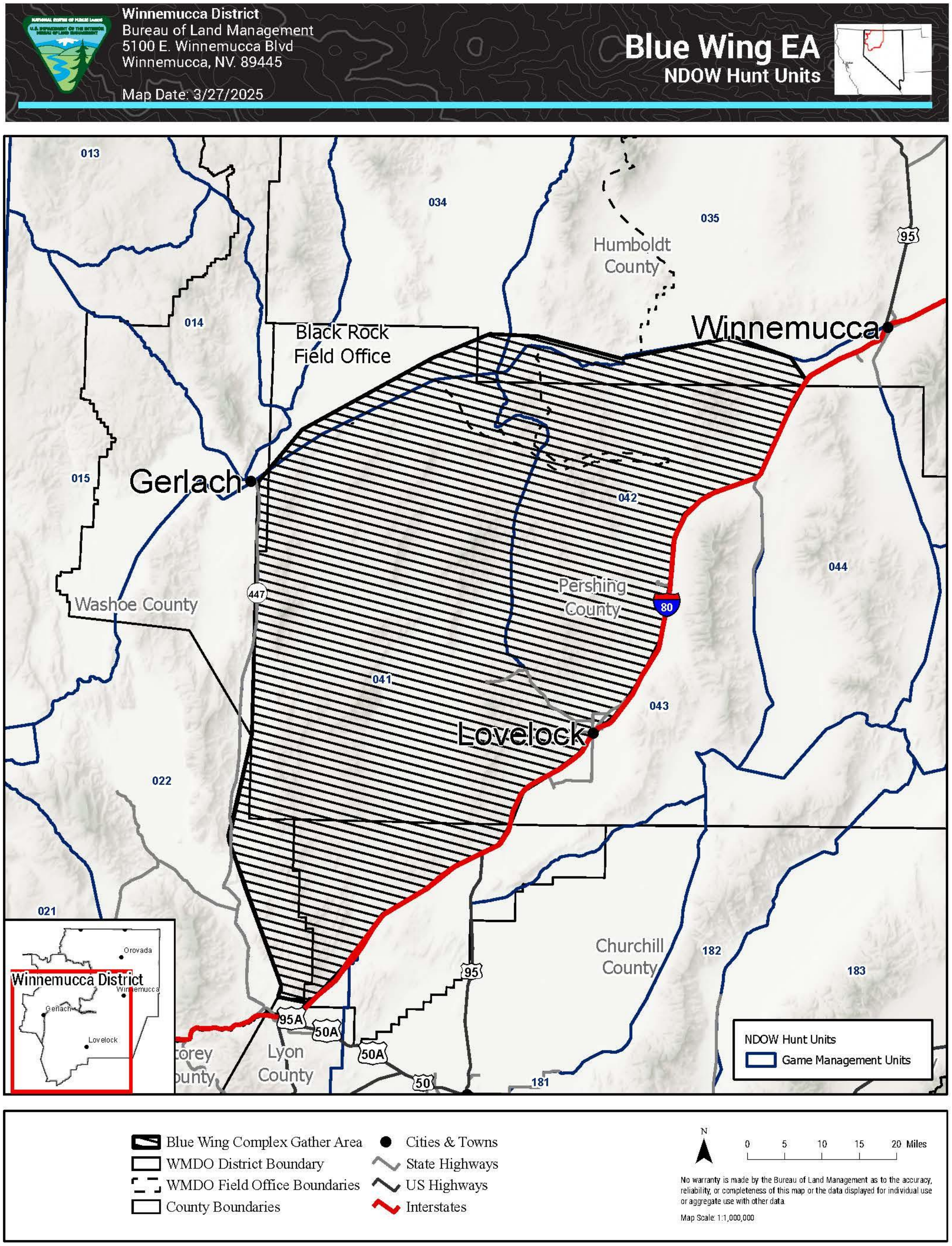
Map 6. SRMAs and RMZs



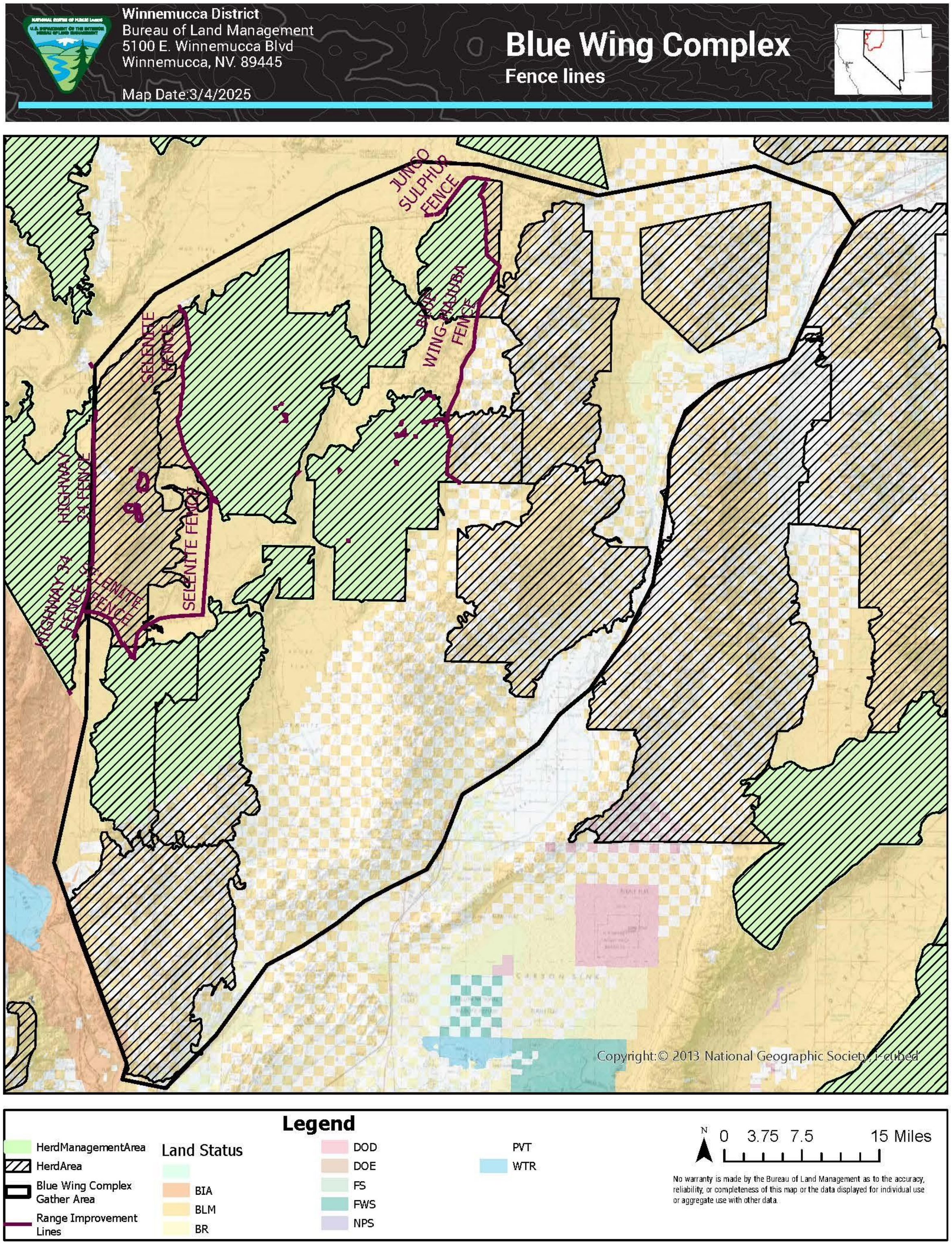
Map 7. Visual Resource Management



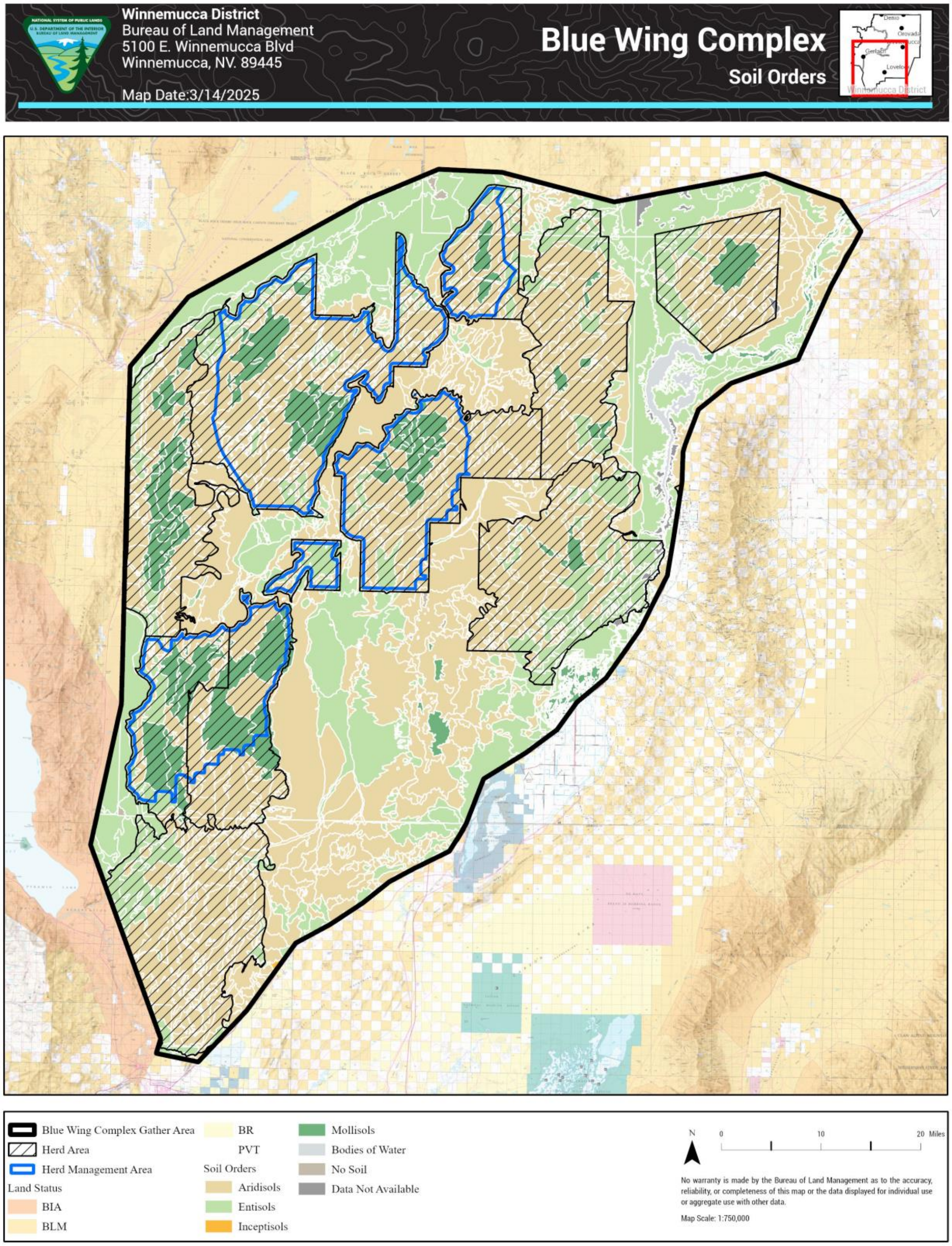
Map 8. Hunt Units



Map 9. Fence lines in the Blue Wing Complex.
Main fence lines are the Blue Wing-Majuba Fence and the Selenite Fence. The map also depicts several isolated exclosures for protecting water sources and vegetation treatments.



Map 10. Soil orders within Blue Wing Complex



APPENDIX II- STANDARD OPERATING PROCEDURES FOR MARE FERTILITY CONTROL TREATMENTS

Mare Fertility Control Treatment (SOPs)

The following management and monitoring requirements are part of the Proposed Action and Alternatives A and B.

SOPs common to all fertility control vaccine types:

Identification
Animals intended for treatment must be clearly, individually identifiable to allow for positive identification during subsequent management activities. For captured animals, marking for identification may be accomplished by marking each individual with a freeze mark on the hip and/ or neck and a microchip in the nuchal ligament. In some cases, identification may be accomplished based by cataloguing markings that make animals uniquely identifiable. Such animals may be photographed using a telephoto lens and high quality digital camera as a record of treated individuals.

Safety
Safety for both humans and animals is the primary consideration in all elements of fertility control vaccine use. Administration of any vaccine must follow all safety guidance and label guidelines on applicable EPA labeling.

Injection Site
For hand-injection, delivery of the vaccine should be by intramuscular injection, while the animal is standing still, into the left or right side, above the imaginary line that connects the point of the hip (hook bone) and the point of the buttocks (pin bone): this is the hip / upper gluteal area. For dart-based injection, delivery of the vaccine should be by intramuscular injection, while the animal is standing still, into the left or right thigh areas (lower gluteal / biceps femoralis).

Monitoring and Tracking of Treatments

1. Estimation of population size and growth rates (in most cases, using aerial surveys) should be conducted periodically after treatments.
2. Population growth rates of some herds selected for intensive monitoring may be estimated every year post-treatment using aerial surveys. If, during routine HMA field monitoring (on-the-ground), data describing adult to foal ratios can be collected, these data should also be shared with HQ-261.
3. Field applicators should record all pertinent data relating to identification of treated animals (including photographs if animals are not freeze-marked) and date of treatment, lot number(s) of the vaccine, quantity of vaccine issued, the quantity used, the date of vaccination, disposition of any unused vaccine, the date disposed, the number of treated mares by HMA, field office, and State along with the microchip numbers and freeze-mark(s) applied by HMA and date. A summary narrative and data sheets will be forwarded to HQ-261 annually. A copy of the form and data sheets and any photos taken should be maintained at the field office.
4. HQ-261 will maintain records sent from field offices, on the quantity of PZP issued, the quantity used, disposition of any unused PZP, the number of treated mares by HMA, field office, and State along with the freeze-mark(s) applied by HMA and date.

SOPs for one-year liquid PZP vaccine (ZonaStat-H)
ZonaStat-H vaccine (Science and Conservation Center, Billings, MT) would be administered through hand-injection or darting by trained BLM personnel or collaborating partners only. For any darting operation, the designated personnel must have successfully completed a nationally recognized wildlife darting course and who have documented and successful experience darting wildlife under field conditions.

Until the day of its use, ZonaStat-H must be kept frozen, except that an emulsified dose that is not used may be refrigerated overnight, then used the following day.

Animals that have never been treated with a PZP vaccine would receive 0.5 cc of PZP vaccine emulsified with 0.5 cc of Freund's Modified Adjuvant (FMA). Animals identified for re-treatment receive 0.5 cc of the PZP vaccine emulsified with 0.5 cc of Freund's Incomplete Adjuvant (FIA). Consistent with EPA guidelines, animals may be held in captivity for at least 2 weeks between primer and booster doses of PZP ZonaStat-H vaccine.

Hand-injection of liquid PZP vaccine would be by intramuscular injection into the gluteal muscles while the animal is restrained in a working chute. The vaccine would be injected into the left hind quarters of the animal, above the imaginary line that connects the point of the hip (hook bone) and the point of the buttocks (pin bone).

For Hand-injection, delivery of the vaccine would be by intramuscular injection into the left or right buttocks and thigh muscles (gluteals, biceps femoris) while the animal is standing still.

Application of ZonaStat-H via Darting
Only designated darters would prepare the emulsion. Vaccine-adjuvant emulsion would be loaded into darts at the darting site and delivered by means of a projector gun.

No attempt to dart should be taken when other persons are within a 100-m radius of the target animal. The Dan Inject gun should not be used at ranges in excess of 30 m while the Pneu-Dart gun should not be used over 50 m.

No attempts would be taken in high wind (greater than 15 mph) or when the animal is standing at an angle where the dart could miss the target area and hit the flank or rib cage. The ideal is when the dart would strike the skin of the animal at a 90° angle.

If a loaded dart is not used within two hours of the time of loading, the contents would be transferred to a new dart before attempting another animal. If the dart is not used before the end of the day, it would be stored under refrigeration and the contents transferred to another dart the next day, for a maximum of one transfer (discard contents if not used on the second day). Refrigerated darts would not be used in the field.

A darting team should include two people. The second person is responsible for locating fired darts. The second person should also be responsible for identifying the animal and keeping onlookers at a safe distance.

To the extent possible, all darting would be carried out in a discrete manner. However, if darting is to be done within view of non-participants or members of the public, an explanation of the nature of the project would be carried out either immediately before or after the darting.

Attempts will be made to recover all darts. To the extent possible, all darts which are discharged and drop from the target animal at the darting site would be recovered before another darting occurs. In exceptional situations, the site of a lost dart may be noted and marked, and recovery efforts made at a later time. All discharged darts would be examined after recovery in order to determine if the charge fired and the plunger fully expelled the vaccine. Personnel conducting darting operations should be equipped with a two-way radio or cell phone to provide a communications link with a project veterinarian for advice and/or assistance. In the event of a veterinary emergency, darting personnel would immediately contact the project veterinarian, providing all available information concerning the nature and location of the incident.

In the event that a dart strikes a bone or imbeds in soft tissue and does not dislodge, the darter would follow the affected animal until the dart falls out or the animal can no longer be found. The darter would be responsible for daily observation of the animal until the situation is resolved.

SOPs for application of PZP-22 pelleted vaccine:
PZP-22 pelleted vaccine treatment would be administered only by trained BLM personnel or designated partners.

A treatment of PZP-22 is comprised of two separate injections: (1) a liquid dose of PZP vaccine (equivalent to one dose of ZonaStat-H) is administered using an 18-gauge needle primarily by hand injection; (2) the pellets are preloaded into a 14-gauge needle. For animals constrained in a working chute, these are delivered using a modified syringe and jabstick to inject the pellets into the gluteal muscles of the animals being returned to the range. The pellets are intended to release PZP over time. Until the day of its use, the liquid portion of PZP-22 must be kept frozen.

Delivery of PZP-22 treatment would primarily be by intramuscular injection into the gluteal muscles while the animal is restrained in a working chute. The primer would consist of 0.5 cc of liquid PZP emulsified with 0.5 cc of adjuvant. Animals that have never been treated with a PZP vaccine would receive 0.5 cc of PZP vaccine emulsified with 0.5 cc of Freund's Modified Adjuvant (FMA). Animals identified for re-treatment receive 0.5 cc of the PZP vaccine emulsified with 0.5 cc of Freund's Incomplete Adjuvant (FIA). The syringe with PZP vaccine pellets would be loaded into the jabstick for the second injection. With each injection, the liquid or pellets would be injected into the left hind quarters of the animal, above the imaginary line that connects the point of the hip (hook bone) and the point of the buttocks (pin bone).

The PZP-22 treatment may be administered remotely using a darting protocol and delivery system, consistent with published studies that have found that method effective (i.e., Rutberg et al. 2017, Carey et al. 2019).

SOPs for GonaCon-Equine Vaccine Treatments
GonaCon-Equine vaccine (USDA National Wildlife Research Center, Fort Collins, CO) is distributed as preloaded doses (2 mL) in labeled syringes. Upon receipt, the vaccine should be kept refrigerated (4° C) until use. <u>Do not freeze GonaCon-Equine</u>. The vaccine has a 6-month shelf-life from the time of production and the expiration date will be noted on each syringe that is provided.

For initial and booster treatments, mares would ideally receive 2.0 ml of GonaCon-Equine.

Administering GonaCon Vaccine by Hand-Injection
Experience has demonstrated that only 1.8 ml of vaccine can typically be loaded into 2 cc darts, and this dose has proven successful. Calculations below reflect a 1.8 ml realized dose, from a 2.0 mL provided dose.

For hand-injection, delivery of the vaccine should be by intramuscular injection, while the animal is standing still, into the left or right side, above the imaginary line that connects the point of the hip (hook bone) and the point of the buttocks (pin bone): this is the hip / upper gluteal area.

A booster vaccine may be administered after the first injection to improve efficacy of the product over subsequent years. Consistent with EPA guidelines, animals may be held in captivity for at least 30 days between primer and booster doses of GonaCon-Equine vaccine.

Application of GonaCon-Equine via Darting

General practice guidelines for darting operations, as noted above for dart-delivery of ZonaStat-H, should be followed for dart-delivery of GonaCon-Equine. One can expect updates in optimal dart configuration, pending results of research and field applications.

For best results, darts with a gelatin barb should be used. Pneu-Dart Brand dart specifications are as follows, though other brands with the same configuration may be acceptable.
Pyrotechnic: “Slow-Inject”
Needle: 3.81 cm (1.5 inch) long, 14-gauge, tri-port
Barb: gelatin, positioned 1.27 cm (0.5 inch) ahead of the ferrule

Depending on specific project needs, either 2cc or 3cc darts may be used. Advantages of 2cc darts include flatter trajectory and softer impact for farther shots, and the advantage of 3cc darts is ease of loading full doses of vaccine (see “Loading Darts” below for details).

Loading Darts

Test each gel barb before loading and before use by pulling and twisting by hand. If the barb rotates on the needle or is loose at all, discard the dart.

For ease of transferring the vaccine, let the vaccine syringes sit at room temperature for about 10 minutes to warm up before attempting to load darts.

Always wear latex gloves and eye protection when handling and loading darts. Number, weigh, and hold the dart upright at a 45-degree angle to fill.

Attach a loading needle (7.62 cm (3 inch); 19 gauge filling needle provided by dart manufacturer) to the syringe containing the vaccine and place the needle into the cannula of the dart to the fullest depth possible. Note: Best results are obtained when a long needle can be inserted fully to the bottom of the chamber to fill darts, allowing air to exit the needle as it is displaced by the vaccine.

Slowly depress the syringe plunger and begin filling the dart. Periodically, gently tap the tail of the dart after (after each 0.2-0.3 mls have been injected into the dart) on a hard surface to remove air bubbles that have been inadvertently injected with the vaccine into the dart during the loading process. Due to the viscous nature of the vaccine, air entrapment can result in a maximum of approximately 1.8 ml of vaccine being loaded into 2cc darts.

Filling the dart too quickly, without dislodging air bubbles, will prevent filling the dart with the correct amount of vaccine. To overcome this issue, repeated tapping (tail down) can be conducted to agitate air bubbles and settle the vaccine in the body of the dart. For synthetic body darts, it is possible to hold the opaque body of the dart up to light while it’s being loaded and visualize the filling process and determine fill levels. Once the dart is filled to near maximum, a small amount of the vaccine can be observed at the tri-ports on the dart needle.

An alternate method for loading 2cc darts that overcomes the problem of air entrapment requires the use of a centrifuge. For this procedure, load darts by syringe to approximately 70% (1.4 ml), place darts tail down in centrifuge tubes (balancing with opposing tubes, filling all tubes, etc.), and run at 500 – 1000 revolutions per minute for one minute duration. Remove darts from centrifuge and continue filling with matching syringe contents, repeating centrifugation as necessary, until the full 2ml is loaded to darts.
A third option to overcome air entrapment is to use 3cc darts, otherwise configured as described in “2” above. Recent field work has demonstrated that additional air injected with the vaccine poses no risk to animals and yields similar performance at depositing the intramuscular bolus.
Record weight of each loaded dart for comparison after delivery.

Important! Do not load and refrigerate darts the night before application. When exposed to moisture and condensation, the edges of gel barbs soften, begin to dissolve, and will not hold the dart in the muscle tissue long enough for full injection of the vaccine. The dart needs to remain in the muscle tissue for a minimum of 1 minute to achieve dependable full injection. Sharp gel barbs are critical for successful injection of a full dose.

If possible, darts should be weighed to the nearest hundredth gram by electronic scale when empty, when loaded with vaccine, and after discharge, to ensure that 90% (1.62 ml) of the vaccine has been injected. GonaCon weighs 0.95 grams/mL, so animals should receive 1.54 grams of vaccine to be considered treated. Animals receiving <50% should be darted with another full dose; those receiving >50% but <90% should receive a half dose (1 ml). All darts should be weighed to verify a combination of ⩾1.62 ml has been administered. Therefore, every effort should be made to recover darts after they have fallen from animals.

For best results, darts should be fired with minimum velocity to achieve accurate shot placement and ignition of the pyrotechnic. Field trial to determine these parameters across multiple shot distances is recommended prior to darting animals with vaccine. Darts should be aimed to strike the left or right hind quarters of the animal above an imaginary line that connects the point of the hip (hook bone) and the point of the buttocks (pin bone).

Although infrequent, dart injections can result in partial injections of the vaccine, and shots are missed. As a precaution, it is recommended that extra doses of the vaccine be ordered to accommodate failed delivery (which may be as high as ~15 %). To determine the amount of vaccine delivered, the dart must be weighed before loading, and before and after delivery in the field. The scale should be sensitive to 0.01 grams or less, and accurate to 0.05 g or less.

Note: It is a good idea to prepare several extra full-dose and half-dose darts in advance of going to the field. Loading darts in the field, after a miss or incomplete delivery, is time consuming and may result in failure for a second approach and shot at the target animal. Alternately, if reweighing darts is not possible, check for a successful delivery of the vaccine by inserting the 19 gauge loading needle into the cannula of the dart. If the dose has been delivered, then the plunger should be at the ferrule, and the needle should not go into the barrel of the dart. If the dose has not been delivered, the needle will encounter resistance inside the containment chamber.

Darts (configured specifically as described above) can be loaded in the field and stored in a cooler prior to application. Darts loaded, but not used can be maintained in dry conditions at about 4° C and used the next day, but do not store in any refrigerator or container likely to cause condensation, which can compromise the gel barbs.

Peak Foaling Season

Peak foaling season of wild horses on public lands occurs in late April and early May. The great majority of foaling happens March through June. As a precaution, unless there is an approved emergency situation, the BLM does not use helicopters to gather wild horses from March through June.

Though foals typically grow rapidly and within days are capable of maintaining speed with their mother, the BLM's Comprehensive Animal Welfare Program includes provisions to protect the welfare of foals that are part of gather operations. For example, the rate of movement and herding distance the pilot uses are based on the weakest or smallest animal in the group (i.e., foals or pregnant mares). Other provisions include re-uniting dependent foals that become separated from their mare/jenny and ensuring foals are protected from larger stallions and/or jacks while in a holding corral or during transport.

A 2016 metaanalysis of available demographic literature for wild equids indicated that foaling rates in feral horses, in the northern hemisphere, drop precipitously after June (Ransom et al., figure 6-2). The same metaanalysis shows that burros appear to have a bimodal foaling season, with foals born largely from February to September.

Ransom, J.I., L Lagos, H. Hrabar, H. Mowrazi, D. Ushkhjargal, and N. Spasskaya. 2016. Wild and feral equid population dynamics. pages 68-86 in J. I. Ransom and P. Kaczensky, eds., Wild equids; ecology, management and conservation. Johns Hopkins University Press, Baltimore, Maryland.

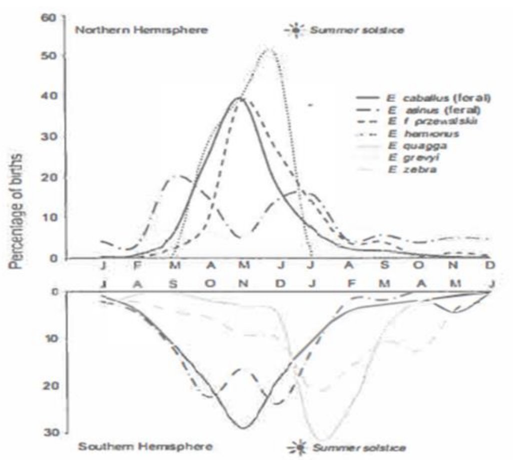


Fig 6.2 Percentage of births by month across equid species. Data are smoothed and shown as the mean across populations. Data for *E. caballus* derived from Tyler 1972, Boyd 1980, Keiper and Houpt 1984, Berger 1986, Berman 1991, Lucas *et al.* 1991, Ashley 2000, Gomes and Oom 2000, Linklater *et al.* 2004, Greyling 2005, Nuñez *et al.* 2010, Scorolli and Lopez Cazorla 2010, Lagos 2013, Ransom *et al.* 2013, and N. Spasskaya, unpublished data; data for *E. asinus* derived from Moehlman 1974, McCool *et al.* 1981, Ruffner and Carothers 1982, and Santiapillai *et al.* 1999; data for *E. f. przewalskii* derived from Chen *et al.* 2008, Prague Zoo 2010 (wild and semiwild populations only), and Usukhjargal and Bandi 2013; data for *E. hemionus* derived from Wolfe 1979 and O. Ganbaatar, unpublished data; data for *E. quagga* derived from Klingel 1965, Smuts 1976*b*, and Sinclair *et al.* 2000, data for *E. grevyi* derived from Dobroruka *et al.* 1987 and Rowen 1992, data for *E. zebra* derived from Joubert 1974*b*, Penzhorn 1985, Westlin-van Aarde *et al.* 1988, and H. Hrabar, unpublished data.

APPENDIX III- FIELD CASTRATION (GELDING) SOPS

Gelding will be performed with general anesthesia and by a veterinarian. The combination of pharmaceutical compounds used for anesthesia, method of physical restraint, and the specific surgical technique used will be at the discretion of the attending veterinarian with the approval of the authorized officer (IM 2009-063).

Pre-Surgery Animal Selection, Handling, and Care

1. Stallions selected for gelding will be greater than 6 months of age and less than 20 years of age.
2. All stallions selected for gelding will have a Henneke body condition score of 3 or greater. No animals which appear distressed, injured or in failing health or condition will be selected for gelding.
3. Stallions will not be gelded within 36 hours of capture and no animals that were roped during capture will be gelded at the temporary holding corrals for rerelease.
4. Whenever possible, a separate holding corral system will be constructed on site to accommodate the stallions that will be gelded. These gelding pens will include a minimum of 3 pens to serve as a working pen, recovery pen(s), and holding pen(s). An alley and squeeze chute built to the same specifications as the alley and squeeze chutes used in temporary holding corrals (solid sides in alley, minimum 30 feet in length, squeeze chute with non-slip floor) will be connected to the gelding pens.
5. When possible, stallions selected for gelding will be separated from the general population in the temporary holding corral into the gelding pens, prior to castration.
6. When it is not possible or practical to build a separate set of pens for gelding, the gelding operation will only proceed when adequate space is available to allow segregation of gelded animals from the general population of stallions following surgery. At no time will recently anesthetized animals be returned to the general population in a holding corral before they are fully recovered from anesthesia.
7. All animals in holding pens will have free access to water at all times. Water troughs will be removed from working and recovery pens prior to use.
8. Prior to surgery, animals in holding pens may be held off feed for a period of time (typically 12-24 hours) at the recommendation and direction of the attending veterinarian.
9. The final determination of which specific animals will be gelded will be based on the professional opinion of the attending veterinarian in consultation with the Authorized Officer.
10. Whether the procedure will proceed on a given day will be based on the discretion of the attending veterinarian in consultation with the Authorized Officer taking into consideration the prevailing weather, temperature, ground conditions and pen set up. If these field situations cannot be remedied, the procedure will be delayed until they can be, the stallions will be transferred to a prep facility, gelded, and later returned, or they will be released to back to the range as intact stallions.

Gelding Procedure

1. All gelding operations will be performed under a general anesthetic administered by a qualified and experienced veterinarian. Stallions will be restrained in a portable squeeze chute to allow the veterinarian to administer the anesthesia.
2. The anesthetics used will be based on a Xylazine/ketamine combination protocol. Drug dosages and combinations of additional drugs will be at the discretion of the attending veterinarian.

3. Animals may be held in the squeeze chute until the anesthetic takes effect or may be released into the working pen to allow the anesthesia to take effect. If recumbency and adequate anesthesia is not achieved following the initial dose of anesthetics, the animal will either be re-dosed or the surgery will not be performed on that animal at the discretion of the attending veterinarian.
4. Once recumbent, rope restraints or hobbles will be applied for the safety of the animal, the handlers and the veterinarian.
5. The specific surgical technique used will be at the discretion of the attending veterinarian.
6. Flunixin meglumine or an alternative analgesic medication will be administered prior to recovery from anesthesia at the professional discretion of the attending veterinarian.
7. Tetanus prophylaxis will be administered at the time of surgery.

The animal would be sedated then placed under general anesthesia. Ropes are placed on one or more limbs to help hold the animal in position and the anesthetized animals are placed in either lateral or dorsal recumbency. The surgical site is scrubbed and prepped aseptically. The scrotum is incised over each testicle, and the testicles are removed using a surgical tool to control bleeding. The incision is left open to drain. Each animal would be given a tetanus shot, antibiotics, and an analgesic.

Any males that have inguinal or scrotal hernias would be removed from the population, sent to a regular BLM facility, and be treated surgically as indicated, if possible, or euthanized if they have a poor prognosis for recovery (PIM 2021-007, IM 2009-063). Horses with only one descended testicle may be removed from the population and managed at a regular BLM facility according to BLM policy or anesthetized with the intent to locate the undescended testicle for castration. If an undescended testicle cannot be located, the animal may be recovered and removed from the population if no surgical exploration has started. Once surgical exploration has started, those that cannot be completely castrated would be euthanized prior to recovering them from anesthesia according to BLM policy (PIM 2021-007, IM 2009-063). All animals would be rechecked by a veterinarian the day following surgery. Those that have excessive swelling, are reluctant to move or show signs of any other complications would be held in captivity and treated accordingly. Once released no further veterinary interventions would be possible.

Selected stallions would be shipped to the facility, gelded, and returned to the range within 30 days. Before release back to the range, they may be marked for visibility with a freeze brand or other method of marking. Gelded animals could be monitored periodically for complications for approximately 7-10 days following release. In the proposed alternatives, gelding is not part of a research study, but additional monitoring on the range could be completed either through aerial reconnaissance, if available, or field observations from major roads and trails. It is not anticipated that all the geldings would be observed but if the goal is to detect complications on the range, then this level of casual observation may help BLM determine if those are occurring. Periodic observations of the long-term outcomes of gelding could be recorded during routine resource monitoring work. Such observations could include but not be limited to band size, social interactions with other geldings and harem bands, distribution within their habitat, forage utilization, and activities around key water sources. Periodic population inventories and future gather statistics could provide additional anecdotal information about how logistically effective it is to manage a portion of the herd as permanently non-reproducing animals.

APPENDIX IV- GATHER OPERATIONS STANDARD OPERATING PROCEDURES

Gathers would be conducted by utilizing contractors from the Wild Horse Gathers-Western States Contract, or BLM personnel. The following procedures for gathering and handling wild horses would apply whether a contractor or BLM personnel conduct a gather. For helicopter gathers conducted by BLM personnel, gather operations will be conducted in conformance with the *Wild Horse Aviation Management Handbook* (January 2009).

Prior to any gathering operation, the BLM will provide for a pre-gather evaluation of existing conditions in the gather area(s). The evaluation will include animal conditions, prevailing temperatures, drought conditions, soil conditions, road conditions, and a topographic map with wilderness boundaries, the location of fences, other physical barriers, and acceptable trap locations in relation to animal distribution. The evaluation will determine whether the proposed activities will necessitate the presence of a veterinarian during operations. If it is determined that a large number of animals may need to be euthanized or gather operations could be facilitated by a veterinarian, these services would be arranged before the gather would proceed. The contractor will be apprised of all conditions and will be given instructions regarding the gather and handling of animals to ensure their health and welfare is protected.

Trap sites and temporary holding sites will be located to reduce the likelihood of injury and stress to the animals, and to minimize potential damage to the natural resources of the area. These sites would be located on or near existing roads whenever possible.

The primary gather methods used in the performance of gather operations include:

1. Helicopter Drive Trapping. This gather method involves utilizing a helicopter to herd WH&Bs into a temporary trap.
2. Helicopter Assisted Roping. This gather method involves utilizing a helicopter to herd WH&Bs to ropers.
3. Bait Trapping. This gather method involves utilizing bait (e.g., water or feed) to lure WH&Bs into a temporary trap.

The following procedures and stipulations will be followed to ensure the welfare, safety and humane treatment of wild horses in accordance with the provisions of 43 CFR 4700.

A. Gather Methods used in the Performance of Gather Contract Operations

1. The primary concern of the contractor is the safe and humane handling of all animals gathered. All gather attempts shall incorporate the following:

   All trap and holding facilities locations must be approved by the Contracting Officer's Representative (COR) and/or the Project Inspector (PI) prior to construction. The Contractor may also be required to change or move trap locations as determined by the COR/PI. All traps and holding facilities not located on public land must have prior written approval of the landowner.

2. The rate of movement and distance the animals travel shall not exceed limitations set by the COR who will consider terrain, physical barriers, access limitations, weather, extreme temperature (high and low), condition of the animals, urgency of the operation (animals facing drought, starvation, fire rehabilitation, etc.) and other factors. In consultation with the contractor the

distance the animals travel will account for the different factors listed above and concerns with each HMA.

3. All traps, wings, and holding facilities shall be constructed, maintained and operated to handle the animals in a safe and humane manner and be in accordance with the following:

    a. Traps and holding facilities shall be constructed of portable panels, the top of which shall not be less than 72 inches high for horses and 60 inches for burros, and the bottom rail of which shall not be more than 12 inches from ground level. All traps and holding facilities shall be oval or round in design.

    b. All loading chute sides shall be a minimum of 6 feet high and shall be fully covered, plywood, metal without holes larger than 2”x4”.

    c. All runways shall be a minimum of 30 feet long and a minimum of 6 feet high for horses, and 5 feet high for burros, and shall be covered with plywood, burlap, plastic snow fence or like material a minimum of 1 foot to 5 feet above ground level for burros and 1 foot to 6 feet for horses. The location of the government furnished portable fly chute to restrain, age, or provide additional care for the animals shall be placed in the runway in a manner as instructed by or in concurrence with the COR/PI.

    d. All crowding pens including the gates leading to the runways shall be covered with a material which prevents the animals from seeing out (plywood, burlap, plastic snow fence, etc.) and shall be covered a minimum of 1 foot to 5 feet above ground level for burros and 2 feet to 6 feet for horses

    e. All pens and runways used for the movement and handling of animals shall be connected with hinged self-locking or sliding gates.

4. No modification of existing fences will be made without authorization from the COR/PI. The Contractor shall be responsible for restoration of any fence modification which he has made.

5. When dust conditions occur within or adjacent to the trap or holding facility, the Contractor shall be required to wet down the ground with water.

6. Alternate pens, within the holding facility shall be furnished by the Contractor to separate mares or jennies with small foals, sick and injured animals, estrays or other animals the COR determines need to be housed in a separate pen from the other animals. Animals shall be sorted as to age, number, size, temperament, sex, and condition when in the holding facility so as to minimize, to the extent possible, injury due to fighting and trampling. Under normal conditions, the government will require that animals be restrained for the purpose of determining an animal’s age, sex, or other necessary procedures. In these instances, a portable restraining chute may be necessary and will be provided by the government. Alternate pens shall be furnished by the Contractor to hold animals if the specific gathering requires that animals be released back into the gather area(s). In areas requiring one or more satellite traps, and where a centralized holding facility is utilized, the contractor may be required to provide additional holding pens to segregate animals transported from remote locations so they may be returned to their traditional ranges. Either segregation or temporary marking and later segregation will be at the discretion of the COR.

7. The Contractor shall provide animals held in the traps and/or holding facilities with a continuous supply of fresh clean water at a minimum rate of 10 gallons per animal per day. Animals held for 10 hours or more in the traps or holding facilities shall be provided good quality hay at the rate of not less than two pounds of hay per 100 pounds of estimated body weight per day. The contractor will supply certified weed free hay if required by State, County, and Federal regulation.

    a. An animal that is held at a temporary holding facility through the night is defined as a horse/burro feed day. An animal that is held for only a portion of a day and is shipped or released does not constitute a feed day.

8. It is the responsibility of the Contractor to provide security to prevent loss, injury, or death of gathered animals until delivery to final destination.

9. The Contractor shall restrain sick or injured animals if treatment is necessary. The COR/PI will determine if animals must be euthanized and provide for the destruction of such animals. The Contractor may be required to humanely euthanize animals in the field and to dispose of the carcasses as directed by the COR/PI.

10. Animals shall be transported to their final destination from temporary holding facilities as quickly as possible after gather unless prior approval is granted by the COR for unusual circumstances. Animals to be released back into the HMA following gather operations may be held up to 21 days or as directed by the COR. Animals shall not be held in traps and/or temporary holding facilities on days when there is no work being conducted except as specified by the COR. The Contractor shall schedule shipments of animals to arrive at final destination between 7:00 a.m. and 4:00 p.m. No shipments shall be scheduled to arrive at final destination on Sunday and Federal holidays, unless prior approval has been obtained by the COR. Animals shall not be allowed to remain standing on trucks while not in transport for a combined period of greater than three (3) hours in any 24 hour period. Animals that are to be released back into the gather area may need to be transported back to the original trap site. This determination will be at the discretion of the COR/PI or Field Office horse specialist.

B. Gather Methods That May Be Used in the Performance of a Gather

1. Gather attempts may be accomplished by utilizing bait (feed, water, mineral licks) to lure animals into a temporary trap. If this gather method is selected, the following applies:

    a. Finger gates shall not be constructed of materials such as "T" posts, sharpened willows, etc., that may be injurious to animals.

    b. All trigger and/or trip gate devices must be approved by the COR/PI prior to gather of animals.

    c. Traps shall be checked a minimum of once every 10 hours.

2. Gather attempts may be accomplished by utilizing a helicopter to drive animals into a temporary trap. If the contractor selects this method the following applies:

    a. A minimum of two saddle-horses shall be immediately available at the trap site to accomplish roping if necessary. Roping shall be done as determined by the COR/PI. Under no circumstances shall animals be tied down for more than one half hour.

b. The contractor shall assure that foals shall not be left behind, and orphaned.

3. Gather attempts may be accomplished by utilizing a helicopter to drive animals to ropers. If the contractor, with the approval of the COR/PI, selects this method the following applies:

   a. Under no circumstances shall animals be tied down for more than one hour.

   b. The contractor shall assure that foals shall not be left behind, or orphaned.

   c. The rate of movement and distance the animals travel shall not exceed limitations set by the COR/PI who will consider terrain, physical barriers, weather, condition of the animals and other factors.

C. Use of Motorized Equipment

1. All motorized equipment employed in the transportation of gathered animals shall be in compliance with appropriate State and Federal laws and regulations applicable to the humane transportation of animals. The Contractor shall provide the COR/PI, if requested, with a current safety inspection (less than one year old) for all motorized equipment and tractor-trailers used to transport animals to final destination.

2. All motorized equipment, tractor-trailers, and stock trailers shall be in good repair, of adequate rated capacity, and operated so as to ensure that gathered animals are transported without undue risk or injury.

3. Only tractor-trailers or stock trailers with a covered top shall be allowed for transporting animals from trap site(s) to temporary holding facilities, and from temporary holding facilities to final destination(s). Sides or stock racks of all trailers used for transporting animals shall be a minimum height of 6 feet 6 inches from the floor. Single deck tractor-trailers 40 feet or longer shall have at least two (2) partition gates providing at least three (3) compartments within the trailer to separate animals. Tractor-trailers less than 40 feet shall have at least one partition gate providing at least two (2) compartments within the trailer to separate the animals. Compartments in all tractor-trailers shall be of equal size plus or minus 10 percent. Each partition shall be a minimum of 6 feet high and shall have a minimum 5 foot wide swinging gate. The use of double deck tractor-trailers is unacceptable and shall not be allowed.

4. All tractor-trailers used to transport animals to final destination(s) shall be equipped with at least one (1) door at the rear end of the trailer which is capable of sliding either horizontally or vertically. The rear door(s) of tractor-trailers and stock trailers must be capable of opening the full width of the trailer. Panels facing the inside of all trailers must be free of sharp edges or holes that could cause injury to the animals. The material facing the inside of all trailers must be strong enough so that the animals cannot push their hooves through the side. Final approval of tractor-trailers and stock trailers used to transport animals shall be held by the COR/PI.

5. Floors of tractor-trailers, stock trailers and loading chutes shall be covered and maintained with wood shavings to prevent the animals from slipping as much as possible during transport.

6. Animals to be loaded and transported in any trailer shall be as directed by the COR/PI and may include limitations on numbers according to age, size, sex, temperament and animal condition. The following minimum square feet per animal shall be allowed in all trailers:

11 square feet per adult horse (1.4 linear foot in an 8 foot wide trailer);
8 square feet per adult burro (1.0 linear foot in an 8 foot wide trailer);
6 square feet per horse foal (.75 linear foot in an 8 foot wide trailer);
4 square feet per burro foal (.50 linear feet in an 8 foot wide trailer).

7. The COR/PI shall consider the condition and size of the animals, weather conditions, distance to be transported, or other factors when planning for the movement of gathered animals. The COR/PI shall provide for any brand and/or inspection services required for the gathered animals.

8. If the COR/PI determines that dust conditions are such that the animals could be endangered during transportation, the Contractor will be instructed to adjust speed.

D. Safety and Communications

1. The Contractor shall have the means to communicate with the COR/PI and all contractor personnel engaged in the gather of wild horses utilizing a VHF/FM Transceiver or VHF/FM portable Two-Way radio. If communications are ineffective the government will take steps necessary to protect the welfare of the animals.

   a. The proper operation, service and maintenance of all contractor furnished property is the responsibility of the Contractor. The BLM reserves the right to remove from service any contractor personnel or contractor furnished equipment which, in the opinion of the contracting officer or COR/PI violate contract rules, are unsafe or otherwise unsatisfactory. In this event, the Contractor will be notified in writing to furnish replacement personnel or equipment within 48 hours of notification. All such replacements must be approved in advance of operation by the Contracting Officer or his/her representative.

   b. The Contractor shall obtain the necessary FCC licenses for the radio system

   c. All accidents occurring during the performance of any task order shall be immediately reported to the COR/PI.

2. Should the contractor choose to utilize a helicopter the following will apply:

   a. The Contractor must operate in compliance with Federal Aviation Regulations, Part 91. Pilots provided by the Contractor shall comply with the Contractor's Federal Aviation Certificates, applicable regulations of the State in which the gather is located.

   b. Fueling operations shall not take place within 1,000 feet of animals.

E. Site Clearances

No personnel working at gather sites may excavate, remove, damage, or otherwise alter or deface or attempt to excavate, remove, damage or otherwise alter or deface any archaeological resource located on public lands or Indian lands.

Prior to setting up a trap or temporary holding facility, BLM will conduct all necessary clearances (archaeological, T&E, etc). All proposed site(s) must be inspected by a government archaeologist. Once archaeological clearance has been obtained, the trap or temporary holding facility may be set up. Said clearance shall be arranged for by the COR, PI, or other BLM employees.

Gather sites and temporary holding facilities would not be constructed on wetlands or riparian zones.

F. Animal Characteristics and Behavior

Releases of wild horses would be near available water when possible. If the area is new to them, a short-term adjustment period may be required while the wild horses become familiar with the new area.

G. Public Participation

Opportunities for public viewing (i.e. media, interested public) of gather operations will be made available to the extent possible; however, the primary considerations will be to protect the health, safety and welfare of the animals being gathered and the personnel involved. The public must adhere to guidance from the on-site BLM representative. It is BLM policy that the public will not be allowed to come into direct contact with WH&BSs being held in BLM facilities. Only authorized BLM personnel or contractors may enter the corrals or directly handle the animals. The general public may not enter the corrals or directly handle the animals at anytime or for any reason during BLM operations.

H. Responsibility and Lines of Communication

Contracting Officer's Representative/Project Inspector

Brianna Brodowski, Wild Horse and Burro Specialist, Winnemucca District
Garrett Swisher, Wild Horse and Burro Specialist, Winnemucca District
Ruth Thompson, NV WH&Bs Program Lead

The Contracting Officer's Representatives (CORs) and the project inspectors (PIs) have the direct responsibility to ensure the Contractor's compliance with the contract stipulations. The Humboldt River Field Managers will take an active role to ensure the appropriate lines of communication are established between the field, Field Office, State Office, National Program Office, and BLM Holding Facility offices. All employees involved in the gathering operations will keep the best interests of the animals at the forefront at all times.

All publicity, formal public contact and inquiries will be handled through the Field Manager and/or the Supervisory Natural Resource Specialist and Field Office Public Affairs. These individuals will be the primary contact and will coordinate with the COR/PI on any inquiries.

The COR will coordinate with the contractor and the BLM Corrals to ensure animals are being transported from the gather site in a safe and humane manner and are arriving in good condition.

The contract specifications require humane treatment and care of the animals during removal operations. These specifications are designed to minimize the risk of injury and death during and after gather of the animals. The specifications will be vigorously enforced.

Should the Contractor show negligence and/or not perform according to contract stipulations, he will be issued written instructions, stop work orders, or defaulted.

APPENDIX V- WILD HORSE AND BURRO GATHER OBSERVATION PROTOCOL

BLM recognizes and respects the right of interested members of the public and the press to observe wild horse gather operations. At the same time, BLM must ensure the health and safety of the public, BLM's employees and contractors, and America's wild horses. Accordingly, the BLM developed these rules to maximize the opportunity for reasonable public access to the gather while ensuring that BLM's health and safety responsibilities are fulfilled. Failure to maintain safe distances from operations at the gather and temporary holding sites could result in members of the public inadvertently getting in the path of the wild horses or gather personnel, thereby placing themselves and others at risk, or causing stress and potential injury to the wild horses. The BLM and the contractor's helicopter pilot must comply with 14 CFR Part 91 of the Federal Aviation Regulations, which determines the minimum safe altitudes and distance people must be from the aircraft. To be in compliance with these regulations, the viewing location at the gather site and holding corrals must be approximately 500 feet from the operating location of the helicopter at all times. The viewing locations may vary depending on topography, terrain and other factors.

Daily Visitor Protocol

- A Wild Horse Gather Information Phone Line would be set up prior to the gather so the public can call for daily updates on gather information and statistics. Visitors are strongly encouraged to check the phone line the evening before they plan to attend the gather to confirm the gather and their tour of it is indeed taking place the next day as scheduled (weather, mechanical issues or other things may affect this) and to confirm the meeting location.

- Visitors must direct their questions/comments to either their designated BLM representative or the BLM spokesperson on site, and not engage other BLM/contractor staff and disrupt their gather duties/responsibilities - professional and respectful behavior is expected of all. BLM may make the BLM staff available during down times for a Q&A session on public outreach and education days. However, the contractor and its staff would not be available to answer questions or interact with visitors.

- Observers must provide their own 4-wheel drive high clearance vehicle, appropriate shoes, winter clothing, food, and water. Observers are prohibited from riding in government and contractor vehicles and equipment.

- Gather operations may be suspended if bad weather conditions create unsafe flying conditions.

- BLM would establish one or more observation areas, in the immediate area of the gather and holding sites, to which individuals would be directed. These areas would be placed so as to maximize the opportunity for public observation while providing for a safe and effective wild horse gather. The utilization of such observation areas is necessary due to the use and presence of heavy equipment and aircraft in the gather operation and the critical need to allow BLM personnel and contractors to fully focus on attending to the needs of the wild horses while maintaining a safe environment for all involved. In addition, observation areas would be sited so as to protect the wild horses from being spooked, startled, or impacted in a manner that results in increased stress.

- BLM would delineate observation areas with yellow caution tape (or a similar type of tape or ribbon).

- ❖ Visitors would be assigned to a specific BLM representative on public outreach and education days and must stay with that person at all times.

- ❖ Visitors are NOT permitted to walk around the gather site or temporary holding facility unaccompanied by their BLM representative.

- ❖ Observers are prohibited from climbing/trespassing onto or in the trucks, equipment, or corrals, which is the private property of the contractor.

- ❖ When BLM is using a helicopter or other heavy equipment in close proximity to a designated observation area, members of the public may be asked to stay by their vehicle for some time before being directed to an observation area once the use of the helicopter or the heavy machinery is complete.

- ❖ When given the signal that the helicopter is close to the gather site bringing wild horses in, visitors must sit down in areas specified by BLM representatives and must not move or talk as the wild horses are guided into the corral.

- ❖ Individuals attempting to move outside a designated observation area would be requested to move back to the designated area or to leave the site. Failure to do so may result in citation or arrest. It is important to stay within the designated observation area to safely observe the wild horse gather.

- ❖ Observers would be polite, professional and respectful to BLM managers and staff and the contractor/employees. Visitors who do not cooperate and follow the rules would be escorted off the gather site by BLM law enforcement personnel and would be prohibited from participating in any subsequent observation days.

- ❖ BLM reserves the right to alter these rules based on changes in circumstances that may pose a risk to health, public safety or the safety of wild horses (such as weather, lightening, wildfire, etc.).

Public Outreach and Education Day

- ❖ The media and public are welcome to attend the gather any day and are encouraged to attend on public outreach and education days. On this day, BLM would have additional interpretive opportunities and staff available to answer questions.

- ❖ The number of public outreach and education days per week, and which days they are, would be determined prior to the gather and would be announced through a press release and on the website. Interested observers should RSVP ahead through the BLM-Winnemucca District Office number (TBD). A meeting place would be set for each public outreach and education day and the RSVP list notified. BLM representatives would escort observers on public outreach and education days to and from the gather site and temporary holding facility.

APPENDIX VI- BLUE WING COMPLEX POPULATION MODELING

PopEquus (1.0.2) Advanced Tool - Simulation Report

30 April 2025 17:54:26

Population inputs

You used the *PopEquus* Advanced Tool to simulate a horse population that started with 609 horses, had a population sex ratio where 0.5 of the population is female, was censused at a time that foals were present (Yes), had a mean annual population growth rate of 20 percent per year, and a capture probability during management (e.g., helicopter gather) of 0.75. You assumed that the target population size range for the population (i.e., Appropriate Management Level) was 333-553 horses, that removals aimed for a target population size of 333, and that if the population decreased to beneath 30 horses that it would be at high risk of local extirpation. In summary:

- Population size: 609
- Female proportion of population: 0.5
- Foals included in population size? Yes
- Population growth rate (% increase per year): 20
- Capture proportion during gathers: 0.75
- Appropriate management level (minimum): 333
- Appropriate management level (maximum): 553
- Target population size: 333
- Persistence threshold (i.e., minimum number of individuals): 30

Simulation inputs

You simulated populations over a 10-year projection interval, and you performed 10 replicate projections.

- Projection interval (years): 10
- Number of simulation replicates: 10

Management alternatives

You simulated 6 management alternatives using the tool: GonaCon, No management, PZP-22, Removals, Removals and GonaCon, Removals and PZP-22.
The following settings were specified for management actions:

Gather options

- Short-term holding costs ($ per day): 7.61

Removal options

- Removal years: 1, 4, 7, 10
- Reactive removals: No

- Minimum gather interval (years) for a reactive removal: 2
- Selective removals: No
- Male proportion of population returned after a removal: 0.6
- Maximum number removed from the population per year: 2000
- Number of years to project holding population: 25
- Long-term holding costs ($ per day): 2.02
- Proportion of horses adopted per year: 0.69
- Net adoption cost to agency ($ per horse): 1775
- Foaling reduction (%) of removed females in captivity the first year after removal: 25

GonaCon options

- Treatment years: 1, 4, 7, 10
- Treatment ages: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20
- Treatment percentage (%) for age-eligible females: 100
- Treatment cost per shot ($): 50
- Hold to give booster treatment: Yes
- Days in holding until booster: 30

PZP-22 options

- Treatment years: 1, 4, 7, 10
- Treatment ages: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20
- Treatment percentage (%) for age-eligible females: 100
- Primer treatment cost ($): 430
- Days in holding to receive treatment: 7
- Booster treatment cost ($): 30

Results

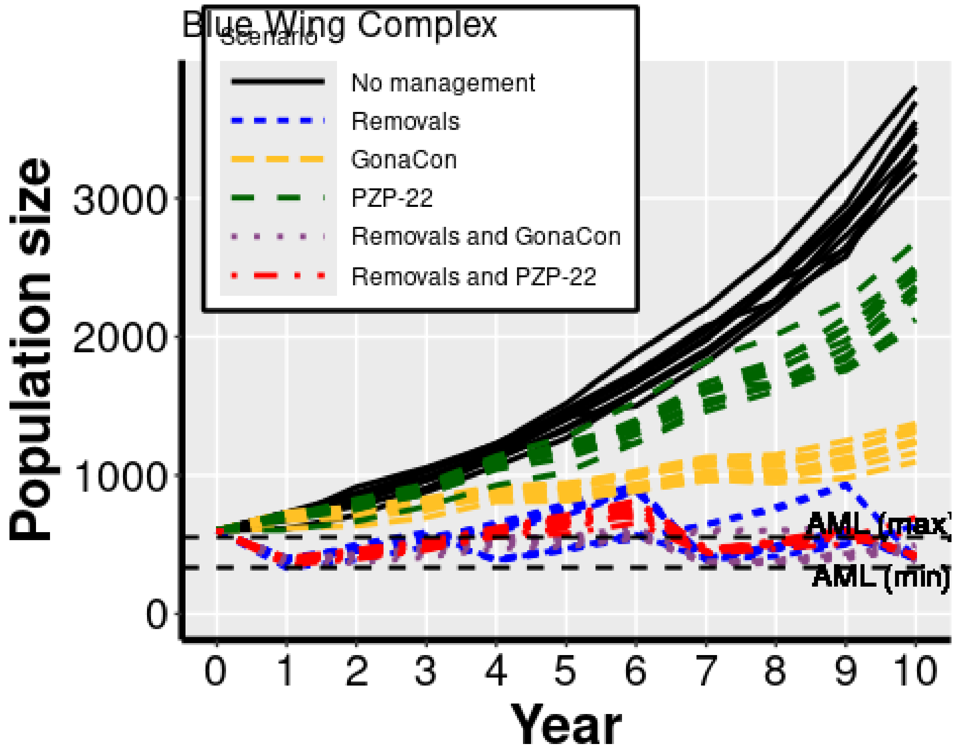
Simulation outcomes can be summarized with a table(s) describing mean values among replicates for relevant metrics. Metrics include: population size in the final year of the projection interval ('Final population size'), average population size across all years ('Mean population size'), proportion of replicates that ended within the AML (i.e., the likelihood that an alternative yielded AML in the final year; 'AML probability'), proportion of replicates that ended above the persistence threshold ('Persistence probability'), total number of horses gathered ('Number gathered'), total number of horses removed ('Number removed'), total number of horses treated ('Number treated'), cost of management in the Herd Management Area (HMA) in millions of USD ['On-range cost ($ million)'], and total cost of management, including costs incurred at the HMA and in holding facilities ['Total cost ($ million)']. Values in parentheses are 95% confidence intervals.

Alternative	Final population size	Overall mean population size	AML probability
No management	3464 (3200-3783)	1632 (1542-1772)	0.00
Removals	448 (393-639)	544 (482-573)	0.80
GonaCon	1259 (1113-1367)	910 (842-961)	0.00
PZP-22	2377 (2089-2648)	1295 (1178-1415)	0.00
Removals and GonaCon	457 (373-506)	475 (459-502)	1.00
Removals and PZP-22	461 (405-672)	538 (514-572)	0.80

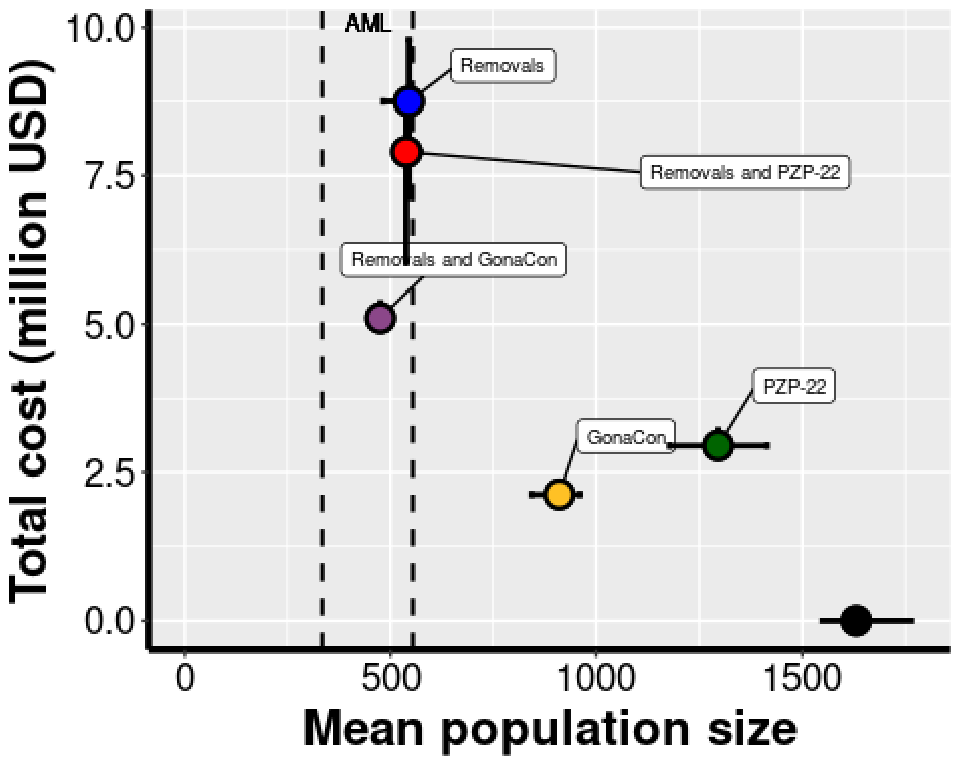
Alternative	Persistence probability	Number gathered	Number removed	Number treated
No management	1.00	0 (0-0)	0 (0-0)	0 (0-0)
Removals	1.00	1516 (1126-1754)	1024 (840-1130)	0 (0-0)
GonaCon	1.00	2611 (2438-2765)	0 (0-0)	1217 (1140-1282)
PZP-22	1.00	3614 (3331-3956)	0 (0-0)	1596 (1478-1757)
Removals and GonaCon	1.00	1578 (1524-1650)	529 (501-569)	565 (540-616)
Removals and PZP-22	1.00	1842 (1716-1917)	901 (632-1009)	543 (513-621)

Alternative	On-range cost ($ million)	Off-range cost ($ million)	Total cost ($ million)
No management	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)
Removals	1.17 (0.85-1.39)	7.58 (6.29-8.59)	8.75 (7.13-9.80)
GonaCon	2.13 (2.01-2.22)	0.00 (0.00-0.00)	2.13 (2.01-2.22)
PZP-22	2.95 (2.75-3.22)	0.00 (0.00-0.00)	2.95 (2.75-3.22)
Removals and GonaCon	1.38 (1.34-1.43)	3.72 (3.54-3.94)	5.10 (4.89-5.36)
Removals and PZP-22	1.57 (1.50-1.64)	6.33 (4.50-7.10)	7.90 (6.03-8.72)

A graph of population size through time can be used to visualize effects of management alternatives on population size. Different colored lines indicate management alternatives simulated by the user; for each alternative, individual lines are different simulation replicates, that vary due to random chance. Dashed horizontal black lines indicate the minimum and maximum target population size range (i.e., AML).



Individuals might be interested in identifying a management alternative(s) that achieves the reduction or maintenance of a population within the target population size range (i.e., AML) while also incurring lower direct costs relative to other options. We can visualize the relationship between predicted population size and direct costs of management by graphing the overall mean population size (number of horses) on the x-axis and total cost of management (millions of USD) on the y-axis predicted by each alternative. Points are mean predictions among replicates and are colored by scenario (as in in the first graph); horizontal and vertical lines from points represent 95% confidence intervals in predicted population size and cost, respectively, for each scenario. While this graph does not account for all factors that might be important during management decisions, the graph provides a useful illustration of the trade-off between predicted population size and total direct cost of management resulting from the simulated alternatives.



Summary

The alternative that yielded the smallest average population size was:

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## [1] "Removals and GonaCon"
```

The alternative that incurred the lowest direct costs 'on range' (other than 'no management') over the next 10 years was:

```
## [1] "Removals"
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The alternative that incurred the lowest total direct costs across the sum of 'on range' and 'off range' (other than 'no management') over the next 35 years was:

```
## [1] "GonaCon"
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Among the alternatives that achieved population size within Appropriate Management Levels, the alternative that incurred the lowest total direct costs across the sum of 'on range' and 'off range':

```
## [1] "Removals"
```

Note: results from the simulations may not be the sole basis for a management decision. The model does not explicitly account for or consider multiple uses on public lands, local land use planning considerations, ecological costs of horses on ecosystems, or other important values. The results presented here reflect considerations related to population size, amount of management, and fiscal costs of management that were estimated, given the input parameters and alternatives specified.

APPENDIX VII- RANGELAND HEALTH STANDARDS

The Sierra Front-Northern Great Basin Resource Advisory Council (SFNGB-RAC) Standards and Guidelines for Rangeland Health are the current basis for assessing rangeland health in relation to management of wild horses and burros, and livestock grazing, within the Winnemucca District. The five (5) Standards outlined below are included in the approved Standards and Guidelines for Rangeland Health in the Nevada's Sierra Front-Northern Great Basin Area and are adopted as Standards for wild horses and burros.

STANDARD 1. SOILS:
Soil processes will be appropriate to soil types, climate and land form. As indicated by:

- Surface litter is appropriate to the potential for the site;
- Soil crusting formations in shrub interspaces, and soil compaction are minimal or not in evidence allowing for appropriate infiltration of water;
- Hydrologic cycle, nutrient cycle, and energy flow are adequate for the vegetative communities;
- Plant communities are diverse and vigorous, and there is evidence of recruitment; and
- Basal and canopy cover (vegetative) is appropriate for the site's potential.

STANDARD 2. RIPARIAN/WETLANDS:
Riparian/Wetland systems are in properly functioning condition. As indicated by:

- Sinuosity, width/depth ration, and gradient are adequate to dissipate stream flow without excessive erosion or deposition;
- Riparian vegetation is adequate to dissipate high flow energy and protect banks from excessive erosion; and
- Plant species diversity is appropriate for riparian-wetland systems.

STANDARD 3. WATER QUALITY:
Water quality criteria in Nevada State Law shall be achieved or maintained. As indicated by:

- Chemical constituents do not exceed the water quality Standards;
- Physical constituents do not exceed the water quality Standards;
- Biological constituents do not exceed the water quality Standards; and
- The water quality of all water bodies, including ground water located on or influenced by BLM lands will meet or exceed the applicable Nevada water quality Standards. Water quality Standards for surface and ground waters include the designated beneficial uses, numeric criteria, narrative criteria, and anti-degradation requirements set forth under State law, and as found in the Section 303(c) of the Clean Water Act.

STANDARD 4. PLANT AND ANIMAL HABITAT:
Populations and communities of native plant species and habitats for native animals species are healthy, production, and diverse. As indicated by:

- Good representation of life forms and numbers of species;
- Good diversity of height, size, and distribution of plants;
- Number of wood stalks, seed stalks, and seed production adequate for stand maintenance; and
- Vegetative mosaic, vegetative corridors for wildlife, and minimal habitat fragmentation.

STANDARD 5. SPECIAL STATUS SPECIES HABITAT:
Habitat conditions meet the life cycle requirement of special status species. As indicated by:

- Habitat areas are large enough to support viable populations of special status species;
- Special status plant and animal numbers and ages appear to ensure stable populations;
- Good diversity of height, size, and distribution of plants;
- Number of wood stalks, seed stalks, and seed production adequate for stand maintenance; and
- Vegetative mosaic, vegetative corridors for wildlife, and minimal habitat fragmentation.

2016 Land Health Assessment (AIM)
The most recent Land Health Assessment (AIM) was conducted in 2016. The Land Health Assessment (AIM) program operates through GBI's Research Associate Program, which focuses on conservation and management of natural and cultural resources in the Intermountain West, including the Great Basin, Mojave Desert, and the Lake Tahoe Basin. The AIM program is a partnership between GBI and the BLM with the main objective of conducting ecological assessments, monitoring, and analysis of BLM rangelands with the purpose of informing BLM multiuse management. During the 2016 assessment, rangeland health was assessed for six plots in the Blue Wing-Seven Troughs Allotment. There was a moderate or greater departure from reference in Biotic Integrity in three plots, and no departures from reference moderate or greater for either Soil and Site Stability or Hydrologic Function.

Table 59 from 2016 LHA: Summary of rangeland health departure from reference condition is shown for each plot in the Blue Wing- Seven Troughs Allotment.

		Rangeland Health Rating		
Plot	**Ecological Site**	**Soil & Site Stability**	**Hydrologic Function**	**Biotic Integrity**
WM-Shade-142	R027XY013NV	NS	NS	M
WM-Shade-145	R027XY013NV	NS	NS	SM
WM-Shade-147	R027XY018NV	NS	NS	M
WM-WySage2-259	R027XY079NV	SM	SM	SM
WM-WySage2-261	R027XY013NV	SM	SM	SM
WM-WySage2-305	R027XY008NV	NS	SM	ME

Notes: Ratings are Not Assessed (NA), None to Slight (NS), Slight to Moderate (SM), Moderate (M), Moderate to Extreme (ME), and Extreme to Total (ET). Red indicates ratings with moderate or greater departure from reference conditions.

Figures 1-4 (below) show trend data from the Blue Wing- Seven Troughs Allotment for annual forb and grass cover, perennial forb and grass cover, shrub cover, and bare ground cover, from 1986-2024. These figures were generated utilizing climateengine.org.

Figure 1. Annual Forb and Grass Cover 1986-2024, Blue Wing-Seven Troughs Allotment

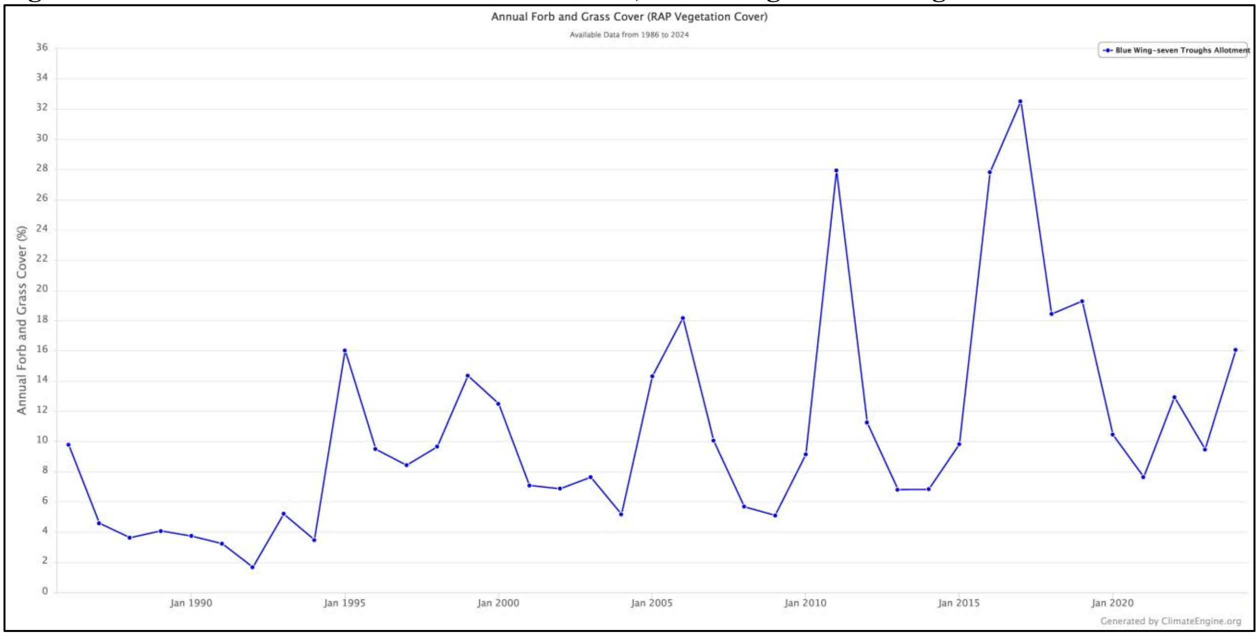


Figure 2. Perennial Forb and Grass Cover 1986-2024, Blue Wing-Seven Troughs Allotment

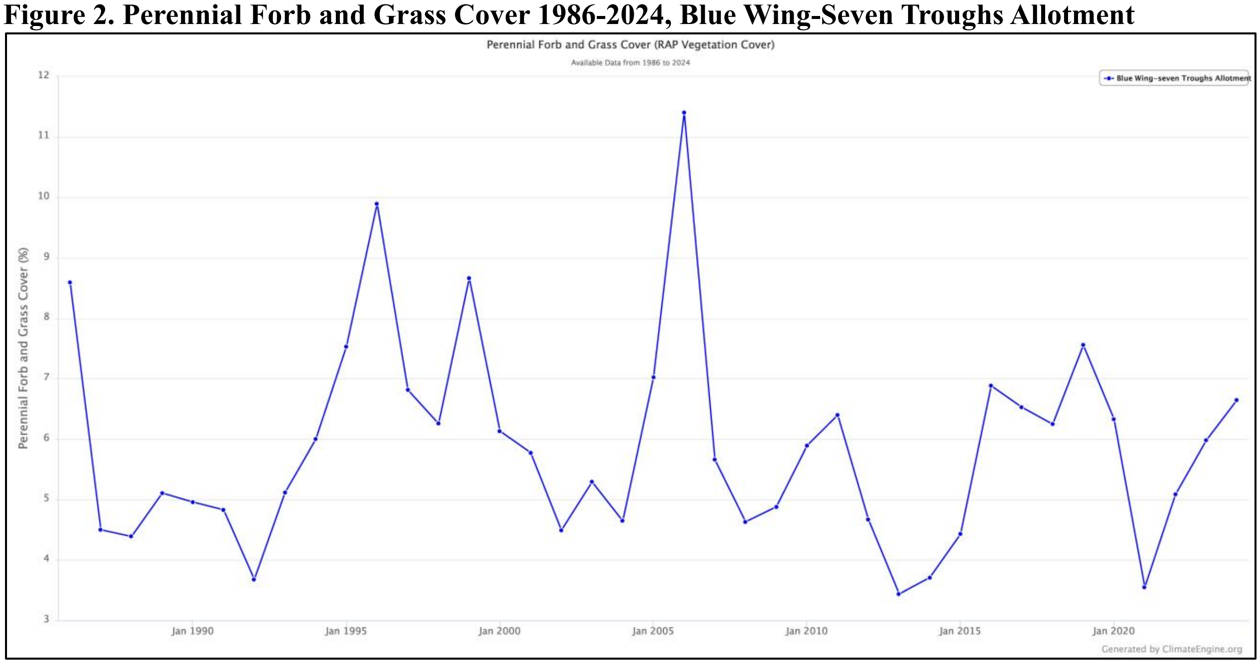


Figure 3. Shrub Cover 1986-2024, Blue Wing-Seven Troughs Allotment

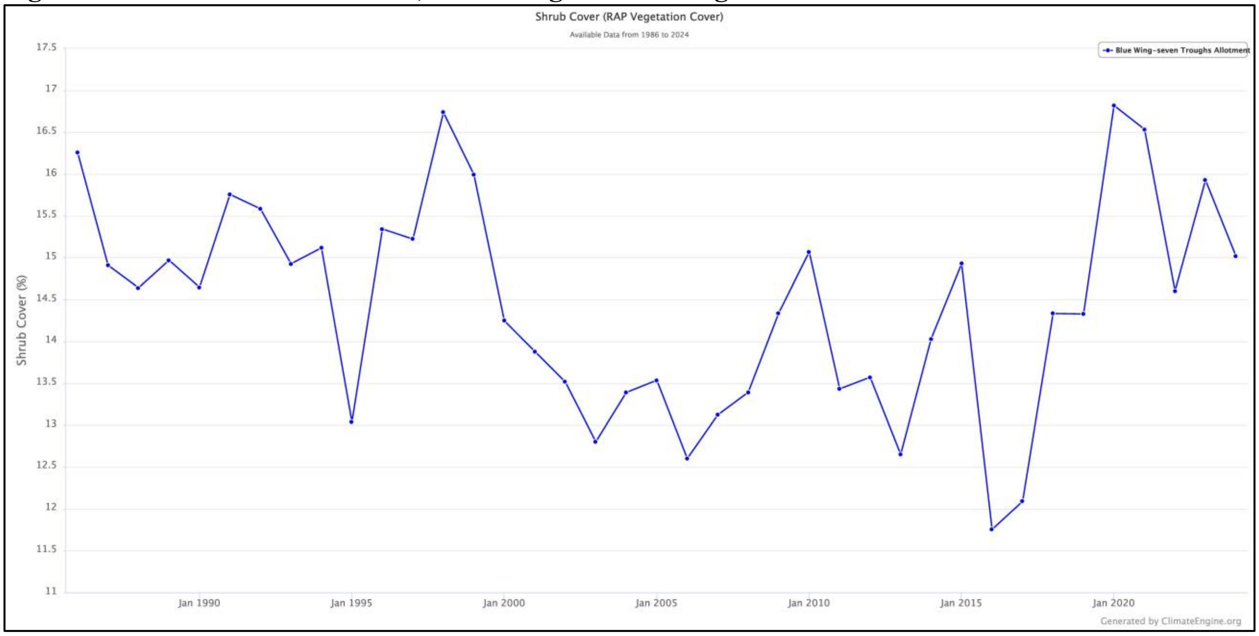
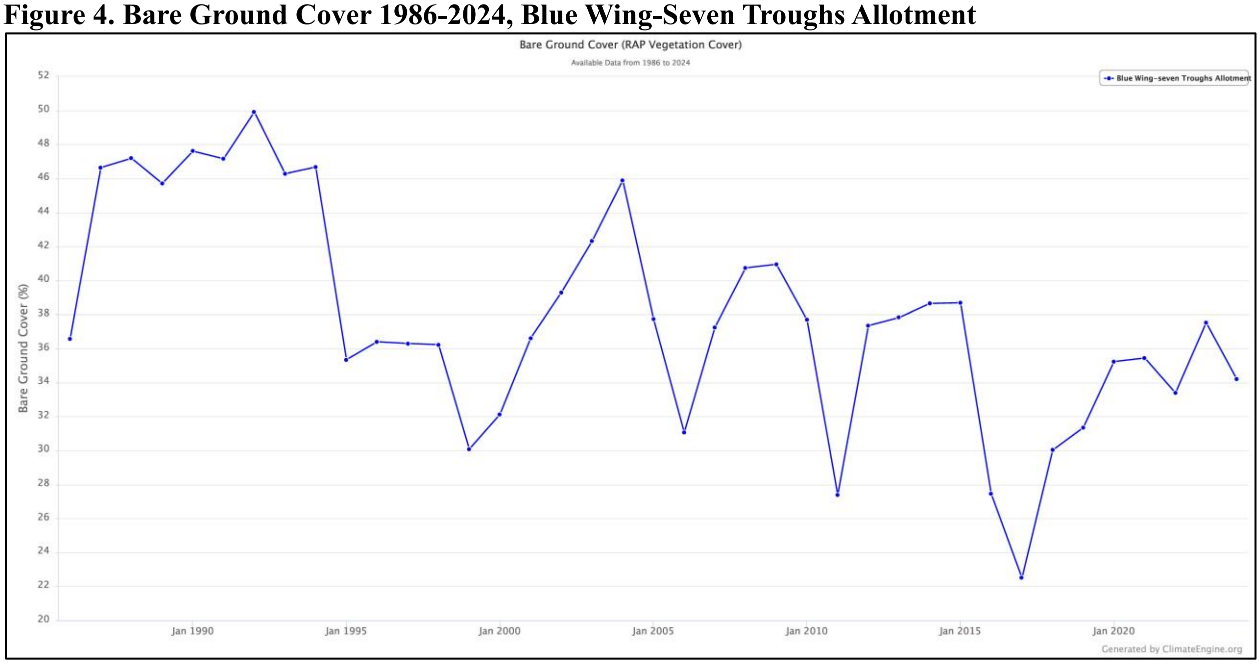


Figure 4. Bare Ground Cover 1986-2024, Blue Wing-Seven Troughs Allotment



APPENDIX VIII- NEVADA NOXIOUS WEEDS LIST

Nevada Administrative Code (effective 10-31-05)
555.010 1. The following weeds are designated noxious weeds:

DEFINITIONS

Category "A": Weeds not found or limited in distribution throughout the state; actively excluded from the state and actively eradicated wherever found; actively eradicated from nursery stock dealer premises; control required by the state in all infestations

Category "B": Weeds established in scattered populations in some counties of the state; actively excluded where possible, actively eradicated from nursery stock dealer premises; control required by the state in areas where populations are not well established or previously unknown to occur.

Category "C": Weeds currently established and generally widespread in many counties of the state; actively eradicated from nursery stock dealer premises; abatement at the discretion of the state quarantine officer

Common Name	Scientific Name
Category A Weeds:	
African Rue	*Peganum harmala*
Austrian fieldcress	*Rorippa austriaca*
Austrian peaweed	*Sphaerophysa salsula / Swainsona salsula*
Black henbane	*Hysocyamus niger*
Camelthorn	*Alhagi camelorum*
Common crupina	*Crupina vulgaris*
Dalmation Toadflax	*Linaria dalmatica*
Dyer's woad	*Isatis tinctoria* Eura-
sian water-milfoil	*Myriophyllum spicatum*
Giant Reed	*Arundo donax*
Giant Salvinia	*Salvinia molesta*
Goats rue	*Galega officinalis*
Green fountain grass	*Pennisetum setaceum*
Houndstongue	*Cynoglossum officinale*
Hydrilla	*Hydrilla verticillata*
Iberian Star thistle	*Centaurea iberica*
Klamath weed	*Hypericum perforatum*
Leafy spurge	*Euphorbia esula*
Malta Starthistle	*Centaurea melitensis*
Mayweed chamomile	*Anthemis cotula*
Mediterranean sage	*Salvia aethiopis*
Purple loosestrife	*Lythrum salicaria, L.virgatum* and their cultivars
Purple Star thistle	*Centaurea calcitrapa*
Rush skeletonweed	*Chondrilla juncea*
Sow Thistle	*Sonchus arvensis*

Spotted Knapweed	*Centaurea masculosa*
Squarrose star thistle	*Centaurea virgata Lam. Var. squarrose*
Sulfur cinquefoil	*Potentilla recta*
Syrian Bean Caper	*Zygophyllum fabago*
Yellow Starthistle	*Centaurea solstiltialis*
Yellow Toadflax	*Linaria vulgaris*

Category B Weeds:

Carolina Horse-nettle	*Solanum carolinense*
Diffuse Knapweed	*Centaurea diffusa*
Medusahead	*Taeniatherum caput-medusae*
Musk Thistle	*Carduus nutans*
Russian Knapweed	*Acroptilon repens*
Sahara Mustard	*Brassica tournefortii*
Scotch Thistle	*Onopordum acanthium*
White Horse-nettle	*Solanum elaeagnifolium*

Category C Weeds:

Canada Thistle	*Cirsium arvense*
Hoary cress	*Cardaria draba*
Johnson grass	*Sorghum halepense*
Perennial pepperweed	*Lepidium latifolium*
Poison Hemlock	*Conium maculatum*
Puncture vine	*Tribulus terrestris*
Salt cedar (tamarisk)	*Tamarix spp*
Water hemlock	*Cicuta maculata*

APPENDIX IX- WILDLIFE SPECIES LIST – NORTH-CENTRAL NEVADA

This list is a combination of wildlife sight record data and NDOW's best effort to predict what wildlife species live within Pershing and Churchill County in all seasons and under optimum habitat conditions.

With the exception of the European Starling, House Sparrow, Eurasian Collared-Dove, Ringed Turtle-Dove and Rock Dove, all birds are protected in Nevada by either the International Migratory Bird Treaty Act, Endangered Species Act or as game species. Several mammal, reptile and amphibian species are also protected as either game, sensitive, threatened or priority species.

Habitats- (Sagebrush steppe, Salt desert scrub, Playa, Mountain brush, Subalpine deciduous forest and Wetland / Riparian/ Lake Habitats)

L.E. = Locally Extirpated

Birds
Order: *Gaviiformes* (Diver/Swimmers)
Family: *Gaviidae* (Loons)
Common Loon *Gavia immer*

Order: *Podicipediformes* (Flat-toed Divers)
Family: *Podicipedidae* (Grebes)
Pied-billed Grebe *Podilymbus podiceps*
Horned Grebe *Podiceps auritus*
Eared Grebe *Podiceps nigricollis*
Western Grebe *Aechmophorus occidentalis*
Clark's Grebe *Aechmophorus clarkii*

Order: *Pelecaniformes* (Four-toed Fisheaters)
Family: *Pelecanidae* (Pelicans)
American White Pelican *Pelecanus erythrorhynchos*

Family: *Phalacrocoracidae* (Cormorants)
Double-crested Cormorant *Phalacrocorax auritus*

Order: *Ciconiiformes* (Long-legged Waders)
Family: *Ardeidae* (Bitterns, Herons, Egrets)
American Bittern *Botaurus lentiginosus*
Great Blue Heron *Ardea herodias*
Great Egret *Ardea alba*
Snowy Egret *Egretta thula*
Black-crowned Night Heron *Nycticorax nycticorax*

Family: *Threskiornithidae* (Ibises)
White-faced Ibis *Plegadis chihi*

Family: *Cathartidae* (New World Vultures)
Turkey Vulture *Cathartes aura*

Order: *Anseriformes* (Waterfowl)
Family: *Anatidae* (Ducks, Geese, Swans)
Greater White-fronted Goose *Anser albifrons*
Snow Goose *Chen caerulescens*
Canada Goose *Branta canadensis*
Tundra Swan *Cygnus columbianus*
Wood Duck *Aix sponsa*
Gadwall *Anas strepera*
American Wigeon *Anas americana*
Eurasian Wigeon *Anas penelope*
Mallard *Anas platyrhynchos*
Blue-winged Teal *Anas discors*
Cinnamon Teal *Anas cyanoptera*
Northern Shoveler *Anas clypeata*
Northern Pintail *Anas acuta*
Green-winged Teal *Anas crecca*
Canvasback *Aythya valisinaria*
Redhead *Aythya americana*
Ring-necked Duck *Aythya collaris*
Greater Scaup *Aythya marila*
Lesser Scaup *Aythya affinis*
Long-tailed Duck *Clangula hyemalis*
Bufflehead *Bucephala albeola*
Common Goldeneye *Bucephala clangula*
Barrow's Goldeneye *Bucephala islandica*
Hooded Merganser *Lophodytes cucullatus*
Common Merganser *Mergus merganser*
Red-breasted Merganser *Mergus serrator*
Ruddy Duck *Oxyura jamaicensis*

Order: *Falconiformes* (Diurnal Flesh Eaters)
Family: *Accipitridae* (Hawks, Eagles, Osprey)
Osprey *Pandion haliaetus*
Bald Eagle *Haliaetus leucocephalus*
Northern Harrier *Circus cyaneus*
Sharp-shinned Hawk *Accipiter striatus*
Cooper's Hawk *Accipiter cooperii*
Northern Goshawk *Accipiter gentilis*
Red-shouldered Hawk *Buteo lineatus*
Broad-winged Hawk *Buteo platypterus*
Swainson's Hawk *Buteo swainsoni*
Red-tailed Hawk *Buteo jamaicensis*
Ferruginous Hawk *Buteo regalis*
Rough-legged Hawk *Buteo lagopus*
Golden Eagle *Aquila chrysaetos*

Family: *Falconidae* (Falcons)
American Kestrel *Falco sparverius*
Merlin *Falco columbarius*
Peregrine Falcon *Falco perigrinus*

Prairie Falcon *Falco mexicanus*

Order: *Galliformes* (Chicken Relatives)
Family: *Phasianidae* (Grouse, Partridge)
Chukar *Alectoris chukar*
Ring-necked Pheasant *Phasianus colchicus*
Ruffed Grouse *Bonasa umbellus*
Greater Sage-Grouse *Centrocercus urophasianus*

Family: *Odontophoridae* (New World Quail)
California Quail *Callipepla californica*
Mountain Quail *Oreortyx pictus*

Order: *Gruiformes* (Cranes and Allies)
Family: *Rallidae* (Rails, Coots)
Virginia Rail *Rallus limicola*
Sora *Porzana carolina*
American Coot *Fulica americana*

Family: *Gruidae* (Cranes)
Greater Sandhill Crane *Grus canadansis tabida*

Order: *Charadriiformes* (Wading Birds)
Family: *Charadriidae* (Plovers)
Black-bellied Plover *Pluvialis squatarola*
Snowy Plover *Charadrius alexandrinus*
Semi-palmated Plover *Charadrius semipalmatus*
Killdeer *Charadrius vociferus*

Family: *Recurvirostridae* (Avocets)
Black-necked Stilt *Himantopus mexicanus*
American Avocet *Recurvirostra americana*

Family: *Scolopacidae* (Sandpipers, Phalaropes)
Greater Yellowlegs *Tringa melanoleuca*
Lesser Yellowlegs *Tringa flavipes*
Solitary Sandpiper *Tringa solitaria*
Willet *Catoptrophorus semipalmatus*
Spotted Sandpiper *Actitus macularia*
Long-billed Curlew *Numenius americanus*
Western Sandpiper *Calidris mauri*
Least Sandpiper *Calidris minutilla*
Long-billed Dowitcher *Limnodromnus scolopaceus*
Wilson’s Snipe *Gallinago gallinago*
Wilson’s Phalarope *Phalaropus tricolor*
Red-necked Phalarope *Phalaropus lobatus*

Family: *Laridae* (Gulls, Terns)
Franklin’s Gull *Larus pipixcan*
Bonaparte’s Gull *Larus philadelphia*
Ring-billed Gull *Larus delawarensis*

California Gull *Larus californicus*
Herring Gull *Larus argentatus*
Caspian Tern *Sterna caspia*
Forster's Tern *Sterna forsteri*

Order: *Columbiformes* (Pigeons and Allies)
Family: *Columbidae* (Doves)
Rock Dove *Columba livia*
White-winged Dove *Zenaida asiatica*
Mourning Dove *Zenaida macroura*
Eurasian Collared-Dove *Streptopelia decaocto*

Order: *Cuculiformes* (Cuckoos and Allies)
Family: *Cuculidae* (Cuckoos and Roadrunners)

Order: *Strigiformes* (Nocturnal Flesh Eaters)
Family: *Tytonidae* (Barn Owls)
Barn Owl *Tyto alba*

Family: *Strigidae* (Owls)
Flammulated Owl *Otus flammeolus*
Western Screech-Owl *Otus kennicottii*
Great Horned Owl *Bubo virginianus*
Northern Pygmy-Owl *Glaucidium gnoma*
Western Burrowing Owl *Athene cunicularia hypugaea*
Long-eared Owl *Asio otus*
Short-eared Owl *Asio flammeus*
Northern Saw-whet Owl *Aegolius acadicus*

Order: *Caprimulgiformes* (Night Jars)
Family: *Caprimulgidae* (Goatsuckers)
Common Nighthawk *Chordeiles minor*
Common Poorwill *Phalaenoptilus nuttallii*

Order: *Apodiformes* (Small Fast Fliers)
Family: *Apodidae* (Swifts)
White-throated Swift *Aeronautes saxatalis*
Family: *Trochilidae* (Hummingbirds)
Black-chinned Hummingbird *Archilochus alexandri*
Calliope Hummingbird *Stellula calliope*
Broad-tailed Hummingbird *Selasphorus platycercus*
Rufous Hummingbird *Selasphorus rufus*

Order: *Coraciiformes* (Cavity Nesters)
Family: *Alcedinidae* (Kingfishers)
Belted Kingfisher *Ceryle alcyon*

Order: *Piciformes* (Cavity Builders)
Family: *Picidae* (Woodpeckers)
Lewis' Woodpecker *Melanerpes lewis*
Red-naped Sapsucker *Sphyrapicus nuchalis*

Downy Woodpecker *Picoides pubescens*
Hairy Woodpecker *Picoides villosus*
Northern Flicker *Colaptes auratus*

Order: *Passeriformes* (Perching Birds)
Family: *Tyrannidae* (Flycatchers)
Western Wood-Pewee *Contopus sordidulus*
Willow Flycatcher *Epidonax traillii*
Hammond's Flycatcher *Epidonax hammondii*
Gray Flycatcher *Epidonax wrightii*
Dusky Flycatcher *Epidonax oberholseri*
Cordilleran Flycatcher *Epidonax occidentalis*
Say's Phoebe *Sayornis saya*
Ash-throated Flycatcher *Myiarchus cinerascens*
Western Kingbird *Tyrannus verticalis*
Eastern Kingbird *Tyrannus tyrannus*

Family: *Laniidae* (Shrikes)
Loggerhead Shrike *Lanius ludovicianus*
Northern Shrike *Lanius excubitor*

Family: *Vireonidae* (Vireos)
Plumbeous Vireo *Vireo plumbeus*
Warbling Vireo *Vireo gilvus*

Family: *Corvidae* (Jays)
Western Scrub-Jay *Aphelocoma californica*
Clark's Nutcracker *Nucifraga columbiana*
Black-billed Magpie *Pica pica*
American Crow *Corvus brachyrhynchos*
Common Raven *Corvus corax*

Family: *Alaudidae* (Larks)
Horned Lark *Eremophila alpestris*

Family: *Hirundinidae* (Swallows)
Tree Swallow *Tachycineta bicolor*
Violet-green Swallow *Tachycineta thalassina*
Bank Swallow *Riparia riparia*
N. Rough-winged Swallow *Stelgidopteryx serripennis*
Cliff Swallow *Petrochelidon pyrrhonota*
Barn Swallow *Hirundo rustica*

Family: *Paridae* (Chickadees, Titmice)
Mountain Chickadee *Poecile gambeli*

Family: *Aegithalidae* (Bushtits)
Bushtit *Psaltriparus minimus*

Family: *Troglodytidae* (Wrens)
Rock Wren *Salpinctes obsoletus*

Canyon Wren *Catherpes mexicanus*
Bewick's Wren *Thyromanes bewickii*
House Wren *Troglodytes aedon*
Winter Wren *Troglodytes troglodytes*
Marsh Wren *Cistothorus palustris*

Family: *Cinclidae* (Dippers)
American Dipper *Cinclus mexicanus*

Family: *Turdidae* (Thrushes)
Mountain Bluebird *Sialia currucoides*
Townsend's Solitaire *Myadestes townsendi*
Swainson's Thrush *Catharus ustulatus*
Hermit Thrush *Catharus guttatus*
American Robin *Turdus migratorius*

Family: *Mimidae* (Thrashers, Mockingbirds)
Northern Mockingbird *Mimus polyglottos*
Sage Thrasher *Oreoscoptes montanus*

Family: *Sturnidae* (Starlings)
European Starling *Sturnus vulgaris*

Family: *Motacillidae* (Pipits)
American Pipit *Anthus rubescens*

Family: *Bombycillidae* (Waxwings)
Cedar Waxwing *Bombycilla cedrorum*

Family: *Parulidae* (Wood Warblers)
Orange-crowned Warbler *Vermivora celata*
Nashville Warbler *Vermivora ruficapilla*
Virginia's Warbler *Vermivora virginae*
Yellow Warbler *Dendroica petechia*
Yellow-rumped Warbler *Dendroica coronata*
MacGillivray's Warbler *Oporornis tolmiei*
Common Yellowthroat *Geothlypis trichas*
Wilson's Warbler *Wilsonia pusilla*
Yellow-breasted Chat *Icteria virens*

Family: *Thraupidae* (Tanagers)
Western Tanager *Piranga ludoviciana*

Family: *Emberizidae* (Sparrows, Towhees, Juncos)
Green-tailed Towhee *Pipilo chlorurus*
Spotted Towhee *Pipilo maculatus*
American Tree Sparrow *Spizella arborea*
Chipping Sparrow *Spizella passerina*
Brewer's Sparrow *Spizella breweri*
Vesper Sparrow *Pooecetes gramineus*
Lark Sparrow *Chondestes grammacus*

Sage Sparrow *Amphispiza belli*
Savannah Sparrow *Passerculus sandwichensis*
Grasshopper Sparrow *Ammodramus bairdii*
Fox Sparrow *Passerella iliaca schistacea*
Song Sparrow *Melospiza melodia*
Lincoln's Sparrow *Melospiza lincolnii*
White-throated Sparrow *Zonotrichia albicollis*
Harris' Sparrow *Zonotrichia querula*
Gambel'sWhite-crownedSparrow *Zonotrichia leucophrys gambelii*
Mountain W-crowned Sparrow *Zonotrichia leucophrys oriantha*
Golden-crowned Sparrow *Zonotrichia atricapilla*
Dark-eyed Junco*(Oregon) Junco hyemalis therburi*
Dark-eyed Junco(*Gray-headed*) *Junco hyemalis caniceps*
Lapland Longspur *Calcarius lapponicus*

Family: *Cardinalidae* (Grosbeaks, Buntings)
Black-headed Grosbeak *Pheucticus melanocephalus*
Lazuli Bunting *Passerina amoena*
Indigo Bunting *Passerina cyanea*

Family: *Icteridae* (Blackbirds, Orioles)
Bobolink *Dolichonyx oryzivorus*
Red-winged Blackbird *Agelaius phoeniceus*
Western Meadowlark *Sturnella neglecta*
Yellow-headed Blackbird *Xanthocephalus xanthocephalus*
Brewer's Blackbird *Euphagus cyanocephalus*
Great-tailed Grackle *Quiscalus mexicanus*
Brown-headed Cowbird *Molothrus ater*
Bullock's Oriole *Icterus bullockii*

Family: *Fringillidae* (Finches, Grosbeaks)
Gray-crowned Rosy-Finch *Leucosticte tephrocotis*
Black Rosy-Finch *Leucosticte atrata*
Cassin's Finch *Carpodacus cassinii*
House Finch *Carpodacus mexicanus*
Pine Siskin *Carduelis pinus*
Lesser Goldfinch *Carduelis psaltria*
American Goldfinch *Carduelis tristis*
Evening Grosbeak *Coccothraustes vespertinus*

Family: *Passeridae* (Old World Sparrows)
House Sparrow *Passer domesticus*

Mammals
Order: *Insectivora* (Insect Eaters)
Family: *Soricidae* (Shrews)
Merriam's Shrew *Sorex meriammi*
Dusky Shrew *Sorex monticolus*
Vagrant Shrew *Sorex vagrans*
Northern Water Shrew *Sorex palustris*
Preble's Shrew *Sorex preblei*

Order: *Chiroptera* (Bats)
Family: *Vespertilionidae* (Plainnose Bats)
California Myotis *Myotis californicus*
Western Small-footed Myotis *Myotis ciliolabrum*
Long-eared Myotis *Myotis evotis*
Little Brown Bat *Myotis lucifugus*
Fringed Myotis *Myotis thysanodes*
Long-legged Myotis *Myotis volans*
Yuma Myotis *Myotis yumanensis*
Western Red Bat *Lasiurus blossvellii*
Hoary Bat *Lasiurus cinereus*
Silver-haired Bat *Lasionycteris noctivagans*
Western Pipistrelle *Parastrellus hesperus*
Big Brown Bat *Eptesicus fuscus*
Townsend's Big-eared Bat *Corynorhinus townsendii*
Spotted Bat *Euderma maculatum*
Pallid Bat *Antrozous pallidus*

Family: *Molossidae* (Freetail Bats)
Brazilian Free-tailed Bat *Tadarida brasiliensis*

Order: *Lagomorpha* (Pikas, Hares, Rabbits)
Family: *Leporidae* (Hares, Rabbits)
Black-tailed Jackrabbit *Lepus californicus*
Mountain Cottontail *Sylvilagus nuttalli*
Desert Cottontail *Sylvilagus audubonii*
Pygmy Rabbit *Brachylagus idahoensis*

Order: *Rodentia* (Rodents)
Family: *Sciuridae* (Squirrels)
Least Chipmunk *Tamias minimus*
Uinta Chipmunk *Tamias umbrinus*
Yellow-bellied Marmot *Marmota flaviventris*
White-tailed Antelope Squirrel *Ammospermophilus leucurus*
Great Basin Ground Squirrel *Spermophilus mollis*
Belding’s Ground Squirrel *Spermophilus beldingi*
Wyoming Ground Squirrel *Spermophilus elegans*
Golden-mantled Ground Squirrel *Spermophilus lateralis*

Family: *Geomyidae* (Gophers)
Botta's Pocket Gopher *Thomomys bottae*
Northern Pocket Gopher *Thomomys talpoides*
Townsend’s Pocket Gopher *Thomomys townsendii*

Family: *Heteromyidae* (Kangaroo Rodents)
Little Pocket Mouse *Perognathus longimembris*
Great Basin Pocket Mouse *Perognathus parvus*
Dark Kangaroo Mouse *Microdipodops megacephalus*

Family: *Heteromyidae* (Kangaroos cont.)

Ord Kangaroo Rat *Dipodomys ordii*
Chisel-toothed Kangaroo Rat *Dipodomys microps*

Family: *Castoridae* (Beavers)
American Beaver *Castor canadensis*

Family: *Cricetidae* (Mice, Rats, Voles)
Western Harvest Mouse *Reithrodontomys megalotis*
Canyon Mouse *Peromyscus crinitus*
Deer Mouse *Peromyscus maniculatus*
Northern Grasshopper Mouse *Onychomys leucogaster*
Desert Woodrat *Neotoma lepida*
Bushy-tailed Woodrat *Neotoma cinerea*
Mountain Vole *Microtus montanus*
Long-tailed Vole *Microtus longicaudus*
Sagebrush Vole *Lemmiscus curtatus*

Family: *Zapodidae* (Jumping Mice)
Western Jumping Mouse *Zapus princeps*

Family: *Erethizontidae* (New World Porcupines)
North American Porcupine *Erethizon dorsatum*

Order: *Carnivora* (Flesh-Eaters)
Family: *Canidae* (Dogs)
Coyote *Canis latrans*
Gray Fox *Urocyon cinereoargenteus*
Kit Fox *Vulpes velox*
Red Fox *Vulpes vulva*

Family: *Procyonidae* (Racoons and Allies)
Common Raccoon *Procyon lotor*

Family: *Mustelidae* (Weasels and Allies)
Short-tailed Weasel *Mustela erminae*
Long-tailed Weasel *Mustela frenata*
Mink *Mustela vison*
Northern River Otter *Lontra canadensis*
American Badger *Taxidea taxus*
Striped Skunk *Mephitis mephitis*
Western Spotted Skunk *Spilogale gracilis*

Family: *Felidae* (Cats)
Mountain Lion *Felix concolor*
Bobcat *Lynx rufus*

Order: *Artiodactyla* (Hoofed Mammals)
Family: *Cervidae* (Deer)
Mule Deer *Odocoileus hemionus*

Family: *Antilocapridae* (Pronghorn)

Pronghorn *Antilocapra americana*

Family: *Bovidae* (Bison, Sheep, Goats)
California Bighorn Sheep *O. c. californiana*

Reptiles
Order: *Squamata* (Lizards, Snakes)
Family: *Iguanidae* (Iguanas and Allies)
Common Zebra-tailed Lizard *Callisaurus draconoides*
Long-nosed Leopard Lizard *Gambelia wislizenii*
Desert Spiny Lizard *Sceloporus magister*
Western Fence Lizard *Sceloporus occidentalis*
Sagebrush Lizard *Sceloporus graciosus*
Side-blotched Lizard *Uta stansburiana*
Pygmy Short-horned Lizard *Phrynosoma douglassii*
Desert Horned Lizard *Phrynosoma platyrhinos*

Family: *Scincidae* (Skinks)
Great Basin Skink *Eumeces skiltonianus utahensis*

Family: *Teiidae* (Whiptails)
Western Whiptail *Cnemidophorus tigrus*

Family: *Boidae* (Boas, Pythons)
Northern Rubber Boa *Charina bottae*

Family: *Colubridae* (Solid-toothed Snakes)
Ringneck Snake *Diadophis punctatus*
Striped Whipsnake *Masticophis taeniatus*
Western Yellow-bellied Racer *Coluber constrictor mormon*
Great Basin Gopher Snake *Pituophis cantenifer deserticola*
Common Kingsnake *Lampropeltis getulus*
Long-nosed Snake *Rhinocheilus lecontei*
Western Terrestrial Garter *Thamnophis elegans*
Variable Ground Snake *Sonora semiannulata*
Night Snake *Hypsiglena torquata*
Family: *Viperidae* (Vipers)
Great Basin Rattlesnake *Crotalus viridis lutosus*

Amphibians
Order: *Anura* (Frogs and Toads)
Family: *Pelobatidae* (Spadefoots)
Great Basin Spadefoot Toad *Spea intermontana*

Family: *Ranidae* (True Frogs)
Northern Leopard Frog *Rana pipiens*
Bullfrog *Rana catesbeiana*

Family: *Bufonidae* (Toads)
Western Toad *Bufo boreas*

Family: *Hylidae* (Treefrogs)
Pacific Chorus Frog *Pseudacris regilla*

Fish
Order: *Salmoniformes*
Family: *Salmonidae* (Salmon and Trout)
Chinook Salmon *Oncorhynchus tshawytscha(L.E.)*
Rainbow Trout *Oncorhynchus mykiss*
Redband Trout *Oncorhynchus mykiss gairdneri*
Lahontan cutthroat trout *Oncorhynchus clarki henshawi*
Brook Trout *Salvelinus fontinalis*
Mountain Whitefish *Prosopium williamsoni*
Brown Trout *Salmo trutta*

Order: *Scorpaeniformes*
Family: *Cottidae* (Sculpins)
Paiute Sculpin *Cottus beldingii*

Order: *Cypriniformes*
Family: *Cyprinidae* (Carps and Minnows)
Chiselmouth *Acrocheilus alutaceus*
Northern Pikeminnow *Ptychochelus oregonensis*
Longnose Dace *Rhinicthys cataractae*
Speckled Dace *Rhinicthys osculus*
Redside Shiner *Richrdsonius balteatus*
Tui Chub *Gila bicolor*
Asiatic Carp *Cyprinus carpio*

Family: *Catastomidae* (Suckers)
Mountain Sucker *Catostomus platyrhynchus*
Tahoe Sucker *Catastomus tahoensis*

Order: *Siluriformes*
Family: *Ictaluridae* (Catfish)
Channel catfish *Ictalurus punctatus*

Order: *Perciformes*
Family: *Percidae* (Walleye)

Family: *Centrarchidae* (Bass and allies)
Largemouth Bass *Micropterus salmoides*
Bluegill *Lepomis macrochirus*
Crappie *Pomoxis nigromaculatus*

On March 13, 2025, the BLM HRFO requested an Official Species List from the U.S. Fish and Wildlife Service through the Information for Planning and Consultation (IPaC) website. The U.S.FWS responded with a list to determine if there were any listed threatened or endangered species that may occur within the proposed project area. There were 8 threatened, endangered, or candidate species identified on the list. In Appendix IX is a table that explains why these species are not present, or present and not affected by the proposed project. In addition, there are BLM Special Status Animal Species included in the list to identify why they are not present or present and not affected by the proposed project.

Species	**Rationale**
LCT	The Lahontan cutthroat trout (LCT)(*Oncorhynchus clarkii henshawi*) is currently listed as threatened and has no critical habitat (Federal Register 1975). According to the species list that the BLM received from U. S. Fish and Wildlife Service (USFWS) on March 13, 2025, USFWS rendered that the LCT may be present within the Bluewing Complex project area. However, the recent U. S. Fish and Wildlife Service LCT status review (USFWS 2023) shows that the LCT do not currently inhabit within the Bluewing Complex project area. The closest occupied stream near the project boundary of the Bluewing Complex is the Truckee River, which is approximately 1.5 miles away. Also, the actions of the Bluewing Complex project are most likely to occur further away from the closest boundary. Therefore, since the project is going to be at least 1.5 miles away from the nearest LCT occupied stream, the BLM believes that the project will have no effect on the LCT.
Cui-ui	The Cui-ui (*Chasmistes cujus*) is currently listed as endangered, with no critical habitat (Federal Register 1967). According to the species list that the BLM received from U. S. Fish and Wildlife Service (USFWS) on March 13, 2025, USFWS rendered that the Cui-ui may be present within the Bluewing Complex project area. However, the recent U. S. Fish and Wildlife Service 5-year Cui-ui review (USFWS 2023b) identified that the Cui-ui inhabits the Truckee River and Pyramid Lake. The closest project boundary of the Bluewing Complex to the Truckee River and Pyramid Lake is approximately 1.5 miles. Also, the actions of the Bluewing Complex project are most likely to occur further away from the closest boundary. Therefore, since the project is going to be at least 1.5 miles away from the nearest Cui-ui population, the BLM believes that the project will have no effect of the Cui-ui.
Dixie Valley Toad	The **Dixie Valley toad** (*Anaxyrus williamsi*), endemic to Dixie Valley marshlands, evolved as part of the Western toad complex during the Pleistocene (Rose JP et al. 2023). No further analysis is needed.
Western Yellow-billed Cuckoo	The Western Yellow-billed Cuckoo (Coccyzus americanus occidentalis) is found south of the project area, with the nearest known habitat along the lower

	Carson River, primarily between Lahontan Reservoir and the Carson Delta. The Walker River also provides habitat and has recorded sightings, though it is likely outside the project area. While there are no confirmed sightings along the lower Truckee River heading toward Pyramid Lake, stretches of riparian habitat there could be considered potential habitat. The Truckee River is approximately 1.5 miles outside of the Bluewing Complex and gather area. Habitat suitability varies between breeding and migration use—while many sub-prime riparian areas may not support breeding, they could still serve as stopover or foraging sites during migration. No further analysis is required.
California Condor	The **California condor** (*Gymnogyps californianus*), a non-essential, experimental population in the Pacific Northwest, has no critical habitat and is treated as a proposed threatened species (86 FR 15602–15623, 50 CFR 17.83(a)). IPaC indicates potential overlap with the Bluewing Gather Complex; however, no condors have been observed by BLM, NDOW, or NDNH. As project activities occur near streams and riparian areas, potential impacts on condors traveling through or residing in the area are minimal. Additionally, the species listed do not fall within the proposed **Bluewing Gather Complex** (see Appendix 9).
Monarch Butterfly	Monarch Butterfly there is no critical habitat shown within the Bluewing Complex and gather area. No further analysis needed.
Bat Species	Bat species. would not be affected during gather operations or construction of proposed exclosure, pipeline, and trough. No further analysis needed.
Small rodents	Small rodents, species would not be affected during gather operations or construction of proposed exclosure, pipeline, and trough. No further analysis needed.

APPENDIX X-GREATER SAGE-GROUSE REQUIRED DESIGN FEATURES

GRSG Proposed Activities Form IM 2016-038, Attachment 3: Required Design Features (RDF) identified in the Nevada and Northeastern California Greater Sage-Grouse Approved Resource Management Plan Amendment (SGPA) Appendix C

Project Name: Blue Wing Complex Wild Horse Gather and Herd Management Plan **NEPA #:** DOI-BLM-NV-W010-2024-0027-EA

General RDFs		Applied	If RDF not applied, select reason:
RDF Gen 1:	Locate new roads outside of GRSG habitat to the extent practical.	☐ Yes ☑ No	☑ A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable. ☐ An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________ ☐ A specific RDF will provide no additional protection to GRSG or its habitat. **Rationale if RDF is not applied:** No New Roads Proposed
RDF Gen 2:	Avoid constructing roads within riparian areas and ephemeral drainages. Construct lowwater crossings at right angles to ephemeral drainages and stream crossings (note that such construction may require permitting under Sections 401 and 404 of the Clean Water Act).	☐ Yes ☑ No	☑ A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable. ☐ An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________ ☐ A specific RDF will provide no additional protection to GRSG or its habitat. **Rationale if RDF is not applied:** No New Roads Proposed
RDF Gen 3:	Limit construction of new roads where roads are already in existence and could be used or upgraded to meet the needs of the project or operation. Design roads to an appropriate standard, no higher than necessary, to accommodate intended purpose and level of use.	☐ Yes ☑ No	☑ A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable. ☐ An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________ ☐ A specific RDF will provide no additional protection to GRSG or its habitat. **Rationale if RDF is not applied:** No New Roads Proposed
RDF Gen 4:	Coordinate road construction and use with ROW holders to minimize disturbance to the extent possible.	☐ Yes ☑ No	☑ A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable. ☐ An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________ ☐ A specific RDF will provide no additional protection to GRSG or its habitat. **Rationale if RDF is not applied:** No New Roads Proposed
RDF Gen 5:	During project construction and operation, establish and post speed limits in GRSG habitat to reduce vehicle/wildlife collisions or design roads to be driven at slower speeds.	☐ Yes ☑ No	☑ A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable. ☐ An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________ ☐ A specific RDF will provide no additional protection to GRSG or its habitat. **Rationale if RDF is not applied:** BLM and Contractors Will Slow in GRSG habitat

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RDF	Description	Applied	Reason	Explanation
RDF Gen 6:	Newly constructed project roads that access valid existing rights would not be managed as public access roads. Proponents will restrict access by employing traffic control devices such as signage, gates, and fencing.	☐ Yes ☑ No	☑	A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
			☐	An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________
			☐	A specific RDF will provide no additional protection to GRSG or its habitat.
		Rationale if RDF is not applied: No New Roads Proposed		
RDF Gen 7:	Require dust abatement practices when authorizing use on roads.	☐ Yes ☑ No	☑	A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
			☐	An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________
			☐	A specific RDF will provide no additional protection to GRSG or its habitat.
		Rationale if RDF is not applied: Driving Reduced Speeds		
NO RDF 8 Identified				
RDF Gen 9:	Upon project completion, reclaim roads developed for project access on public lands unless, based on site-specific analysis, the route provides specific benefits for public access and does not contribute to resource conflicts.	☐ Yes ☑ No	☑	A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
			☐	An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________
			☐	A specific RDF will provide no additional protection to GRSG or its habitat.
		Rationale if RDF is not applied: No Reclamation Required		
RDF Gen 10:	Design or site permanent structures that create movement (e.g., pump jack/ windmill) to minimize impacts on GRSG habitat.	☐ Yes ☑ No	☑	A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
			☐	An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________
			☐	A specific RDF will provide no additional protection to GRSG or its habitat.
		Rationale if RDF is not applied: No Structures Proposed		
RDF Gen 11:	Equip temporary and permanent aboveground facilities with structures or devices that discourage nesting and perching of raptors, corvids, and other predators.	☐ Yes ☑ No	☑	A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
			☐	An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________
			☐	A specific RDF will provide no additional protection to GRSG or its habitat.
		Rationale if RDF is not applied: No Structures Proposed		

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RDF	Description	Applied		Reason
RDF Gen 12:	Control the spread and effects of nonnative, invasive plant species (e.g., by washing vehicles and equipment, minimize unnecessary surface disturbance; Evangelista et al. 2011). All projects would be required to have a noxious weed management plan in place prior to construction and operations.	☑ Yes	☐	A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
		☐ No	☐	An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________
			☐	A specific RDF will provide no additional protection to GRSG or its habitat.
		Rationale if RDF is not applied:		
RDF Gen 13:	Implement project site-cleaning practices to preclude the accumulation of debris, solid waste, putrescible wastes, and other potential anthropogenic subsidies for predators of GRSG.	☑ Yes	☐	A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
		☐ No	☐	An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________
			☐	A specific RDF will provide no additional protection to GRSG or its habitat.
		Rationale if RDF is not applied:		
RDF Gen 14:	Locate project related temporary housing sites outside of GRSG habitat.	☐ Yes	☑	A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
		☑ No	☐	An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________
			☐	A specific RDF will provide no additional protection to GRSG or its habitat.
		Rationale if RDF is not applied: No Temporary Housing Proposed		
RDF Gen 15:	When interim reclamation is required, irrigate site to establish seedlings more quickly if the site requires it.	☐ Yes	☑	A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
		☑ No	☐	An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________
			☐	A specific RDF will provide no additional protection to GRSG or its habitat.
		Rationale if RDF is not applied: No Reclamation Required		
RDF Gen 16:	Utilize mulching techniques to expedite reclamation and to protect soils if the site requires it.	☐ Yes	☑	A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
		☑ No	☐	An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________
			☐	A specific RDF will provide no additional protection to GRSG or its habitat.
		Rationale if RDF is not applied: No Reclamation Required		

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RDF	Description	Applied	Reason	Explanation
RDF Gen 17:	Restore disturbed areas at final reclamation to the pre-disturbance landforms and desired plant community.	☐ Yes	☐	A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
		☑ No	☐	An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________
			☐	A specific RDF will provide no additional protection to GRSG or its habitat.
		Rationale if RDF is not applied: No Reclamation Required		
RDF Gen 18:	When authorizing ground-disturbing activities, require the use of vegetation and soil reclamation standards suitable for the site type prior to construction.	☐ Yes	☐	A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
		☑ No	☐	An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________
			☐	A specific RDF will provide no additional protection to GRSG or its habitat.
		Rationale if RDF is not applied: No Reclamation Required		
RDF Gen 19:	Instruct all construction employees to avoid harassment and disturbance of wildlife, especially during the GRSG breeding (e.g., courtship and nesting) season. In addition, pets shall not be permitted on site during construction (BLM 2005b).	☑ Yes	☐	A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
		☐ No	☐	An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________
			☐	A specific RDF will provide no additional protection to GRSG or its habitat.
		Rationale if RDF is not applied:		
RDF Gen 20:	To reduce predator perching in GRSG habitat, limit the construction of vertical facilities and fences to the minimum number and amount needed and install anti-perch devices where applicable.	☐ Yes	☑	A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
		☑ No	☐	An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________
			☐	A specific RDF will provide no additional protection to GRSG or its habitat.
		Rationale if RDF is not applied: Fence will be built over 15 miles away from leks		
RDF Gen 21:	Outfit all reservoirs, pits, tanks, troughs or similar features with appropriate type and number of wildlife escape ramps (BLM 1990; Taylor and Tuttle 2007).	☑ Yes	☐	A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
		☐ No	☐	An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # _________
			☐	A specific RDF will provide no additional protection to GRSG or its habitat.
		Rationale if RDF is not applied:		

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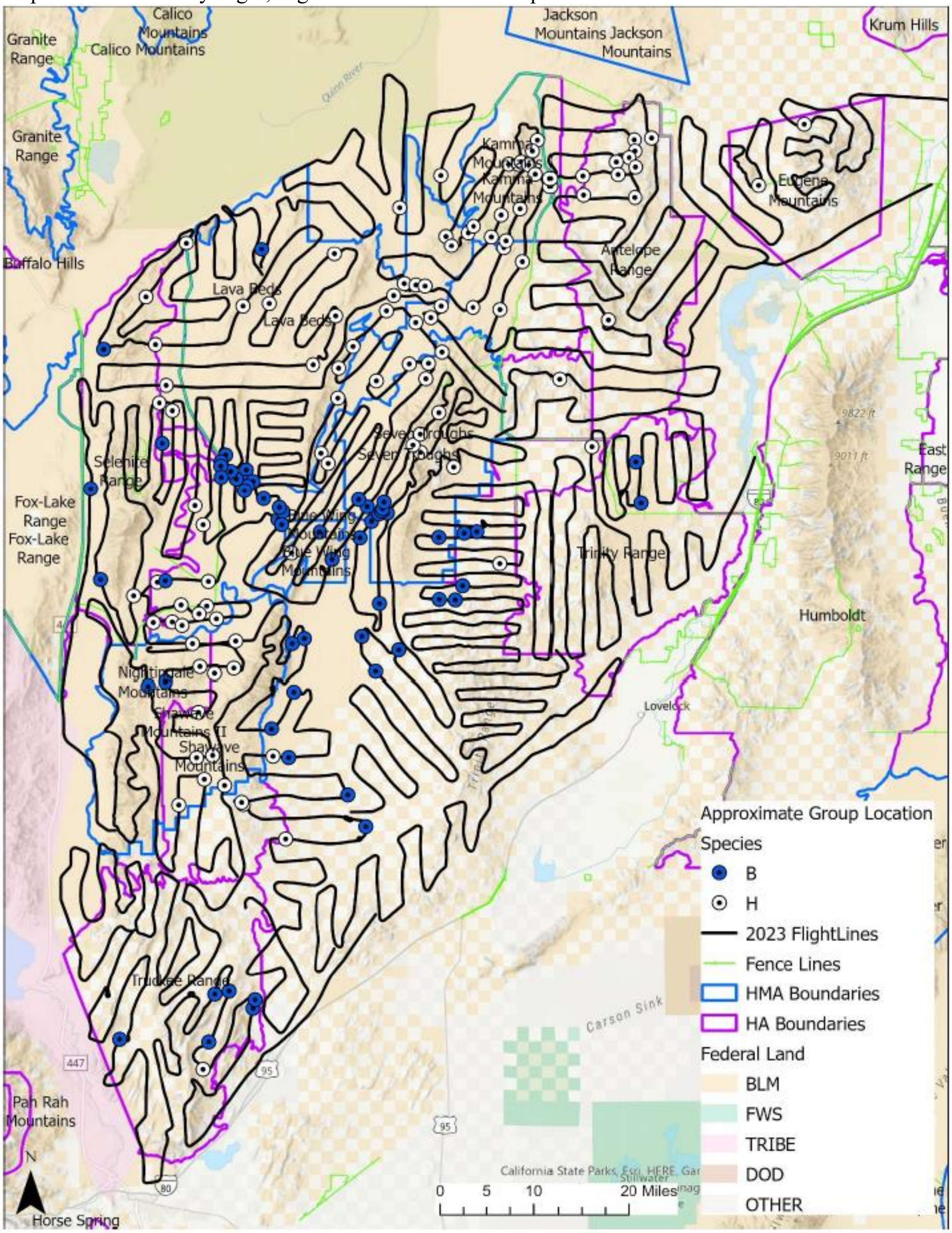
RDF Gen 22:	Load and unload all equipment on existing roads to minimize disturbance to vegetation and soil.	☑ Yes ☐ No	☐	A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
			☐	An alternative RDF is determined to provide equal or better protection for GRSG or its habitat. Alternative RDF # __________
			☐	A specific RDF will provide no additional protection to GRSG or its habitat.
		Rationale if RDF is not applied:		

APPENDIX XI- INVENTORY FLIGHT DATA AND MAP.

Map of 2023 inventory flight, flight lines and observation points.



APPENDIX XII- LITERATURE REVIEWS

Literature reviews on effects of gathers, ecological interactions, and population growth suppression methods

This appendix includes scientific literature reviews addressing five topics: effects of gathers, effects of wild horses and burros on rangeland ecosystems, effects of fertility control vaccines and sex ratio manipulations, effects of sterilization, and effects of intrauterine devices (IUDs).

Effects of Gathers on Wild Horses and Burros

Gathering any wild animals into pens has the potential to cause impacts to individual animals. There is also the potential for impacts to individual horses and burros during transportation, short-term holding, long-term holding that take place after a gather. However, BLM follows guidelines to minimize those impacts and ensure humane animal care and high standards of welfare. The following literature review summarizes the limited number of scientific papers and government reports that have examined the effects of gathers and holding on wild horses and burros.

Two early papers, by Hansen and Mosley (2000) and Ashley and Holcomb (2001) examined limited effects of gathers, including behavioral effects and effects on foaling rates. Hansen and Mosley (2000) observed BLM gathers in Idaho and Wyoming. They monitored wild horse behaviors before and after a gather event, and compared the behavioral and reproductive outcomes for animals that were gathered by helicopter against those outcomes for animals that were not. This comparison led to the conclusion that gather activities used at that time had no effect on observed wild horse foraging or social behaviors, in terms of time spent resting, feeding, vigilant, traveling, or engaged in agonistic encounters (Hansen and Mosley 2000). Similarly, the authors did not find any statistically significant difference in foaling rates in the year after the gather in comparisons between horses that were captured, those that were chased by a helicopter but evaded capture, or those that were not chased by a helicopter. The authors concluded that the gathers had no deleterious effects on behavior or reproduction. Ashley and Holcomb (2001) conducted observations of reproductive rates at Garfield Flat HMA in Nevada, where horses were gathered in 1993 and 1997, and compared those observations at Granite Range HMA in Nevada, where there was no gather. The authors found that the two gathers had a short-term effect on foaling rates; pregnant mares that were gathered had lower foaling rates than pregnant mares that were not gathered. The authors suggested that BLM make changes to the gather methods used at that time, to minimize the length of time that pregnant mares are held prior to their release back to the range. Since the publications by Hansen and Mosley (2000) and by Ashley and Holcomb (2001), BLM did make changes to reduce the stress that gathered animals, including pregnant females, may experience as a result of gather and removal activities; these measures have been formalized as policy in the comprehensive animal welfare program (BLM IM 2021-002). That policy also covers care of animals in corrals, where measures to ensure wild horse and burro health and welfare include oversight by attending veterinarians.

A thorough review of gather practices and their effects on wild horses and burros can be found in a 2008 report from the Government Accounting Office. The report found that the BLM had controls in place to help ensure the humane treatment of wild horses and burros (GAO 2008). The controls included SOPs for gather operations, inspections, and data collection to monitor animal welfare. These procedures led to humane treatment during gathers, and in short-term and long-term holding facilities. The report found that cumulative effects associated with the capture and removal of excess wild horses include gather-related mortality averaged only about 0.5% and approximately 0.7% of the captured animals, on average, are humanely euthanized due to pre-existing conditions (such as lameness or club feet) in accordance with BLM policy. Scasta (2020) found the same overall mortality rate (1.2%) for BLM WH&Bs gathers in 2010-2019, with a mortality rate of 0.25% caused directly by the gather, and a mortality rate of 0.94% attributable to euthanasia of animals with pre-existing conditions such as blindness or club-footedness.

Scasta (2020) summarized mortality rates from 70 BLM WH&Bs gathers across nine states, from 2010-2019. Records for 28,821 horses and 2,005 burros came from helicopter and bait/water trapping. For wild burro bait / water trapping, mortality rates were 0.05% due to acute injury caused by the gather process, and death for burros with pre-existing conditions was 0.2% (Scasta 2020). For wild horse bait / water trapping, mortality rates were 0.3% due to acute injury, and the mortality rate due to pre-existing conditions was 1.4% (Scasta 2020). For wild horses gathered with the help of helicopters, mortality rates were only slightly lower than for bait / water trapping, with 0.3% due to acute causes, and 0.8% due to pre-existing conditions (Scasta 2020). Scasta (2020) noted that for other wildlife species capture operations, mortality rates above 2% are considered unacceptable and that, by that measure, BLM WH&Bs "…welfare is being optimized to a level acceptable across other animal handling disciplines." In a separate analysis of 2010-2019 BLM wild horse gathers, Scasta et al. (2021) concluded that fewer than 20% of wild horse deaths at gathers were attributable to acute causes, with the great majority being euthanasia of animals with pre-existing, chronic conditions.

King et al. (2023) studied the fate of wild horse foals, as part of a broader 2016-2020 study on the effects of having some geldings in with breeding herds (King et al. 2022). In two HMAs in Utah that were intensively monitored for 4 years, about 5% of foals died in their first year of life, and about 2.5% of foals younger than 70 days old that became separated from their mothers (dams) survived and joined other social bands. BLM gather activities were not associated with any statistical increase in foal mortality, foal separation from their dams, or infanticide. King et al. (2023) concluded that, "…separation of offspring may be more common than previously considered, and that this is a natural event that does not necessarily result in mortality. … the separation of young foals from their dams was not a result of human disturbance or handling, resulting in the conclusion that foals even as young as 2 months old have a good chance of survival if separated from their dam or orphaned, as long as other social groups remain on the range that they can join."

The GAO report (2008) noted the precautions that BLM takes before gather operations, including screening potential gather sites for environmental and safety concerns, approving facility plans to ensure that there are no hazards to the animals there, and limiting the speeds that animals travel to trap sites. BLM used SOPs for short-term holding facilities (e.g., corrals) that included procedures to minimize excitement of the animals to prevent injury, separating horses by age, sex, and size, regular observation of the animals, and recording information about the animals in a BLM database. The GAO reported that BLM had regular inspections of short-term holding facilities and that animals I there, ensuring that the corral equipment is up to code and that animals are treated with appropriate veterinary care (including that hooves are trimmed adequately to prevent injury). Mortality was found to be about 5% per year associated with transportation, short term holding, and adoption or sale with limitations. The GAO noted that BLM also had controls in place to ensure humane care at long-term holding facilities (i.e., pastures). BLM staff monitor the number of animals, the pasture conditions, winter feeding, and animal health. Veterinarians from the USDA Animal and Plant Health Inspection Service inspect long-term facilities annually, including a full count of animals, with written reports. Contract veterinarians provide animal care at long-term facilities, when needed. Weekly counts provide an incentive for contractors that operate long-term holding facilities to maintain animal health (GAO 2008). Mortality at long-term holding was found to be about 8% per year, on average (GAO 2008). The mortality rates at short-term and long-term holding facilities are comparable to the natural annual mortality rate on the range of about 16% per year for foals (animals under age 1), about 5-10% per year for horses ages 1-10 years, and about 10-25% for animals aged 10-20 years (Ransom et al. 2016).

In 2010, the American Association of Equine Practitioners (AAEP 2011) was invited by the BLM to visit the BLM operations and facilities, spend time on WH&Bs gathers and evaluate the management of the wild equids. The AAEP Task Force evaluated horses in the BLM Wild Horse and Burro Program through several visits to wild horse gathers, and short- and long-term holding facilities. The task force was specifically asked to "review animal care and handling within the Wild Horse and Burro Program, and make whatever recommendations, if any, the Association feels may be indicated, and if possible, issue a public statement regarding the care and welfare of animals under BLM management." In their report (AAEP 2011), the task force concluded "that the care, handling and management practices utilized by the agency are appropriate for this population of horses and generally support the safety, health status and welfare of the animals." The comprehensive animal welfare program (BLM 2021) includes standards of care of animals in corrals, where measures include oversight by attending veterinarians.

In June 2010 BLM invited independent observers organized by American Horse Protection Association (AHPA) to observe BLM gathers and document their findings. AHPA engaged four independent credentialed professionals who are academia-based equine veterinarians or equine specialists. Each observer served on a team of two, and was tasked specifically to observe the care and handling of the animals for a 3-4-day period during the gather process, and submit their findings to AHPA. An Evaluation Checklist was provided to each of the observers that included four sections: Gather Activities; Horse Handling During Gather; Horse Description; and Temporary Holding Facility. The independent group visited 3 separate gather operations and found that "BLM and contractors are responsible and concerned about the welfare of the horses before, during and after the gather process" and that "gentle and knowledgeable, used acceptable methods for moving horses… demonstrated the ability to review, assess and adapt procedures to ensure the care and well-being of the animals" (Greene et al. 2011).

BLM commissioned the Natural Resources Council of the National Academies of Sciences (NRC) to conduct an independent, technical evaluation of the science, methodology, and technical decision making approaches of the BLM Wild Horse and Burro Management Program. Among the conclusions of their 2013 report, NRC (2013) concluded that wild horse populations grow at 15-20 percent a year, and that predation will not typically control population growth rates of free-ranging horses. The report (NRC 2013) also noted that, because there are human-created barriers to dispersal and movement (such as fences and highways) and not enough substantial predator pressure to actually cause herds to decrease, maintaining a herd within an AML requires removing animals in roundups, also known as gathers, and may require management actions that limit population growth rates. The report (NRC 2013) examined a number of population growth suppression techniques, including the use of sterilization, fertility control vaccines, and sex ratio manipulation.

The effects of gathers as part of feral horse management have also been documented on National Park Service Lands. Since the 1980s, managers at Theodore Roosevelt National Park have used periodic gathers, removals, and auctions to maintain the feral horse herd size at a carrying capacity level of 50 to 90 horses (Amberg et al. 2014). In practical terms, this carrying capacity is equivalent to an AML. Horse herd sizes at those levels were determined to allow for maintenance of certain sensitive forage plant species. Gathers every 3-5 years did not prevent the herd from self-sustaining. The herd continues to grow, to the point that the NPS now uses gathers and removals along with temporary fertility control methods in its feral horse management (Amberg et al. 2014).

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Effects of Wild Horses and Burros on Rangeland Ecosystems

The presence of wild horses and burros can have substantial effects on rangeland ecosystems, and on the capacity for habitat restoration efforts to achieve landscape conservation and restoration goals. While wild horses and burros may have some beneficial ecological effects, such benefits are outweighed by ecological damage they cause when herds are at levels greater than supportable by allocated, available natural resources (i.e., when herds are greater than AML).

In the biological sense, all free-roaming horses and burros in North America are feral, meaning that they are descendants of domesticated animals brought to the Americas by European colonists. Available evidence has indicated that horses went extinct in the Americas by the end of the Pleistocene, about 10,000 years ago (Webb 1984; MacFadden 2005), though DNA samples from permafrost suggest their extinction from Alaska could possibly have been as recent as about 6,000 years ago (Murchie et al. 2021). Burros evolved in Eurasia (Geigl et al. 2016). After domesticated horses were introduced to the Americas, their geographic distribution was facilitated by Native Americans and colonizing Europeans (Taylor et al. 2023a, 2023b). The published literature refers to free-roaming horses and burros as either feral or wild. In the ecological context the terms are interchangeable, but the terms 'wild horse' and 'wild burro' are associated with a specific legal status. The legal status of federally recognized wild horses and burros stems entirely from the WFRHBA of 1971, and is not dependent on whether the animals are or are not considered 'native' to the particular lands of the western USA where they are managed by the BLM and US Forest Service. Whether or not those animals were continuously present throughout the Holocene period in the 10 states where they are currently managed does not appear to influence the magnitude or direction of their ecological effects (Lundgren et al. 2024), but those effects are by no measure benign with respect to less well known plant and animal species, many of which have far more limited geographic distributions.

The following literature review on the effects of wild horses and burros on rangeland ecosystems draws on scientific studies of feral horses and burros, some of which also have wild horse or wild burro legal status. Parts of this review draw heavily on Parts 1 and 2 of the 'Science framework for conservation and restoration of the sagebrush biome' interagency report (Chambers et al. 2017, Crist et al. 2019).

Because of the known damage that overpopulated wild horse and burro herds can cause in rangeland ecosystems, the presence of wild horses and burros is considered a threat to Greater sage-grouse habitat quality, particularly in the bird species' western range (Beever and Aldridge 2011, USFWS 2013). Wild horse population sizes on federal lands have more than doubled in the five years since the USFWS report (2013) was published (BLM 2018). On lands administered by the BLM, there were over 82,000 BLM-administered wild horses and burros as of March 1, 2022, which does not include foals born in 2020. Lands with wild horses and burros are managed for multiple uses; scientific studies designed to separate out effects of wild horses and burros, which are summarized below, point to conclusions that landscapes with greater wild horse and burro abundance will tend to have lower resilience to disturbance and lower resistance to invasive plants than similar landscapes with herds at or below target AML levels.

In contrast to managed livestock grazing, neither the seasonal timing nor the intensity of wild horse and burro grazing can be managed, except through efforts to manage their numbers and distribution. Wild horses live on the range year round, they roam freely, and wild horse populations have the potential to grow 15-20% per year (Wolfe 1980; Eberhardt et al. 1982; Garrott et al 1991; Dawson 2005; Roelle et al. 2010; Scorolli et al. 2010). Although this annual growth rate may be lower in some areas where mountain lions can take foals (Turner and Morrison 2001, Turner 2015, Andreasen et al. 2021, Schulman et al. 2024), horses tend to favor use of more open habitats (Schoenecker 2016) that are dominated by grasses and shrubs and where ambush is less likely. Wild horses may compete for forage with elk, mule deer, other wild ungulates, and managed livestock (Smith et al. 1986a, Scasta et al. 2016, Platte and Torland 2024).

As a result of the potential for wild horse populations to grow rapidly, impacts from wild horses on water, soil, vegetation, and native wildlife resources (Davies and Boyd 2019) can increase exponentially unless there is active management to limit their population sizes. For the majority of wild horse herds, there is little overall evidence that population growth is significantly affected by predation (NRC 2013), although wild horse and burro herd growth rates may be somewhat reduced by predation in some localized areas, particularly where individual cougars specialize on horse or burro predation (Turner and Morrison 2001, Roelle et al. 2010, Mesler and Jones 2021). Andreasen et al. (2021) and Iacono (2024) found that the level of specializing on young horse varies across individual mountain lions (*Puma concolor*). This specialization seems more prevalent where horses are at very high densities and native ungulates are at very low densities (Andreasen et al. 2021). Some of the greatest recorded rates of predation on horses, by mountain lions, have been in the Virginia Range (Schulman et al. 2024), where the state of Nevada manages a herd of feral horses that is not federally protected. Where lion predation on horses was common, Andreasen et al. (2021) found that female lions preyed on horses year-round, but 13% or fewer of horses killed by lions were adults. Andreasen et al. (2021) concluded that, "at landscape scales, cougar predation is unlikely to limit the growth of feral horse populations." Mesler and Jones (2021) also documented that some mountain lions have a far higher prevalence of wild burro in their diet than others, though their sample size was relatively lower than Andreasen et al. (2021) or Iacono (2024). Similarly, Lundgren et al. (2022) documented that mountain lions kill feral burros in Death Valley National Park. Lundgren et al. (2022) advocated for not eliminating wild equids from landscapes, but that is not a consideration on HMAs, where the BLM aims to have herd sizes of wild horses and burros that are at or above the low level of AML. BLM does not have the legal authority to regulate or manage mountain lion populations, and it does not appear that enough mountain lions (if any) specialize on horse predation to the extent needed to prevent herd growth in the Blue Wing Complex. Andreasen et al. (2021) concluded that "At landscape scales, cougar predation is unlikely to limit the growth of feral horse populations." In a study of Mexican wolf predation in an area of Arizona with free-roaming horses, horses were not part of the documented wolf diet (Smith et al. 2023). Given the recent history of consistent growth in the Blue Wing Complex wild horse and burro herds, as documented by repeated aerial surveys, the inference that predation does not limit local wild horse and burro herd growth rates apparently applies.

The USFWS (2008), Beever and Aldridge (2011), and Chambers et al (2017) summarize much of the literature that quantifies direct ecosystem effects of wild horse presence. Beever and Aldridge (2011) present a conceptual model that illustrates the effects of wild horses on sagebrush ecosystems. In the Great Basin, areas without wild horses had greater shrub cover, plant cover, species richness, native plant cover, and overall plant biomass, and less cover percentage of grazing-tolerant, unpalatable, and invasive plant species, including cheatgrass, compared to areas with horses (Smith 1986b; Beever et al. 2008; Davies et al. 2014; Zeigenfuss et al. 2014; Boyd et al. 2017). There were also measurable increases in soil penetration resistance and erosion, decreases in ant mound and granivorous small mammal densities, and changes in reptile communities (Beever et al. 2003; Beever and Brussard 2004; Beever and Herrick 2006; Ostermann-Kelm et al. 2009). Intensive grazing by horses and other ungulates can damage biological crusts (Belnap et al. 2001). In contrast to domestic livestock grazing, where post-fire grazing rest and deferment can foster recovery, wild horse grazing occurs year round. These effects imply that horse presence can have broad effects on ecosystem function that could influence conservation and restoration actions.

Many studies corroborate the general conclusion that wild horses can lead to biologically significant changes in rangeland ecosystems, particularly when their populations are overabundant relative to water and forage resources, and other wildlife living on the landscape (Eldridge et al. 2020). The presence of wild horses is associated with a reduced degree of Greater sage-grouse lekking behavior (Muñoz et al. 2020). Moreover, increasing densities of wild horses, measured as a percentage above AML, are associated with decreasing greater sage-grouse population sizes, measured by lek counts (Coates et al. 2021). In northwest Nevada, Behnke et al. (2023) found that Greater sage-grouse nesting rates were marginally higher in areas with wild horses, but Behnke et al. (2022) found that Greater sage-grouse in areas with feral horses had elevated corticosterone levels, especially under drought conditions. Behnke et al. (2022) also found that high corticosterone levels were associated with low Greater sage-grouse nesting success rates. In Wyoming, Hennig et al (2023) found a high degree of spatial overlap between wild horses and Greater sage-grouse in summer. Most recently, Beck et al. (2024) demonstrated significant declines in Greater sage-grouse survival rates associated with wild horse densities, with greater wild horse densities above AML causing greater declines in sag-grouse survival at several life stages. Horses are primarily grazers (Hanley and Hanley 1982), but shrubs – including sagebrush – can represent a large part of a horse's diet, at least in summer in the Great Basin (Nordquist 2011). Horses may crop grazed plants closer to the ground than bovids because horses have agile lips and top and bottom teeth (Chapter 21 in McNew et al. 2023). Free-ranging equids have a high affinity for habitats that are close to water (Esmaeili et al. 2021, Karish et al 2023), which appears to be stronger than for like-sized ruminants (Esmaeili et al. 2021). Grazing by wild horses can have severe impacts on water source quality, aquatic ecosystems and riparian communities as well (Beever and Brussard 2000; Barnett 2002; Nordquist 2011; USFWS 2008; Earnst et al. 2012; USFWS 2012, Kaweck et al. 2018), sometimes excluding native ungulates from water sources (Ostermann-Kelm et al. 2008; USFWS 2008; Perry et al. 2015; Hall et al. 2016; Gooch et al. 2017; Hall et al. 2018). Impacts to riparian vegetation per individual wild horse can exceed impacts per individual domestic cow (Kaweck et al. 2018, Burdick et al. 2021). Bird nest survival may be lower in areas with wild horses (Zalba and Cozzani 2004), and bird populations have recovered substantially after livestock and / or wild horses have been removed (Earnst et al. 2005; Earnst et al. 2012; Batchelor et al. 2015). Wild horses can spread nonnative plant species, including cheatgrass, and may limit the effectiveness of habitat restoration projects (Beever et al. 2003; Couvreur et al. 2004; Jessop and Anderson 2007; Loydi and Zalba 2009). Riparian and wildlife habitat improvement projects intended to increase the availability of grasses, forbs, riparian habitats, and water will likely attract and be subject to heavy grazing and trampling by wild horses that live in the vicinity of the project. Even after domestic livestock are removed, continued wild horse grazing can cause ongoing detrimental ecosystem effects (USFWS 2008; Davies et al. 2014) which may require several decades for recovery (e.g., Anderson and Inouye 2001).

Wild horses and burros may have ecologically beneficial effects, especially when herd sizes are low relative to available natural resources, but those ecological benefits do not typically outweigh damage caused when herd sizes are high, relative to available natural resources. Under some conditions, there may not be observable competition with other ungulate species for water (e.g., Meeker 1979), but recent studies that used remote cameras have found wild horses excluding native wildlife from water sources under conditions of relative water scarcity (Perry et al. 2015, Hall et al. 2016, Hall et al. 2018). Compared to landscapes where large herbivores such as horses and burros are completely absent, the presence of some large herbivores can cause local-scale ecological disturbances that may increase local species diversity (Trepel et al. 2024); this is consistent with the intermediate disturbance hypothesis (e.g., Wilkinson 1999), which also predicts that excessive disturbance, such as may be associated with wild horse herds far above AML, leads to reduced species diversity. Burros (and, less frequently, wild horses) have been observed digging 'wells;' such digging may improve habitat conditions for some vertebrate species and, in one site, may improve tree seedling survival (Lundgren et al. 2021). This behavior has been observed in intermittent stream beds where subsurface water is within 2 meters of the surface (Lundgren et al. 2021). The BLM is not aware of published studies that document wild horses or burros in the western United States causing similar or widespread habitat amelioration on drier upland habitats such as sagebrush, grasslands, or pinyon-juniper woodlands. Lundgren et al. (2021) suggested that, due to well-digging in ephemeral streambeds, burros (and horses) could be considered 'ecosystem engineers;' a term for species that modify resource availability for other species (Jones et al. 1994). Rubin et al. (2021) and Bleich et al. (2021) responded by pointing out that ecological benefits from wild horse and burro presence must be weighted against ecological damage they can cause, especially at high densities. Rubin et al. (2024) summarized effects of burro presence on Sonoran desert vegetation, birds, small mammals, and reptiles as a function of distance to water; some species had strongly negative associations with burro presence. Burro density appears to be negatively correlated with endangered desert tortoise presence which implies that burros should be considered along with other known environmental factors that can degrade tortoise habitat and demographic rates (Berry et al. 2020).

In HMAs where wild horse and burro biomass is very large relative to the biomass of native ungulates (Boyce and McLoughlin 2021), they should probably also be considered 'dominant species' (Power and Mills 1995) whose ecological influences result from their prevalence on the landscape. Wild horse densities could be maintained at high levels in part because artificial selection for early or extended reproduction may mean that wild horse population dynamics are not constrained in the same way as large herbivores that were never domesticated (Boyce and McLoughlin 2021). Another potentially positive ecological effect of wild horses and burros is that they, like all large herbivores, redistribute organic matter and nutrients in dung piles (i.e., King and Gurnell 2007), which could disperse and improve germination of undigested seeds. This could be beneficial if the animals spread viable native plant seeds (i.e., Downer 2022), but could have negative consequences if the animals spread viable seeds of invasive plants such as cheatgrass (i.e,, Loydi and Zalba 2009, King et al. 2019). Increased wild horse and burro density would be expected to increase the spatial extent and frequency of seed dispersal, whether the seeds distributed are desirable or undesirable. As is true of herbivory by any grazing animals, light grazing can increase rates of nutrient cycling (Manley et al. 1995) and foster compensatory growth in grazed plants which may stimulate root growth (Osterheld and McNaughton 1991, Schuman et al. 1999) and, potentially, an increase in carbon sequestration in the soil (i.e., Derner and Schuman 2007, He et al. 2011). In Spain, Segarra et al. (2023) noted that an area lightly to moderately grazed by donkeys had lower net productivity but higher plant biodiversity than ungrazed pastures where trees were encroaching. However, when grazer density is high relative to available forage resources – as can be the case when wild horse and burro densities exceed AML – then overgrazing by any species can lead to long-term reductions in plant productivity, including decreased root biomass (Herbel 1982, Williams et al. 1968) and potential reduction of stored carbon in soil horizons. Ecological processes associated with large herbivore carcass decomposition can contribute to higher insect and microbial diversity and localized nutrient flux to soils and plants, with effects that may last for several years (Newsome and Barton 2023). Degraded ecosystems may not have the capacity to use and recycle the ecological benefits of decomposing carcasses to the same level as healthy, diverse, resilient ecosystems (Newsome and Barton 2023).

Recognizing the potential beneficial effects of low-density wild horse and burro herds, but also recognizing the totality of available published studies documented ecological effects of wild horse and burro herds, especially when above AML (as noted elsewhere), it is prudent to conclude that horse and burro herd sizes above AML may cause levels of disturbance that reduce landscapes' capacity for resilience in the face of further disturbance (Rubin et al. 2024), such as is posed by extreme weather events and other consequences of climate change.

Most analyses of wild horse effects have contrasted areas with wild horses to areas without, which is a study design that should control for effects of other grazers, but historical or ongoing effects of livestock grazing may be difficult to separate from horse effects in some cases (Davies et al. 2014). Analyses have generally not included horse density as a continuous covariate; therefore, ecosystem effects have not been quantified as a linear function of increasing wild horse density. One exception is an analysis of satellite imagery confirming that varied levels of feral horse biomass were negatively correlated with average plant biomass growth (Ziegenfuss et al. 2014).

Horses require access to large amounts of water; an individual can drink an average of 7.4 gallons of water per day (Groenendyk et al. 1988). Despite a general preference for habitats near water (e.g., Crane et al. 1997), wild horses will routinely commute long distances (e.g., 10+ miles per day) between water sources and palatable vegetation (Hampson et al. 2010).

Burros can also substantially affect riparian habitats (e.g., Tiller 1997), native wildlife (e.g., Seegmiller and Ohmart 1981), and have grazing and trampling impacts that are similar to wild horses (Carothers et al. 1976; Hanley and Brady 1977; Douglas and Hurst 1983). Where burros and Greater sage-grouse co-occur, burros' year-round use of low-elevation habitats may lead to a high degree of overlap between burros and Greater sage-grouse (Beever and Aldridge 2011).

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Effects of Fertility Control Treatments and Sex Ratio Manipulations in Wild Horse and Burro Management

Various forms of fertility control can be used in wild horses and burros, with the goals of maintaining herds at or near AML, reducing fertility rates, and reducing the frequency of gathers and removals. The WFRHBA of 1971 specifically provides for contraception and sterilization (16 U.S.C. 1333 section 3.b.1). Although sex ratio manipulation is not expected to directly reduce individual fertility, it is included in discussions of fertility control treatments here because it can be a form of population growth suppression. Fertility control measures have been shown to be a cost-effective and humane treatment to slow increases in wild horse populations or, when used in combination with gathers, to reduce horse population size (Bartholow 2004, de Seve and Boyles-Griffin 2013, Fonner and Bohara 2017). Although fertility control treatments may be associated with a number of potential physiological, behavioral, demographic, and genetic effects, those impacts are generally minor and transient, do not prevent overall maintenance of a self-sustaining population, and do not generally outweigh the potential benefits of using contraceptive treatments in situations where it is a management goal to reduce population growth rates (Garrott and Oli 2013).

The percentage of effectively contracepted mares in the herd could vary over time, depending on the number of mares that are treated in different years, the formulation of vaccine that is used and the expected duration of vaccine effectiveness. After the initial gather, the BLM could use a population modeling software such as PopEquus (Folt et al. 2023a, 2023b) to help inform expectations about how many animals in future gathers or actions should be removed, or mares treated, in order to achieve herd management goals. Herd management projections and specific decisions about the number of mares to be treated in the future would be informed by the best available information at the time, based on the results of records of past treatments and on herd monitoring results. However, logistical constraints associated with gather scheduling (for vaccine hand-injection) and animal approachability (for dart-based vaccine treatments) are such that it is unlikely that the fraction of mares that are effectively contracepted in any given year would ever exceed 75%. Because of high foal and adult survival rates (Ransom et al. 2016), the likely result is that the herd will always have a positive growth rate over time.

An extensive body of peer-reviewed scientific literature details the impacts of fertility control methods on wild horses and burros. No finding of excess animals is required for BLM to pursue contraception in wild horses or burros, but NEPA analysis has been required, as there are possible effects to individuals and groups of wild horses and burros. This review focuses on peer-reviewed scientific literature. The summary that follows first examines effects of fertility control vaccine use in mares, then of sex ratio manipulation. This sub-section of the literature review does not examine effects of spaying and neutering, and does not include an analysis of oocyte growth factor vaccine formulations, which are the subject of ongoing research (Bruemmer et al. 2023). Cited studies are generally limited to those involving horses and burros, except where including studies on other species helps in making inferences about physiological or behavioral questions not yet addressed in horses or burros specifically. Burros (donkeys) are a distinct species from horses, however they are both of the family Equidae. While there are notable differences between the species in their anatomy, diet, behaviors and metabolism (Burden and Thiemann 2015), the essential endocrine controls of the hypothalamic-pituitary-gonadal axis and the function of the zona pellucida in fertility are the same. While most studies reviewed are based on results from horses, burros are similar enough in their reproductive physiology and immunology (i.e., Turini et al. 2021) that expected effects of immunocontraception are comparable.

On the whole, the identified impacts of fertility control methods are generally transient – other than the contraceptive effects which are the purpose of treatment – and affect primarily the individuals treated. Fertility control that affects individual horses and burros does not prevent BLM from ensuring that there will be self-sustaining populations of wild horses and burros in single herd management areas (HMAs), in complexes of HMAs, and at regional scales of multiple HMAs and complexes. Under the WFRHBA of 1971, BLM is charged with maintaining self-reproducing populations of wild horses and burros. The National Academies of Sciences (NRC 2013) encouraged BLM to manage wild horses and burros at the spatial scale of "metapopulations" – that is, across multiple HMAs and complexes in a region. In fact, many HMAs have historical and ongoing genetic and demographic connections with other HMAs, and BLM routinely moves animals from one to another to improve local herd traits and maintain high genetic diversity. The NAS report (2013) includes information (pairwise genetic 'fixation index' values for sampled WH&Bs herds) confirming that WH&B in the vast majority of HMAs are genetically similar to animals in multiple other HMAs.

All fertility control methods affect the behavior and physiology of treated animals (NRC 2013), and are associated with potential risks and benefits, including effects of handling, frequency of handling, physiological effects, behavioral effects, and reduced population growth rates (Hampton et al. 2015). Contraception alone does not remove excess horses from an HMA's population, so one or more gathers are usually needed in order to bring the herd down to a level close to AML. Because population growth rates depend partly on the frequency of females that give birth (i.e., the foaling rate), the use of fertility control vaccination to reduce growth rates is more effective when a herd is relatively close to AML. Population modeling (i.e. Gross 2000, deSeve and Boyles-Griffin 2013, Folt et al. 2023a, 2023b) confirms the common sense conclusion that the higher the fraction of contracepted mares, generally the lower the growth rate. Schulman et al. (2024) demonstrated that a shorter duration of effect requires larger fractions of mares need to be frequently treated to maintain a 'fertility control index' large enough to reduce herd-level growth rates. This is one reason that the BLM has historically sought to use humane, longer-lasting fertility control methods. For example, it is easier to achieve the 60-90% rate of effectively treated mares if the method used does not require treatment every year. Horses are long-lived, potentially reaching 20 years of age or more in the wild. Except in cases where extremely high fractions of mares are rendered infertile over long time periods of (i.e., 10 or more years), fertility control methods such as immunocontraceptive vaccines and sex ratio manipulation are not very effective at reducing population growth rates to the point where births equal deaths in a herd. However, even more modest fertility control activities can reduce the frequency of horse gather activities, and costs to taxpayers. Bartholow (2007) concluded that the application of 2-year or 3-year contraceptives to wild mares could reduce operational costs in a project area by 12-20%, or up to 30% in carefully planned population management programs.

Population monitoring will be useful to guide BLM in achieving and maintaining the managed population at over the duration of any action. To determine desired fertility control vaccine application rates, the BLM could use a population modeling software such as PopEquus (Folt et al. 2023a, 2023b) to help assess how many animals at that time should be removed or mares treated in order to achieve herd management goals and update its herd management projections in the future, based on the results of local, contemporaneous herd monitoring. Because applying contraception to horses often requires capturing and handling, the risks and costs associated with capture and handling of horses may be comparable to those of gathering for removal, but with expectedly lower adoption and long-term holding costs. Dart-based fertility control applications would entail no capture cost, but administration costs will vary in relation to approachability. Population growth suppression becomes less expensive if fertility control is long-lasting (Hobbs et al. 2000).

In the context of BLM wild horse and burro management, fertility control vaccines and sex ratio manipulation rely on reducing the number of reproducing females. Taking into consideration available literature on the subject, the National Academies of Sciences concluded in their 2013 report that forms of fertility control vaccines were two of the three 'most promising' available methods for contraception in wild horses and burros (NRC 2013). That report also noted that sex ratio manipulations where herds have approximately 60% males and 40% females can expect lower annual growth rates, simply as a result of having a lower number of reproducing females.

It is not realistic to rely on wild horse and burro herds to limit their own population size or growth rates in the western United States. Predators such as mountain lions tend to not fully prevent free-roaming horse population growth, even in locations where relatively high numbers of foals die per year, such as in the Virginia Range of Nevada (Schulman et al. 2024). Wild horses and burros are long-lived species with documented survival rates that can exceed 95 percent (Ransom et al. 2016) and they do not self-regulate their population (NRC 2013). The National Academies of Sciences report (NRC 2013) concluded that the primary way that equid populations self-limit is through increased competition for forage at higher densities, which results in smaller quantities of forage available per animal, poorer body condition and decreased natality and survival. It also concluded that the effect of this would be impacts to resource and herd health that are contrary to BLM management objectives and statutory and regulatory mandates. In the absence of management actions to limit the herd size, wild horse and burro populations would be expected to increase to a point where forage and/ or water resources are depleted resulting in the irreversible loss of native vegetation, a loss of wildlife habitat (including riparian habitat), and eventually the potential for periodic large-scale die-offs of the wild horses and burros themselves (NRC 2013). In a detailed demographic study of a growing population of Przewalski horses in Hungary, Kerekes et al. (2021) did observe slight reductions in foaling rates at high population sizes, but not nearly enough to prevent the population from continuing to grow at high annual rates, except during a winter die-off event when a quarter of the herd died. As such, there is a continuing need for active wild horse and burro herd management, such as through removals and fertility control.

Fertility Control Vaccines

Fertility control vaccines (also known as (immunocontraceptives) meet BLM requirements for safety to mares and the environment (EPA 2009a, 2012). Because they work by causing an immune response in treated animals, there is no risk of hormones or toxins being taken into the food chain when a treated mare dies. The BLM and other land managers have mainly used three fertility control vaccine formulations for fertility control of wild horse mares on the range: ZonaStat-H, PZP-22, and GonaCon-Equine. As other formulations become available they may be applied in the future.

In any vaccine, the antigen is the stimulant to which the body responds by making antigen-specific antibodies. Those antibodies then signal to the body that a foreign molecule is present, initiating an immune response that removes the molecule or cell. Adjuvants are additional substances that are included in vaccines to elevate the level of immune response. Adjuvants help to incite recruitment of lymphocytes and other immune cells which foster a long-lasting immune response that is specific to the antigen.

Liquid emulsion vaccines can be injected by hand or remotely administered in the field using a pneumatic dart (Roelle and Ransom 2009, Rutberg et al. 2017, Baker et al. 2023) in cases where mares are relatively approachable. Use of remotely delivered (dart-delivered) vaccine is generally limited to populations where individual animals can be accurately identified and repeatedly approached within 50 m (BLM 2010). Booster doses can be safely administered by hand or by dart. Even with repeated booster treatments of the vaccines, it is expected that most mares would eventually return to fertility, though some individual mares treated repeatedly may remain infertile. Once the herd size in a project area is at AML and population growth seems to be stabilized, BLM can make adaptive determinations as to the required frequency of new and booster treatments.

BLM has guidelines for fertility control vaccine application, with respect to selection of herds (BLM IM 2009-090). Herds selected for fertility control vaccine use should have annual growth rates over 5%, have a herd size over 50 animals, and have a target rate of treatment of between 50% and 90% of female wild horses or burros. Treated mares should be identifiable via a visible freeze brand or individual color markings, so that their vaccination history can be known. Follow-up population surveys should be used to determine the realized annual growth rate in herds treated with fertility control vaccines.

The BLM’s potential application of PZP ZonaStat-H vaccine booster doses 2 weeks or more after an initial dose, and GonaCon-Equine booster doses 30 or more days after an initial dose are consistent with use specifications on original and current product labels (EPA 2012, 2013, 2025). Temporarily holding animals or use of dart-based delivery to provide a booster dose does not require further study for justification. The Environmental Protection Agency regulates the use of fertility control agents such as the PZP vaccine ZonaStat-H or the GnRH vaccine GonaCon-Equine, in wild horses and burros. These vaccines are registered with the EPA, and are not experimental. The EPA-required product label associated with the registration for ZonaStat-H is cited in the EA as EPA (2012). That label states that “For maximum efficacy, ZonaStat-H is administered as an initial priming dose followed by a booster dose at least two weeks later.” The original EPA-required product label associated with the registration for GonaCon-Equine is cited in the EA as EPA (2013). That label states that “If longer contraceptive effect is desired, a second vaccination may be given 30 or more days after the first injection or during the following year with no known adverse health effects to the vaccinated animal.” The GonaCon-Equine label has been updated and states that a booster dose “…may be given as few as 7 days after the first injection or during the following year with no known adverse health effects…” (EPA 2025) but the BLM would not plan to booster mares at intervals of less than 30 days.

The explicit intention of BLM's potential use of fertility control vaccines such as PZP ZonaStat-H or GonaCon-Equine, is to reduce the fertility rate of treated individual mares for one or more years and, therefore, to reduce the herd-level annual growth rates. This outcome would be consistent with the Purpose and Need identified in the EA, and consistent with authorities in the WFRHBA. The BLM acknowledges that there is a range of possible duration of contraceptive effects (noted below). It is even possible that some fertility control vaccine-treated mares may not reproduce again before they die. The 2013 EPA label for GonaCon-Equine states that, "there is a chance some vaccinated females will become permanently sterile." Precise probabilistic estimates of the return time to fertility for individual mares are not required for the BLM to ensure that these methods are humane, safe, and effective, and that herd management goals of achieving and maintaining the AML are met.

Vaccine Formulations: Porcine Zona Pellucida (PZP)
PZP vaccines have been used on dozens of horse herds by the National Park Service, US Forest Service, Bureau of Land Management, and Native American tribes and PZP vaccine use is approved for free-ranging wild and feral horse herds in the United States (EPA 2012). PZP use can reduce or eliminate the need for gathers and removals, if very high fractions of mares are treated over a very long time period (Turner et al. 1997). PZP vaccines have been used extensively in wild horses (NRC 2013), and in wild and feral burros (Turner et al. 1996, French et al. 2017, French et al. 2020, Kahler and Boyles-Griffin 2022). PZP vaccine formulations are produced as ZonaStat-H, an EPA-registered commercial product (EPA 2012, SCC 2015), as PZP-22, which is a formulation of PZP in polymer pellets that can lead to a longer immune response (Turner et al. 2002, Rutberg et al. 2017, Grams et al. 2022), and as SpayVac, where the PZP protein is enveloped in liposomes (Killian et al. 2008, Roelle et al. 2017, Bechert and Fraker 2018, Bechert et al 2022). 'Native' PZP proteins can be purified from pig ovaries (Liu et al. 1989). Recombinant ZP proteins may be produced with molecular techniques (Gupta and Minhas 2017, Joonè et al. 2017a, Nolan et al. 2018a).

When advisories on the product label (EPA 2025) are followed, the product is safe for users and the environment (EPA 2012). In keeping with the EPA registration for ZonaStat-H (EPA 2012; reg. no. 86833-1), certification through the Science and Conservation Center in Billings Montana is required to apply that vaccine to equids.

For maximum effectiveness, PZP is administered within the December to February timeframe. When applying ZonaStat-H, first the primer with modified Freund's Complete adjuvant is given and then the booster with Freund's Incomplete adjuvant is given 2-6 weeks later. Preferably, the timing of the booster dose is at least 1-2 weeks prior to the onset of breeding activity. Following the initial 2 inoculations, only annual boosters are required. For the PZP-22 formulation, each released mare would receive a single dose of the two-year PZP contraceptive vaccine at the same time as a dose of the liquid PZP vaccine with modified Freund's Complete adjuvant. The pellets are applied to the mare with a large gauge needle and jab-stick into muscles near the hip. PZP-22 pellets have been successfully delivered via darting (Rutberg et al 2017, Carey et al. 2019).

Vaccine Formulations: Gonadotropin Releasing Hormone (GnRH)
GonaCon (which is produced under the trade name GonaCon-Equine for use in feral horses and burros) is approved for use by authorized federal, state, tribal, public and private personnel, for application to free-ranging wild horse and burro herds in the United States (EPA 2025). GonaCon has been used on feral horses in Theodore Roosevelt National Park and on wild horses administered by BLM. GonaCon has been produced by USDA-APHIS (Fort Collins, Colorado) in several different formulations, the history of which is reviewed by Miller et al. (2013). GonaCon vaccines present the recipient with hundreds of copies of GnRH as peptides on the surface of a linked protein that is naturally antigenic because it comes from invertebrate hemocyanin (Miller et al 2013). Early GonaCon formulations linked many copies of GnRH to a protein from the keyhole limpet (GonaCon-KHL), but more recently produced formulations

where the GnRH antigen is linked to a protein from the blue mussel (GonaCon-B) proved less expensive and more effective (Miller et al. 2008). GonaCon-Equine is in the category of GonaCon-B vaccines.

As with other contraceptives applied to wild horses, the long-term goal of GonaCon-Equine use is to reduce or eliminate the need for gathers and removals (NRC 2013). GonaCon-Equine contraceptive vaccine is an EPA-approved pesticide (EPA, 2009a) that is relatively inexpensive, meets BLM requirements for safety to mares and the environment, and is produced in a USDA-APHIS laboratory. GonaCon is a pharmaceutical-grade vaccine, including aseptic manufacturing technique to deliver a sterile vaccine product (Miller et al. 2013). If stored at 4° C, the shelf life is 6 months (Miller et al 2013).

Miller et al. (2013) reviewed the vaccine environmental safety and toxicity. When advisories on the product label (EPA 2025) are followed, the product is safe for users and the environment (EPA 2009b). EPA waived a number of tests prior to registering the vaccine, because GonaCon was deemed to pose low risks to the environment, so long as the product label is followed (Wang-Cahill et al. 2022).

GonaCon-Equine can safely be reapplied as necessary to control the population growth rate; booster dose effects may lead to increased effectiveness of contraception, which is generally the intent. Even after booster treatment of GonaCon-Equine, it is expected that most, if not all, mares would return to fertility at some point. Although the exact timing for the return to fertility in mares boosted more than once with GonaCon-Equine has not been quantified, a prolonged return to fertility would be consistent with the desired effect of using GonaCon (e.g., effective contraception).

The adjuvant used in GonaCon, Adjuvac, generally leads to a milder reaction than Freund's Complete Adjuvant (Powers et al. 2011). Adjuvac contains a small number of killed *Mycobacterium avium* cells (Miller et al. 2008, Miller et al. 2013). The antigen and adjuvant are emulsified in mineral oil, such that they are not all presented to the immune system right after injection. It is thought that the mineral oil emulsion leads to a 'depot effect' that is associated with slow or sustained release of the antigen, and a resulting longer-lasting immune response (Miller et al. 2013). Miller et al. (2008, 2013) have speculated that, in cases where memory-B leukocytes are protected in immune complexes in the lymphatic system, it can lead to years of immune response. Increased doses of vaccine may lead to stronger immune reactions, but only to a certain point; when Yoder and Miller (2010) tested varying doses of GonaCon in prairie dogs, antibody responses to the 200µg and 400µg doses were equal to each other but were both higher than in response to a 100µg dose.

Direct Effects: PZP Vaccines

The historically accepted hypothesis explaining PZP vaccine effectiveness posits that when injected as an antigen in vaccines, PZP causes the mare's immune system to produce antibodies that are specific to zona pellucida proteins on the surface of that mare's eggs. The antibodies bind to the mare's eggs surface proteins (Liu et al. 1989), and effectively block sperm binding and fertilization (Zoo Montana, 2000). Because treated mares do not become pregnant but other ovarian functions remain generally unchanged, PZP can cause a mare to continue having regular estrus cycles throughout the breeding season. More recent observations support a complementary hypothesis, which posits that PZP vaccination causes reductions in ovary size and function (Mask et al. 2015, Joonè et al. 2017b, Joonè et al. 2017c, Nolan et al. 2018b, 2018c, French et al. 2020). PZP vaccines do not appear to interact with other organ systems, as antibodies specific to PZP protein do not crossreact with tissues outside of the reproductive system (Barber and Fayrer-Hosken 2000).

Research has demonstrated that contraceptive efficacy of an injected liquid PZP vaccine, such as ZonaStat-H, is approximately 90% or more for mares or burros treated twice in the first year (Turner and Kirkpatrick 2002, Turner et al. 2008, French et al. 2020). In the PopEquus projection model (Folt et al. 2023a, 2023b), a primer and booster dose of PZP ZonaStat-H treatment is modeled as having 95% and

19% reductions on reproduction one and two years after the first two doses, respectively. The same effect is modeled for a third dose, but a higher effectiveness of 95%, 72%, 58% and 30% fertility reductions is modeled for one, two, three, and four years, respectively, after receiving a fourth dose. The highest success for fertility control has been reported when the vaccine has been applied November through February. High contraceptive rates of 90% or more can be maintained in horses that are given a booster dose annually (Kirkpatrick et al. 1992). Approximately 60% to 85% of mares are successfully contracepted for one year when treated simultaneously with a liquid primer and PZP-22 pellets (Rutberg et al. 2017, Carey et al. 2019, Grams et al. 2022). Application of PZP for fertility control would reduce fertility in a large percentage of mares for at least one year (Ransom et al. 2011). The contraceptive result for a single application of the liquid PZP vaccine primer dose along with PZP vaccine pellets (PZP-22), based on winter applications, can be expected to fall in the approximate efficacy ranges as follows (based on figure 2 in Rutberg et al. 2017). Below, the approximate efficacy used in PopEquus (Folt et al. 2023a, 2023b) modeling for PZP-22 effects is based on available studies and is measured as the relative decrease in foaling rate for treated mares, compared to control mares:

Year 1	Year 2	Year 3
0 (developing fetuses come to term)	~33-72%	~20-40%

If mares that have been treated with PZP-22 vaccine pellets subsequently receive a booster dose of either the liquid PZP vaccine or the PZP-22 vaccine pellets, the subsequent contraceptive effect is apparently more pronounced and long-lasting. The approximate efficacies following a booster dose can be expected to be in the following ranges (based on figure 3 in Rutberg et al. 2017, and used in Folt et al. (2023a, 2023b).

Year 1	Year 2	Year 3	Year 4
0 (developing fetuses come to term)	~68-85%	~70-75%	~60-72%

The fraction of mares treated in a herd can have a large effect on the realized change in growth rate due to PZP contraception, with an extremely high portion of mares required over many years to be treated to totally prevent population-level growth (e.g., Turner and Kirkpatrick 2002, Grams et al. 2022). Gather efficiency is typically less than 80% via helicopter, and may be less with bait and water trapping, so there will almost always be a portion of the female population uncaptured that is not treated in any given year. Additionally, a small number of mares may not respond to the fertility control vaccine, but instead will continue to foal normally (i.e., BLM 2023).

Direct Effects: GnRH Vaccines

GonaCon-Equine is one of several vaccines that have been engineered to create an immune response to the gonadotropin releasing hormone peptide (GnRH). GnRH is a small peptide that plays an important role in signaling the production of other hormones involved in reproduction in both sexes. When combined with an adjuvant, a GnRH vaccine stimulates a persistent immune response resulting in prolonged antibody production against GnRH, the carrier protein, and the adjuvant (Miller et al., 2008). The most direct result of successful GnRH vaccination is that it has the effect of decreasing the level of GnRH signaling in the body, as evidenced by a drop in luteinizing hormone levels, and a cessation of ovulation.

GnRH is highly conserved across mammalian taxa, so some inferences about the mechanism and effects of GonaCon-Equine in horses can be made from studies that used different anti-GnRH vaccines, in horses and other taxa. Other commercially available anti-GnRH vaccines include: Improvac (Imboden et al. 2006, Botha et al. 2008, Janett et al. 2009, Schulman et al. 2013, Dalmau et al. 2015, Nolan et al. 2018c), made in South Africa; Equity (Elhay et al. 2007), made in Australia; Improvest, for use in swine (Bohrer et al. 2014); Repro-BLOC (Boedeker et al. 2012); and Bopriva, for use in cows (Balet et al. 2014). Of these, GonaCon-Equine, Improvac, and Equity are specifically intended for horses. Other anti-GnRH vaccine formulations have also been tested, but did not become trademarked products (e.g., Goodloe 1991, Dalin et al 2002, Stout et al. 2003, Donovan et al. 2013, Schaut et al. 2018, Yao et al. 2018). The effectiveness and side-effects of these various anti-GnRH vaccines may not be the same as would be expected from GonaCon-Equine use in horses. Results could differ as a result of differences in the preparation of the GnRH antigen, and the choice of adjuvant used to stimulate the immune response. For some formulations of anti-GnRH vaccines, a booster dose is required to elicit a contraceptive response, though GonaCon can cause short-term contraception in a fraction of treated animals from one dose (Powers et al. 2011, Gionfriddo et al. 2011a, Baker et al. 2013, Miller et al 2013).

GonaCon can provide multiple years of infertility in several wild ungulate species, including horses (Killian et al., 2008; Gray et al., 2010). The lack of estrus cycling that results from successful GonaCon vaccination has been compared to typical winter period of anoestrus in open mares. As anti-GnRH antibodies decline over time, concentrations of available endogenous GnRH increase and treated animals usually regain fertility (Power et al., 2011). In the PopEquus projection model (Folt et al. 2023a, 2023b), a single dose of GonaCon-equine treatment is modeled as having 37% and 29% reductions on reproduction one and two years; as with the PZP ZonaStat-H vaccine, GonaCon is not expected to reduce the foaling rate for existing pregnancies. The PopEquus model (Folt et al. 2023a, 2023b) models fertility reductions of 100%, 85%, and 50% respectively for years 1, 2–4, and 5–7 years after two or more doses.

Baker et al. (2018) showed that mares which receive only one dose of GonaCon-Equine tend to return to fertility within 3 years. Baker et al. (2018, 2023) have also shown that mares treated twice with GonaCon-Equine return to fertility over time, with an increasing number of mares returning to fertility the longer the time since the second dose. The specific method of injection and the time between the first and second dose appear to influence the effectiveness. Two hand-injected doses 4 years apart caused 100% infertility for a year, but that had dropped to 80% by year 6. Two darted injections separated by 6 months, 1 year, or 2 years appear less effective: within 3-4 years after two darted injections, only between about 55% to 75% of mares were infertile. When two hand-injections were only separated by 30 days, approximately 85% of treated mares were infertile for 1 year (BLM 2022); this is more effective than one dose, but less effective than when the doses are separated by 4 years. This 30-day timing is becoming a relatively common treatment schedule and is consistent with the original and most current product labels (EPA 2013, 2025).

As is true for PZP vaccine treatments, the fraction of mares treated in a herd can have a large effect on the realized change in growth rate. Due to high wild horse survival rates, in any given year, a very high fraction of mares (i.e. ~75%) must be effectively contracepted (i.e., to the point that the fertility control vaccine prevents fertility in that year) to cause overall herd-level growth rates to be anywhere close to zero. The fraction of contracepted mares at any given time has also been called the 'fertility control index' (Grams et al. 2022, Schulman et al. 2024). As part of its adaptive management in decisions about how many mares to treat with fertility control vaccine, the BLM could use results of monitoring to make inferences about the number of mares present and the expected fraction of those that may be effectively contracepted, based on their treatment histories. Due to logistical limitations associated with difficult access in the Blue Wing Complex, there could almost always be a sizeable portion of the female population that is fertile in any given year.

Females that are successfully contracepted by GnRH vaccination enter a state similar to anestrus, have a lack of or incomplete follicle maturation, and no ovarian cycling (Botha et al. 2008, Nolan et al. 2018c). A leading hypothesis is that anti-GnRH antibodies bind GnRH in the hypothalamus – pituitary 'portal vessels,' preventing GnRH from binding to GnRH-specific binding sites on gonadotroph cells in the pituitary, thereby limiting the production of gonadotropin hormones, particularly luteinizing hormone (LH) and, to a lesser degree, follicle-stimulating hormone (FSH) (Powers et al. 2011, NRC 2013). This reduction in LH (and FSH), and a corresponding lack of ovulation, has been measured in response to treatment with anti-GnRH vaccines (Boedeker et al. 2012, Garza et al. 1986).

Females successfully treated with anti-GnRH vaccines have reduced progesterone levels (Garza et al. 1986, Stout et al. 2003, Imboden et al. 2006, Elhay et al. 2007, Botha et al. 2008, Killian et al. 2008, Miller et al. 2008, Schulman et al. 2013, Balet et al 2014, Dalmau et al. 2015) and β-17 estradiol levels (Elhay et al. 2007), but no great decrease in estrogen levels (Balet et al. 2014). Reductions in progesterone do not occur immediately after the primer dose, but can take several weeks or months to develop (Elhay et al. 2007, Botha et al. 2008, Schulman et al. 2013, Dalmau et al. 2015). This indicates that ovulation is not occurring and corpora lutea, formed from post-ovulation follicular tissue, are not being established.

Antibody titer measurements are proximate measures of the antibody concentration in the blood specific to a given antigen. Anti-GnRH titers generally correlate with a suppressed reproduction system (Gionfriddo et al. 2011a, Powers et al. 2011). Various studies have attempted to identify a relationship between anti-GnRH titer levels and infertility, but that relationship has not been universally predictable or consistent. The time length that titer levels stay high appears to correlate with the length of suppressed reproduction (Dalin et al. 2002, Levy et al. 2011, Donovan et al. 2013, Powers et al. 2011). For example, Goodloe (1991) noted that mares did produce elevated titers and had suppressed follicular development for 11-13 weeks after treatment, but that all treated mares ovulated after the titer levels declined. Similarly, Elhay et al. (2007) found that high initial titers correlated with longer-lasting ovarian and behavioral anoestrus. However, Powers et al. (2011) did not identify a threshold level of titer that was consistently indicative of suppressed reproduction despite seeing a strong correlation between antibody concentration and infertility, nor did Schulman et al. (2013) find a clear relationship between titer levels and mare acyclicity.

In many cases, young animals appear to have higher immune responses, and stronger contraceptive effects of anti-GnRH vaccines than older animals (Brown et al. 1994, Curtis et al. 2002, Stout et al. 2003, Schulman et al. 2013). Vaccinating with GonaCon at too young an age, though, may prevent effectiveness; Gionfriddo et al. (2011a) observed weak effects in 3-4 month old fawns. It has not been possible to predict with precision which individuals of a given age class will have long-lasting immune responses to the GonaCon vaccine. Gray (2009a) noted that mares in poor body condition tended to have lower contraceptive efficacy in response to GonaCon-B. Miller et al. (2013) suggested that higher parasite loads might have explained a lower immune response in free-roaming horses than had been observed in a captive trial. At this time it is unclear what the quantitative relationship is between various factors and the resulting contraceptive efficacy, but average efficacy rates have been reported in studies such as Baker et al. (2023).

Several studies have monitored animal health after immunization against GnRH. GonaCon treated mares did not have any measurable difference in uterine edema (Killian et al. 2006, Killian et al. 2008). Powers et al. (2011, 2013) noted no differences in blood chemistry except a mildly elevated fibrinogen level in some GonaCon treated elk. In that study, one sham-treated elk and one GonaCon treated elk each developed leukocytosis, suggesting that there may have been a causal link between the adjuvant and the effect. Curtis et al. (2008) found persistent granulomas at GonaCon-KHL injection sites three years after injection, and reduced ovary weights in treated females. Yoder and Miller (2010) found no difference in blood chemistry between GonaCon treated and control prairie dogs. One of 15 GonaCon treated cats died without explanation, and with no determination about cause of death possible based on necropsy or histology (Levy et al. 2011). Other anti-GnRH vaccine formulations have led to no detectable adverse effects (in elephants; Boedeker et al. 2012), though Imboden et al. (2006) speculated that young treated animals might conceivably have impaired hypothalamic or pituitary function.

Kirkpatrick et al. (2011) raised concerns that anti-GnRH vaccines could lead to adverse effects in other organ systems outside the reproductive system. GnRH receptors have been identified in tissues outside of the pituitary system, including in the testes and placenta (Khodr and Siler-Khodr 1980), ovary (Hsueh and Erickson 1979), bladder (Coit et al. 2009), heart (Dong et al. 2011), and central nervous system, so it is plausible that reductions in circulating GnRH levels could inhibit physiological processes in those organ systems. Kirkpatrick et al. (2011) noted elevated cardiological risks to human patients taking GnRH agonists (such as leuprolide), but the National Academy of Sciences (NRC 2013) concluded that the mechanism and results of GnRH agonists would be expected to be different from that of anti-GnRH antibodies; the former flood GnRH receptors, while the latter deprive receptors of GnRH.

Return to Fertility and Effects on Ovaries: PZP Vaccines
In most cases, PZP contraception appears to be temporary and most treated mares return to fertility over time (Kirkpatrick and Turner 2002) unless they receive additional vaccine treatments. The return to fertility associated with a reduced immune response to the fertility control vaccine antigen has been called 'reversibility,' but the timing of the return to fertility is not under direct human control in the same sense that a narcotic drug can be reversed by application of naloxone, for example. The ZonaStat-H formulation of the vaccine tends to confer only one year of efficacy per dose. Some studies have found that a PZP vaccine in long-lasting pellets (PZP-22) can confer multiple years of contraception (Turner et al. 2007), particularly when boostered with subsequent PZP vaccination (Rutberg et al. 2017). Other trial data, though, indicate that the pelleted vaccine may only be effective for one year (see Appendix B in BLM 2021).

The purpose of applying PZP vaccine treatment is to prevent mares or jennies from conceiving foals, but BLM acknowledges that long-term infertility could be a result for some number of individual wild horses receiving PZP vaccinations. The effect of the PZP vaccine treatments is an immune response but if it happens that multiple PZP vaccine treatments cause a mare to not regain fertility before death, some would interpret that course of immunocontraceptive treatment to have caused sterility. The rate of long-term or permanent sterility following vaccinations with PZP is hard to predict for individual horses, but that outcome appears to increase in likelihood as the number of doses increases (Kirkpatrick and Turner 2002). This form of vaccine-induced long-term infertility or sterility for mares treated consecutively in each of 5-7 years was observed by Nuñez et al. (2010, 2017). In a graduate thesis, Knight (2014) suggested that repeated treatment with as few as three to four years of PZP treatment may lead to longer-term sterility, and that sterility may result from PZP treatment before puberty. Repeated treatment with PZP led long-term infertility in Przewalski's horses receiving as few as one PZP booster dose (Feh 2012). However, even if some number of mares become sterile as a result of PZP treatment, that potential result would be consistent with the contraceptive purpose that motivates BLM's potential use of the vaccine, and with Congressional guidance that condones such treatment in the management of wild horses and burros, in WFRHBA section 1333(b).

In some number of individual mares and jennies, PZP vaccination may cause direct effects on ovaries (Gray and Cameron 2010, Joonè et al. 2017b, Joonè et al. 2017c, Joonè et al. 2017d, Nolan et al. 2018b, French et al. 2020). Joonè et al. (2017a) noted that effects on ovaries in mares treated with one primer dose and booster dose were temporary. Joonè et al. (2017c) and Nolan et al. (2018b) documented decreased anti-Mullerian hormone (AMH) levels in mares treated with native or recombinant PZP vaccines; AMH levels are thought to be an indicator of ovarian function. French et al. (2020) documented fewer visible follicles and reduced uterine horn diameter in PZP treated jennies; 25% of treated burros returned to fertility during that study. Bechert et al. (2013) found that ovarian function was affected by the SpayVac PZP vaccination, but that there were no effects on other organ systems. Mask et al. (2015) demonstrated that equine antibodies that resulted from SpayVac immunization could bind to oocytes, ZP proteins, follicular tissues, and ovarian tissues. It is possible that result is specific to the immune response to SpayVac, which may have lower PZP purity than ZonaStat or PZP-22 (Hall et al. 2016). However, in studies with native ZP proteins and recombinant ZP proteins, Joonè et al. (2017a) found transient effects on ovaries after PZP vaccination in some treated mares; normal estrus cycling had resumed 10 months after the last treatment. SpayVac is a patented formulation of PZP in liposomes that led to multiple years of infertility in some breeding trials (Killian et al. 2008, Roelle et al. 2017, Bechert and Fraker 2018), but unacceptably poor efficacy in a subsequent trial (Kane 2018). Kirkpatrick et al. (1992) noted effects on horse ovaries after three years of treatment with PZP. Observations at Assateague Island National Seashore indicated that the more times a mare is consecutively treated, the longer the time lag before fertility returns, but that even mares treated 7 consecutive years did eventually return to ovulation (Kirkpatrick and Turner 2002). Other studies have reported that continued PZP vaccine applications may result in decreased estrogen levels (Kirkpatrick et al. 1992) but that decrease was not biologically significant, as ovulation remained similar between treated and untreated mares (Powell and Monfort 2001). Skinner et al. (1984) raised concerns about PZP effects on ovaries, based on their study in laboratory rabbits, as did Kaur and Prabha (2014), though neither paper was a study of PZP effects in equids. Bagavant et al. (2002) demonstrated T-cell clusters on ovaries, but no loss of ovarian function after ZP protein immunization in macaques.

Return to Fertility and Effects on Ovaries: GnRH Vaccines
As with PZP vaccines, mares that are treated with GonaCon-equine vaccine can be expected to return to fertility when the immune response to the antigen declines; in the colloquial usage of the term, this also makes GonaCon-equine a ‘reversible’ treatment, even though the return to fertility is not under direct human control in the same sense that a narcotic drug can be ‘reversed’ by application of naloxone, for example. The NAS (2013) review pointed out that single doses of GonaCon-Equine do not lead to high rates of initial effectiveness, or long duration. Initial effectiveness of one dose of GonaCon-Equine vaccine appears to be lower than for a combined primer plus booster dose of the PZP vaccine Zonastat-H (Kirkpatrick et al. 2011), and the initial effect of a single GonaCon dose can be limited to as little as one breeding season; a relatively ow fraction of mares that receive only one dose of GonaCon-equine may be contracepted in the first year after treatment. However, preliminary results on the effects of boostered doses of GonaCon-Equine indicate that a booster dose in horses can increase the strength and duration of immune response – this can result in high contraceptive efficacy and longer-lasting effects (Baker et al. 2017, 2018) than the one-year effect that is generally expected from a single booster of Zonastat-H.

Too few studies have reported on the various formulations of anti-GnRH vaccines to make generalizations about differences between products, but GonaCon formulations were consistently good at causing loss of fertility in a statistically significant fraction of treated mares for at least one year (Killian et al. 2009, Gray et al. 2010, Baker et al. 2013, 2017, 2018). With few exceptions (e.g., Goodloe 1991), anti-GnRH treated mares gave birth to fewer foals in the first season when there would be an expected contraceptive effect (Botha et al. 2008, Killian et al. 2009, Gray et al. 2010, Baker et al. 2013, 2018). Goodloe (1991) used an anti-GnRH-KHL vaccine with a triple adjuvant, in some cases attempting to deliver the vaccine to horses with a hollow-tipped ‘biobullet, ’but concluded that the vaccine was not an effective immunocontraceptive in that study.

Not all mares should be expected to respond to the GonaCon-equine vaccine; some number should be expected to continue to become pregnant and give birth to foals. In studies where mares were exposed to stallions, the fraction of treated mares that are effectively contracepted in the year after anti-GnRH vaccination varied from study to study, ranging from ~50% (Baker et al. 2017), to 61% (Gray et al. 2010), to ~90% (Killian et al. 2006, 2008, 2009). Miller et al. (2013) noted lower effectiveness in free-ranging mares (Gray et al. 2010) than captive mares (Killian et al. 2009). Some of these rates are lower than the high rate of effectiveness typically reported for the first year after PZP vaccine treatment (Kirkpatrick et al. 2011). In the one study that tested for a difference, darts and hand-injected GonaCon doses were equally effective in terms of short-term fertility outcome (McCann et al. 2017). After treatment with GonaCon-equine vaccine, some mares may return to fertility faster than others (Thompson et al. 2022).

In studies where mares were not exposed to stallions, the duration of effectiveness also varied. A primer and booster dose of Equity led to anoestrus for at least 3 months (Elhay et al. 2007). A primer and booster dose of Improvac also led to loss of ovarian cycling for all mares in the short term (Imboden et al. 2006, Nolan et al. 2018c). It is worth repeating that those vaccines do not have the same formulation as GonaCon.

Results from horses (Baker et al. 2017, 2018, 2023) and other species (Curtis et al. 2002) suggest that providing a booster dose of GonaCon-Equine will increase the fraction of temporarily infertile animals to higher levels than would a single vaccine dose alone.

Longer-term infertility has been observed in some mares treated with anti-GnRH vaccines, including GonaCon-Equine. In a single-dose mare captive trial with an initial year effectiveness of 94%, Killian et al. (2008) noted infertility rates of 64%, 57%, and 43% in treated mares during the following three years, while control mares in those years had infertility rates of 25%, 12%, and 0% in those years. GonaCon effectiveness in free-roaming populations was lower, with infertility rates consistently near 60% for three years after a single dose in one study (Gray et al. 2010) and annual infertility rates decreasing over time from 55% to 30% to 0% in another study with one dose (Baker et al. 2017, 2018). Similarly, gradually increasing fertility rates were observed after single dose treatment with GonaCon in elk (Powers et al. 2011) and deer (Gionfriddo et al. 2011a); these results are consistent with the expectation that contraceptive effect of GonaCon in mammals results from the immune response, and that return to fertility increases as that immune response wanes.

Baker et al. (2017, 2018) observed a return to fertility over 4 years in mares treated once with GonaCon, but then noted extremely low fertility rates of 0% and 16% in the two years after the same mares were given a booster dose four years after the primer dose. Four of nine mares treated with primer and booster doses of Improvac did not return to ovulation within 2 years of the primer dose (Imboden et al. 2006), though one should probably not make conclusions about the long-term effects of GonaCon-Equine based on results from Improvac. In 2023, Baker et al. reported that mares treated with two doses of GonaCon-Equine returned to fertility at different rates and timing, depending on the length of time between the primer and booster dose. The longer the time between primer and booster, generally the longer-lasting was the contraceptive effect. For mares re-treated 4 years after the first dose, 29% had returned to fertility within 6 years after the second dose. For mares re-treated 2 years after the first dose, 36% had returned to fertility within 4 years of the second dose. For mares retreated 1 year, or 6 months after their first dose, 57%, and 46% of mares, respectively, had returned to fertility within 3 years. Results for the timing of return to fertility among mares treated twice with GonaCon-Equine vaccine is consistent with immune response being the cause of contraception, and that those contraceptive effects wane as the immune response declines over time (Baker et al. 2023).

In a presentation to the wild horse and burro Advisory Board (BLM 2025), the BLM summarized some preliminary, unpublished results from monitoring a subset of wild mares that were gathered, given a first dose of GonaCon-Equine vaccine, held for approximately 30 days, treated with a second dose, and then released back to their herd management areas of origin. This treatment regime may be casually referred to as 'capture-treat-hold-release,' though there is actually a second vaccine treatment before release. Because results are not yet peer-reviewed, the methods are described briefly here. GPS radio collared, GonaCon-Equine treated wild mares at Swasey HMA, Sulphur HMA, and Eagle HMA were monitored every 30 days after release to determine their survival and the presence of a foal, until the GPS collars were dropped from the mares. No detrimental effects of GonaCon treatment on mare survival were observed in the wild. In some cases, additional GonaCon-treated mares were also observed frequently enough to provide reliable foaling rate data because they associated consistently with radio-collared mares. In the first foaling season after release, closely monitored mares at those three HMAs had a 54% observed foaling rate (n=70; SE=0.06). It is consistent with expectations that mares that are pregnant at the time they are treated with GonaCon would bring the fetus to term despite the vaccination (see below, *Effects on*

Existing Pregnancies, Foals, and Birth Phenology: GnRH Vaccines). In the second foaling season after vaccine treatment at all three of those HMAs, there was an observed foaling rate of 13% among treated mares (n=64; SE=0.06). Radio collar-based observations provided foaling rates for GonaCon-Equine-treated mares in the third foaling season only at Eagle HMA, when foaling rate had increased among treated mares to 31% (n=45; SE=0.07). A gather took place at Swasey HMA in the fourth year after treatment, and foaling rate estimates are possible there based on monitoring of re-gathered, GonaCon-Equine-treated mares, among which the foaling rate in that year was up to 47% (n=17; SE=0.12). These results of monitoring are consistent with expectations, in that among these mares treated with GonaCon-Equine via the capture-treat-hold-release approach, there was an initially high effectiveness (low foaling rate) in the first breeding season after treatment, the effectiveness waned somewhat over time, and the effectiveness was higher in years 3 and 4 than would be expected for a capture-treat-hold-release regimen of ZonaStat-H vaccine. The observed foaling rates over time for capture-treat-hold-release GonaCon-Equine treated mares were roughly comparable in value to observations for mares treated twice via darting at Theodore Roosevelt NP (*in* Baker et al. 2023).

It is difficult to predict which females will exhibit strong or long-term immune responses to anti-GnRH vaccines (Killian et al. 2006, Miller et al. 2008, Levy et al. 2011). A number of factors may influence responses to vaccination, including age, body condition, nutrition, prior immune responses, and genetics (Cooper and Herbert 2001, Curtis et al. 2002, Powers et al. 2011, Thompson et al. 2022). It is not expected that the BLM would treat prepubertal mares in the Blue Wing Complex. One apparent trend is that animals that are treated at a younger age, especially before puberty, may have stronger and longer-lasting responses (Brown et al. 1994, Curtis et al. 2002, Stout et al. 2003, Schulman et al. 2013). It is plausible that giving GonaGon-Equine to prepubertal mares will lead to long-lasting infertility, but no published data are available.

To date, short term evaluation of anti-GnRH vaccines, show contraception appears to be temporary, and a result of an immune response that can wane over time. Killian et al. noted long-term effects of GonaCon in some captive mares (2009). However, Baker et al. (2017) observed horses treated with GonaCon-B return to fertility after they were treated with a single primer dose; after four years, the fertility rate was indistinguishable between treated and control mares. It appears that a single dose of GonaCon results in temporary infertility lasting a short time (i.e., usually less than 2 years). Baker et al (2023) noted the possibility that some mares treated twice with GonaCon-Equine vaccine could remain contracepted for over 6 years, or even until they die; the latter outcome would presumably depend on the animal’s age when treated, with older animals more likely to die before regaining fertility simply because their lifespan may not be long enough for the immune reaction to wane and cause a resumption of fertility. If long-term treatment resulted in such a long duration of immune response that a mare remains infertile until death, that type of permanent infertility would be consistent with the desired effect of using GonaCon (e.g., effective contraception), and with section 1333(b) of the WFRHBA.

Other anti-GnRH vaccines also have had temporary effects in mares. Elhay et al. (2007) noted a return to ovary functioning over the course of 34 weeks for 10 of 16 mares treated with Equity. That study ended at 34 weeks, so it is not clear when the other six mares would have returned to fertility. Donovan et al. (2013) found that half of mares treated with an anti-GnRH vaccine intended for dogs had returned to fertility after 40 weeks, at which point the study ended. In a study of mares treated with a primer and booster dose of Improvac, 47 of 51 treated mares had returned to ovarian cyclicity within 2 years; younger mares appeared to have longer-lasting effects than older mares (Schulman et al. 2013). Joonè et al. (2017) analyzed samples from the Schulman et al. (2013) study, and found no significant decrease in anti-Mullerian hormone (AMH) levels in mares treated with GnRH vaccine. AMH levels are thought to be an indicator of ovarian function, so results from Joonè et al. (2017) support the general view that the anoestrus resulting from GnRH vaccination is physiologically similar to typical winter anoestrus. In a small study with a non-commercial anti-GnRH vaccine (Stout et al. 2003), three of seven treated mares had returned to cyclicity within 8 weeks after delivery of the primer dose, while four others were still suppressed for 12 or more weeks. In elk, Powers et al. (2011) noted that contraception after one dose of GonaCon was temporary. In white-tailed deer, single doses of GonaCon appeared to confer two years of contraception (Miller et al. 2000). Ten of 30 domestic cows treated became pregnant within 30 weeks after the first dose of Bopriva (Balet et al. 2014).

Long-term infertility could result from multiple doses of GonaCon-equine vaccine. As is the case for PZP vaccines (noted above), it is possible that some fraction of mares treated with multiple doses of GonaCon-equine could be prevented from having any more foals before they die – this outcome would depend on the age when the mare is treated, duration of the mare's immune response, and the mare's longevity. All available evidence supports the conclusion that the effect of GonaCon-equine vaccine treatments is to cause an immune response, and that when that immune response wanes a mare is expected to return to fertility. As noted above, Baker et al (2023) demonstrated increasing rates of return to fertility over time, after a second dose of GoanCon-Equine was administered. But if it happens that GonaCon-equine vaccine treatments cause a mare or jennie to not return to fertility before death, some would interpret that course of immunocontraceptive treatment to have caused sterility. If some fraction of mares or jennies treated with GonaCon-Equine were to become sterile, though, that result would be consistent with the contraceptive purpose that motivates BLM's potential use of the vaccine, and with Congressional guidance that condones such treatment in the management of wild horses and burros, in WFRHBA section 1333(b).

In summary, based on the above results related to fertility effects of GonaCon and other anti-GnRH vaccines, application of a single dose of GonaCon-Equine to gathered or remotely-darted wild horses could be expected to prevent pregnancy in perhaps 30%-60% of mares for one year. Some smaller number of wild mares should be expected to have persistent contraception for a second year, and less still for a third year. Applying one booster dose of GonaCon to previously-treated mares may lead to four or more years with relatively high rates (80+%) of additional infertility expected (Baker et al. 2018. 2023), with the potential for additional infertility until the immune response to the vaccine wears off. The duration of effect after a second dose would appear to depend on the length of time between first and second dose, with longer-lasting effects if that time span is 4 years than if it is 1 year or less (Baker et al 2023). Given that GonaCon-Equine is formulated as a highly immunogenic long-lasting vaccine, it is reasonable to hypothesize that additional boosters would increase the effectiveness and duration of the vaccine

GonaCon-Equine only affects the fertility of treated animals; untreated animals will still be expected to give birth. Even under favorable circumstances for population growth suppression, gather efficiency is typically less than 80% via helicopter, and may be less with bait and water trapping. Similarly, not all animals may be approachable for darting. The uncaptured or undarted portion of the female population would still be expected to have normally high fertility rates in any given year, though those rates could go up slightly if contraception in other mares increases forage and water availability.

Changes in hormones associated with anti-GnRH vaccination lead to measurable changes in ovarian structure and function. The volume of ovaries reduced in response to treatment (Garza et al. 1986, Dalin et al. 2002, Imboden et al. 2006, Elhay et al. 2007, Botha et al. 2008, Gionfriddo 2011a, Dalmau et al. 2015). Treatment with an anti-GnRH vaccine changes follicle development (Garza et al. 1986, Stout et al. 2003, Imboden et al. 2006, Elhay et al. 2007, Donovan et al. 2013, Powers et al. 2011, Balet et al. 2014), with the result that ovulation does not occur. A related result is that the ovaries can exhibit less activity and cycle with less regularity or not at all in anti-GnRH vaccine treated females (Goodloe 1991, Dalin et al. 2002, Imboden et al. 2006, Elhay et al. 2007, Powers et al. 2011, Donovan et al. 2013). In studies where the vaccine required a booster, hormonal and associated results were generally observed within several weeks after delivery of the booster dose.

Effects on Existing Pregnancies, Foals, and Birth Phenology: PZP Vaccines
Although fetuses are not explicitly protected under the WFRHBA of 1971, as amended, it is prudent to analyze the potential effects of fertility control vaccines on developing fetuses and foals. Any impacts identified in the literature have been found to be transient, and do not influence the future reproductive capacity of offspring born to treated females.

If a mare is already pregnant, the PZP vaccine has not been shown to affect normal development of the fetus or foal, or the hormonal health of the mare with relation to pregnancy (Kirkpatrick and Turner 2003). Studies on Assateague Island (Kirkpatrick and Turner 2002) showed that once female offspring born to mares treated with PZP during pregnancy eventually breed, they produce healthy, viable foals. It is possible that there may be transitory effects on foals born to mares or jennies treated with PZP. For example, in mice, Sacco et al. (1981) found that antibodies specific to PZP can pass from mother mouse to pup via the placenta or colostrum, but that did not apparently cause any innate immune response in the offspring: the level of those antibodies were undetectable by 116 days after birth. There was no indication in that study that the fertility or ovarian function of those mouse pups was compromised, nor is BLM aware of any such results in horses or burros. Unsubstantiated, speculative connections between PZP treatment and 'foal stealing' has not been published in a peer-reviewed study and thus cannot be verified. 'Foal stealing,' where a near-term pregnant mare steals a neonate foal from a weaker mare, is unlikely to be a common behavioral result of including sterile mares in a wild horse herd. McDonnell (2012) noted that "foal stealing is rarely observed in horses, except under crowded conditions and synchronization of foaling," such as in horse feed lots. Those conditions are not likely in the wild, where pregnant mares will be widely distributed across the landscape, and where the expectation is that parturition dates would be distributed across the normal foaling season. Similarly, although Nettles (1997) noted reported stillbirths after PZP treatments in cynomolgus monkeys, those results have not been observed in equids despite extensive use in horses and burros.

On-range observations from 20 years of application to wild horses indicate that PZP application in wild mares does not generally cause mares to give birth to foals out of season or late in the year (Kirkpatrick and Turner 2003). Research by Nuñez et al. (2010) showed that a small number of mares that had previously been treated with PZP foaled later than untreated mares and expressed the concern that this late foaling "may" impact foal survivorship and decrease band stability, or that higher levels of attention from stallions on PZP-treated mares might harm those mares. However, that paper provided no evidence that such impacts on foal survival or mare well-being actually occurred. Rubenstein (1981) called attention to a number of unique ecological features of horse herds on Atlantic barrier islands, such as where Nuñez et al. made observations, which calls into question whether inferences drawn from island herds can be applied to western wild horse herds. Ransom et al. (2013), though, did identify a potential shift in reproductive timing as a possible drawback to prolonged treatment with PZP, stating that treated mares foaled on average 31 days later than non-treated mares. Results from Ransom et al. (2013), however, showed that over 81% of the documented births in that study were between March 1 and June 21, i.e., within the normal, peak, spring foaling season. Ransom et al. (2013) pointedly advised that managers should consider carefully before using fertility control vaccines in small refugia or rare species. There was a slightly later foaling season observed in two other PZP vaccine-treated herds, but foal survival rates were over 95% and there was no discernable difference in foal survival as a function of birth date (Rutberg and Grams 2024). Wild horses and burros managed by BLM do not generally occur in isolated refugia, nor are they at all rare species. The US Fish and Wildlife Service denied a petition to list wild horses as endangered (USFWS 2015). Moreover, any effect of shifting birth phenology was not observed uniformly: in two of three PZP-treated wild horse populations studied by Ransom et al. (2013), foaling season of treated mares extended three weeks and 3.5 months, respectively, beyond that of untreated mares. In the other population, the treated mares foaled within the same time period as the untreated mares. Furthermore, Ransom et al. (2013) found no negative impacts on foal survival even with an extended birthing season. Nuñez (2018) suggested that if there are shifts in birth phenology it would be reasonable to assume that some negative effects on foal survival for a small number of foals might result from particularly severe weather events; such effects were not observed, though, in North Dakota (Baker et al. 2023).

Effects on Existing Pregnancies, Foals, and Birth Phenology: GnRH Vaccines
Although fetuses are not explicitly protected under the WFRHBA of 1971, as amended, it is prudent to analyze the potential effects of fertility control vaccines on developing fetuses and foals. Any impacts identified in the literature have been found to be transient, and do not influence the future reproductive capacity of offspring born to treated females.

GonaCon and other anti-GnRH vaccines can be injected while a female is pregnant (Miller et al. 2000, Powers et al. 2011, Baker et al. 2013) – in such a case, a successfully contracepted mare will be expected to give birth during the following foaling season, but to be infertile during the same year's breeding season. Thus, a mare injected in November of 2018 would not show the contraceptive effect (i.e., no new foal) until spring of 2020.

GonaCon had no apparent effect on pregnancies in progress, foaling success, or the health of offspring, in horses that were immunized in October (Baker et al. 2013), elk immunized 80-100 days into gestation (Powers et al. 2011, 2013), or deer immunized in February (Miller et al. 2000). Kirkpatrick et al. (2011) noted that anti-GnRH immunization is not expected to cause hormonal changes that would lead to abortion in the horse, but this may not be true for the first 6 weeks of pregnancy (NRC 2013). Curtis et al. (2002) noted that GonaCon-KHL treated white tailed deer had lower twinning rates than controls, but speculated that the difference could be due to poorer sperm quality late in the breeding season, when the treated does did become pregnant. Goodloe (1991) found no difference in foal production between treated and control animals.

Offspring of anti-GnRH vaccine treated mothers could exhibit an immune response to GnRH (Khodr and Siler-Khodr 1980), as antibodies from the mother could pass to the offspring through the placenta or colostrum. In the most extensive study of long-term effects of GonaCon immunization on offspring, Powers et al. (2012) monitored 15 elk fawns born to GonaCon treated cows. Of those, 5 had low titers at birth and 10 had high titer levels at birth. All 15 were of normal weight at birth, and developed normal endocrine profiles, hypothalamic GnRH content, pituitary gonadotropin content, gonad structure, and gametogenesis. All the females became pregnant in their second reproductive season, as is typical. All males showed normal development of secondary sexual characteristics. Powers et al. (2012) concluded that suppressing GnRH in the neonatal period did not alter long-term reproductive function in either male or female offspring. Miller et al. (2013) report elevated anti-GnRH antibody titers in fawns born to treated white tailed deer, but those dropped to normal levels in 11 of 12 of those fawns, which came into breeding condition; the remaining fawn was infertile for three years.

Direct effects on foal survival are equivocal in the literature. Goodloe (1991), reported lower foal survival for a small sample of foals born to anti-GnRH treated mares, but did not assess other possible explanatory factors such as mare social status, age, body condition, or habitat (NRC 2013). Gray et al. (2010) found no difference in sex ratio, parturition phenology, or foal survival in foals born to free-roaming mares treated with GonaCon.

It is possible that immunocontracepted mares returning to fertility late in the breeding season could give birth to foals at a time that is out of the normal range (Nuñez et al. 2010, Ransom et al 2013), but it is also important to note that where such shifts have been documented, there have not been any associated effects on foal survival or long-term shifts in birth phenology for individual mares. The effects of GnRH vaccination on foaling phenology appear similar to those for PZP vaccine treated mares in which the effects of the vaccine wear off. In North Dakota, Baker et al. (2023) documented that 95% of foals born to untreated mares were born between March 1 – August 1. Baker et al. (2023) found that GonaCon-Equine treated mares had, on average, a peak foaling date (May 30) that was 34 days later than that of untreated mares (April 26), which is comparable to the 31-day later peak in PZP-treated mares that Ransom et al. (2013) documented. One might suppose that if there is a shift in foaling date for some treated mares, any associated effect on foal survival could depend on weather severity and local conditions. But importantly, even though Baker et al. (2023) observed foals born to GonaCon-Equine treated mares as late as December in North Dakota, their survival rate analysis showed that "…no difference in survival resulting from contraceptive effects was observed on timing of parturition." Also, similar to results in Ransom et al. (2013) for PZP-treated mares, observations by Baker et al. (2023) lead to the conclusion that late foaling phenology is 'self correcting' for any given mare, in that if a mare gave birth to a foal later than the typical foaling season, in the following year that mare either had no foal, or gave birth to a foal during the typical foaling season. Similarly, Curtis et al. (2002) observed a slightly later fawning date for GonaCon treated deer in the second year after treatment, when some does regained fertility late in the breeding season. In other anti-GnRH vaccine trials in free-roaming horses, there were no published differences in mean date of foal production (Goodloe 1991, Gray et al. 2010). Because of the concern that contraception could lead to shifts in the timing of parturitions for some treated animals, Ransom et al. (2013) advised that managers should consider carefully before using PZP immunocontraception in small refugia or rare species; the same considerations could be advised for use of GonaCon, but wild horses and burros in most areas do not generally occur in isolated refugia, they are not a rare species at the regional, national, or international level, and genetically they represent descendants of domestic livestock with most populations containing few if any unique alleles (NRC 2013). Moreover, in PZP-treated horses that did have some degree of parturition date shift, Ransom et al. (2013) found no negative impacts on foal survival even with an extended birthing season; however, this may be more related to stochastic, inclement weather events than extended foaling seasons.

Effects of Marking and Injection

Standard practices require that immunocontraceptive-treated animals be readily identifiable, either via brand marks or unique coloration (BLM 2010). Some level of transient stress is likely to result in newly captured mares that do not have markings associated with previous fertility control treatments. It is difficult to compare that level of temporary stress with the long-term stress that can result from food and water limitation on the range (e.g., Creel et al. 2013).

Handling may include freeze-marking and / or RFID chipping, for the purpose of identifying that mare and identifying that mare's vaccine treatment history. Under past management practices, captured mares experienced increased stress levels from handling (Ashley and Holcombe 2001), but BLM has instituted guidelines to reduce the sources of handling stress in captured animals (BLM 2021).

Most mares recover from the stress of capture and handling quickly once released back to the range, and none are expected to suffer serious long term effects from the fertility control injections, other than the direct consequence of becoming temporarily infertile. Injection site reactions associated with fertility control treatments are possible in treated mares and jennies (Roelle and Ransom 2009, Bechert et al. 2013, French et al. 2017, Baker et al. 2018, French et al. 2020), but swelling or local reactions at the injection site are expected to be minor in nature. Roelle and Ransom (2009) found that the most time-efficient method for applying PZP is by hand-delivered injection of 2-year pellets when horses are gathered. They observed only two instances of swelling from that technique. French et al. (2020) observed localized swelling, transient lameness in PZP vaccine-treated burros, and sterile abscesses in 87% of those treated jennies. Whether injection is by hand or via darting, GonaCon-Equine is associated with some degree of inflammation, swelling, and the potential for abscesses at the injection site (Baker et al. 2013). Swelling or local reactions at the injection site are generally expected to be minor in nature, but some may develop into draining abscesses. Use of remotely delivered vaccine is generally limited to populations where individual animals can be accurately identified and repeatedly approached. The dart-delivered PZP formulation produced injection-site reactions of varying intensity, though none of the observed reactions appeared debilitating to the animals (Roelle and Ransom 2009) but that was not observed with dart-delivered GonaCon (McCann et al. 2017). Joonè et al. (2017a) found that injection site reactions had healed in most mares within 3 months after the booster dose, and that they did not affect movement or cause fever.

Long-lasting nodules observed did not appear to change any animal's range of movement or locomotor patterns and in most cases did not appear to differ in magnitude from naturally occurring injuries or scars. Mares treated with one formulation of GnRH-KHL vaccine developed pyogenic abscesses (Goodloe 1991). Miller et al. (2008) noted that the water and oil emulsion in GonaCon will often cause cysts, granulomas, or sterile abscesses at injection sites; in some cases, a sterile abscess may develop into a draining abscess. In elk treated with GonaCon, Powers et al. (2011) noted up to 35% of treated elk had an abscess form, despite the injection sites first being clipped and swabbed with alcohol. Even in studies where swelling and visible abscesses followed GonaCon immunization, the longer term nodules observed did not appear to change any animal's range of movement or locomotor patterns (Powers et al. 2013, Baker et al. 2017, 2018). The result that other formulations of anti-GnRH vaccine may be associated with less notable injection site reactions in horses may indicate that the adjuvant formulation in GonaCon leads a single dose to cause a stronger immune reaction than the adjuvants used in other anti-GnRH vaccines. Despite that, a booster dose of GonaCon-Equine appears to be more effective than a primer dose alone (Baker et al. 2017). Horses injected in the hip with Improvac showed only transient reactions that disappeared within 6 days in one study (Botha et al. 2008), but stiffness and swelling that lasted 5 days were noted in another study where horses received Improvac in the neck (Imboden et al. 2006). Equity led to transient reactions that resolved within a week in some treated animals (Elhay et al. 2007). Donovan et al. noted no reactions to the canine anti-GnRH vaccine (2013). In cows treated with Bopriva there was a mildly elevated body temperature and mild swelling at injection sites that subsided within 2 weeks (Balet et al. 2014).

Indirect Effects: PZP Vaccines

One expected long-term, indirect effect on wild horses treated with fertility control would be an improvement in their overall health (Turner and Kirkpatrick 2002). Many treated mares would not experience the biological stress of reproduction, foaling and lactation as frequently as untreated mares. The observable measure of improved health is higher body condition scores (Nuñez et al. 2010). After a treated mare returns to fertility, that mare's future foals would be expected to be healthier overall, and would benefit from improved nutritional quality in the mare's milk. This is particularly to be expected if there is an improvement in rangeland forage quality at the same time, due to reduced wild horse population size. Past application of fertility control has shown that mares' overall health and body condition remains improved even after fertility resumes. PZP treatment may increase mare survival rates, leading to longer potential lifespan (Turner and Kirkpatrick 2002, Ransom et al. 2014a) that may be as much as 5-10 years (NPS 2008). To the extent that this happens, changes in lifespan and decreased foaling rates could combine to cause changes in overall age structure in a treated herd (i.e., Turner and Kirkpatrick 2002, Roelle et al. 2010), with a greater prevalence of older mares in the herd (Gross 2000, NPS 2008). Observations of mares treated on Park Service lands (Turner and Kirkpatrick 2002) and in BLM gathers (Ransom et al. 2010, Rutberg and Grams 2024) indicate that many treated mares maintained higher body condition than untreated mares.

Following resumption of fertility, the proportion of mares that conceive and foal could be increased due to their increased fitness; this has been called a 'rebound effect.' Elevated fertility rates have been observed after horse gathers and removals (Kirkpatrick and Turner 1991). If repeated contraceptive treatment leads to a prolonged contraceptive effect, then that may minimize or delay the hypothesized rebound effect. Selectively applying contraception to older animals and returning them to the range could reduce long-term holding costs for such horses, which are difficult to adopt, and may reduce the compensatory reproduction that often follows removals (Kirkpatrick and Turner 1991).

Because successful fertility control in a given herd reduces foaling rates and population growth rates, another indirect effect should be to reduce the number of wild horses that have to be removed over time to achieve and maintain the established AML. Contraception may change a herd's age structure, with a relative increase in the fraction of older animals in the herd (NPS 2008). Reducing the numbers of wild horses that would have to be removed in future gathers could allow for removal of younger, more easily adoptable excess wild horses, and thereby could eliminate the need to send additional excess horses from this area to off-range holding corrals or pastures for long-term holding.

A principal motivation for use of contraceptive vaccines or sex ratio manipulation is to reduce population growth rates and maintain herd sizes at AML. Where successful, this should allow for continued and increased environmental improvements to range conditions within the project area, which would have long-term benefits to wild horse and burro habitat quality, and well-being of animals living on the range. As the population nears or is maintained at the level necessary to achieve a thriving natural ecological balance, vegetation resources would be expected to recover, improving the forage available. With rangeland conditions more closely approaching a thriving natural ecological balance, and with a less concentrated distribution of wild horses and burros, there should also be less trailing and concentrated use of water sources. Lower population density should lead to reduced competition among wild horses using the water sources, and less fighting among horses accessing water sources. Water quality and quantity would continue to improve to the benefit of all rangeland users including wild horses. Wild horses would also have to travel less distance back and forth between water and desirable foraging areas. Among mares in the herd that remain fertile, a higher level of physical health and future reproductive success would be expected in areas where lower horse and burro population sizes lead to increases in water and forage resources. While it is conceivable that widespread and continued treatment with fertility control vaccines could reduce the birth rates of the population to such a point that birth is consistently below mortality, that outcome is not likely unless a very high fraction of the mares present are all treated in almost every year.

Indirect Effects: GnRH Vaccines

As noted above to PZP vaccines, an expected long-term, indirect effect on wild horses treated with fertility control would be an improvement in their overall health. Body condition of anti-GnRH-treated females was equal to or better than that of control females in published studies. Ransom et al. (2014b) observed no difference in mean body condition between GonaCon-B treated mares and controls. Goodloe (1991) found that GnRH-KHL treated mares had higher survival rates than untreated controls. Baker et al (2023) noted higher body condition scores in GonaCon-Equine vaccine treated mares than in untreated mares. In other species, treated deer had better body condition than controls (Gionfriddo et al. 2011b), treated cats gained more weight than controls (Levy et al. 2011), as did treated young female pigs (Bohrer et al. 2014).

Following resumption of fertility, the proportion of mares that conceive and foal could be increased due to their increased fitness; this has been called by some a 'rebound effect.' Elevated fertility rates have been observed after horse gathers and removals (Kirkpatrick and Turner 1991). If repeated contraceptive treatment leads to a prolonged contraceptive effect, then that may minimize or delay the hypothesized rebound effect. Selectively applying contraception to older animals and returning them to the range could reduce long-term holding costs for such horses, which are difficult to adopt, and could negate the compensatory reproduction that can follow removals (Kirkpatrick and Turner 1991).

Because successful fertility control would reduce foaling rates and population growth rates, another indirect effect would be to reduce the number of wild horses that have to be removed over time to achieve and maintain the established AML. Contraception would be expected to lead to a relative increase in the fraction of older animals in the herd. Reducing the numbers of wild horses that would have to be removed in future gathers could allow for removal of younger, more easily adoptable excess wild horses, and thereby could eliminate the need to send additional excess horses from this area to off-range holding corrals or pastures for long-term holding. Among mares in the herd that remain fertile, a high level of physical health and future reproductive success would be expected because reduced population sizes should lead to more availability of water and forage resources per capita.

Reduced population growth rates and smaller population sizes could also allow for continued and increased environmental improvements to range conditions within the project area, which would have long-term benefits to wild horse habitat quality. As the local horse abundance nears or is maintained at the level necessary to achieve a thriving natural ecological balance, vegetation resources would be expected to recover, improving the forage available to wild horses and wildlife throughout the area. With rangeland conditions more closely approaching a thriving natural ecological balance, and with a less concentrated distribution of wild horses across the range, there should also be less trailing and concentrated use of water sources. Lower population density would be expected to lead to reduced competition among wild horses using the water sources, and less fighting among horses accessing water sources. Water quality and quantity would continue to improve to the benefit of all rangeland users including wild horses. Wild horses would also have to travel less distance back and forth between water and desirable foraging areas. Should GonaCon-Equine treatment, including booster doses, continue into the future, with treatments given on a schedule to maintain a lowered level of fertility in the herd, the chronic cycle of overpopulation and large gathers and removals might no longer occur, but instead a consistent abundance of wild horses could be maintained, resulting in continued improvement of overall habitat conditions and animal health. While it is conceivable that widespread and continued treatment with GonaCon-Equine could reduce the birth rates of the population to such a point that birth is consistently below mortality, that outcome is not likely unless a very high fraction of the mares present are all treated with primer and booster doses, and perhaps repeated booster doses.

Behavioral Effects: PZP Vaccines
Behavioral difference, compared to mares that are fertile, should be considered as potential results of successful contraception. The NAS report (2013) noted that all forms of fertility suppression have effects on mare behavior, mostly because of the lack of pregnancy and foaling, and concluded that fertility control vaccines were among the most promising fertility control methods for wild horses and burros. The resulting impacts may be seen as neutral in the sense that a wide range of natural behaviors is already observable in untreated wild horses, or mildly adverse in the sense that effects are expected to be transient and to not affect all treated animals.

PZP vaccine-treated mares may continue estrus cycles throughout the breeding season. Ransom and Cade (2009) delineated wild horse behaviors. Ransom et al. (2010) found no differences in how PZP-treated and untreated mares allocated their time between feeding, resting, travel, maintenance, and most social behaviors in three populations of wild horses, which is consistent with Powell's (1999) findings in another population. Likewise, body condition of PZP-treated and control mares did not differ between treatment groups in Ransom et al.'s (2010) study. Nuñez et al. (2010) found that PZP-treated mares had higher body condition than control mares in another population, presumably because energy expenditure was reduced by the absence of pregnancy and lactation. Knight (2014) found that PZP-treated mares had better body condition, lived longer and switched harems more frequently, while mares that foaled spent more time concentrating on grazing and lactation and had lower overall body condition.

In two studies involving a total of four wild horse populations, both Nuñez et al. (2009) and Ransom et al. (2010) found that PZP vaccine treated mares were involved in reproductive interactions with stallions more often than control mares, which is not surprising given the evidence that PZP-treated females of other mammal species can regularly demonstrate estrus behavior while contracepted (Shumake and Killian 1997, Heilmann et al. 1998, Curtis et al. 2002, Duncan et al. 2017). There was no evidence, though, that mare welfare was affected by the increased level of herding by stallions noted in Ransom et al. (2010). Later analysis by Nuñez et al. (2017) noted no difference in mare reproductive behavior as a function of contraception history.

Ransom et al. (2010) found that control mares were herded by stallions more frequently than PZP-treated mares, and Nuñez et al. (2009, 2014, 2017, 2018) found that PZP-treated mares exhibited higher infidelity to their band stallion during the non-breeding season than control mares. Madosky et al. (2010) and Knight (2014) found this infidelity was also evident during the breeding season in the same population that Nuñez et al. (2009, 2010, 2014, 2017, 2018) studied. Nuñez et al. (2014, 2017) and Nuñez (2018) concluded that PZP-treated mares changing bands more frequently than control mares could lead to band instability. Nuñez et al. (2009), though, cautioned against generalizing from that island population to other herds. Also, despite any potential changes in band infidelity due to PZP vaccination, horses continued to live in social groups with dominant stallions and one or more mares. Nuñez et al. (2014) found elevated levels of fecal cortisol, a marker of physiological stress, in mares that changed bands. The research is inconclusive as to whether all the mares' movements between bands were related to the PZP treatments themselves or the fact that the mares were not nursing a foal, and did not demonstrate any long-term negative consequence of the transiently elevated cortisol levels. In separate work in a long-term study of semi-feral Konik ponies, Jaworska et al. (2020) showed that neither infanticide nor feticide resulted for mares and their foals after a change in dominant stallion. Nuñez et al. (2014) wrote that these effects "…may be of limited concern when population reduction is an urgent priority." Nuñez (2018) and Jones et al. (2019, 2020) noted that band stallions of mares that have received PZP treatment can exhibit changes in behavior and physiology. Nuñez (2018) cautioned that PZP use may limit the ability of mares to return to fertility, but also noted that, "such aggressive treatments may be necessary when rapid reductions in animal numbers are of paramount importance…If the primary management goal is to reduce population size, it is unlikely (and perhaps less important) that managers achieve a balance between population control and the maintenance of more typical feral horse behavior and physiology."

In contrast to transient stresses, Creel et al. (2013) highlight that variation in population density is one of the most well-established causal factors of chronic activation of the hypothalamic-pituitary-adrenal axis, which mediates stress hormones; high population densities and competition for resources can cause chronic stress. Creel et al. (2013) also state that "…there is little consistent evidence for a negative association between elevated baseline glucocorticoids and fitness." Band fidelity is not an aspect of wild horse biology that is specifically protected by the WFRHBA of 1971. It is also notable that Ransom et al. (2014b) found higher group fidelity after a herd had been gathered and treated with a contraceptive vaccine; in that case, the researchers postulated that higher fidelity may have been facilitated by the decreased competition for forage after excess horses were removed. At the population level, available research does not provide evidence of the loss of harem structure among any herds treated with PZP. No biologically significant negative impacts on the overall animals or populations overall, long-term welfare or well-being have been established in these studies.

The National Research Council (2013) found that harem changing was not likely to result in serious adverse effects for treated mares: "The studies on Shackleford Banks (Nuñez et al., 2009; Madosky et al., 2010) suggest that there is an interaction between pregnancy and social cohesion. The importance of harem stability to mare well-being is not clear, but considering the relatively large number of free-ranging mares that have been treated with liquid PZP in a variety of ecological settings, the likelihood of serious adverse effects seem low."

Nuñez et al. (2010) stated that not all populations will respond similarly to PZP treatment. Differences in habitat, resource availability, and demography among conspecific populations will undoubtedly affect their physiological and behavioral responses to PZP contraception, and may be considered. Kirkpatrick et al. (2010) concluded that: "the larger question is, even if subtle alterations in behavior may occur, this is still far better than the alternative," and that the "…other victory for horses is that every mare prevented from being removed, by virtue of contraception, is a mare that will only be delaying her reproduction rather than being eliminated permanently from the range. This preserves herd genetics, while gathers and adoption do not."

The NAS report (2013) provides a comprehensive review of the literature on the behavioral effects of contraception that puts research up to that date by Nuñez et al. (2009, 2010) into the broader context of all of the available scientific literature, and cautions, based on its extensive review of the literature that: ". . . in no case can the committee conclude from the published research that the behavior differences observed are due to a particular compound rather than to the fact that treated animals had no offspring during the study. That must be borne in mind particularly in interpreting long-term impacts of contraception (e.g., repeated years of reproductive "failure" due to contraception)."

Behavioral Effects: GnRH Vaccines
The result that GonaCon treated mares may have suppressed estrous cycles throughout the breeding season can lead treated mares to behave in ways that are functionally similar to pregnant mares. Where it is successful in mares, GonaCon and other anti-GnRH vaccines are expected to induce fewer estrous cycles when compared to non-pregnant control mares. This has been observed in many studies (Garza et al. 1986, Curtis et al. 2002, Dalin et al. 2002, Killian et al. 2006, Dalmau et al. 2015). Females treated with GonaCon had fewer estrous cycles than control or PZP-treated mares (Killian et al. 2006) or deer (Curtis et al. 2002). Thus, any concerns about PZP treated mares receiving more courting and breeding behaviors from stallions (Nuñez et al. 2009, Ransom et al. 2010) are not generally expected to be a concern for mares treated with anti-GnRH vaccines (Botha et al. 2008).

Ransom et al. (2014b) and Baker et al. (2018) found that GonaCon treated mares had similar rates of reproductive behaviors that were similar to those of pregnant mares. Among other potential causes, the reduction in progesterone levels in treated females may lead to a reduction in behaviors associated with reproduction. Despite this, some females treated with GonaCon or other anti-GnRH vaccines did continue to exhibit reproductive behaviors, albeit at irregular intervals and durations (Dalin et al. 2002, Stout et al. 2003, Imboden et al. 2006), which is a result that is similar to spayed (ovariectomized) mares (Asa et al. 1980). Gray (2009a) and Baker et al. (2018) found no difference in sexual behaviors in mares treated with GonaCon and untreated mares. In a sense, the hormonal state of and the behaviors of GonaCon-Equine vaccine treated animals is generally comparable to when they are pregnant, but Baker et al. (2023) noted that GonaCon-Equine treated mares actually do still "…show periodic estrous behaviors throughout the normal breeding season suggesting that vaccination only partially suppresses the hormones responsible for stimulating reproductive behavior, although concentrations are likely insufficient to induce ovulation." Mares treated with GonaCon-Equine do not leave their bands any more often than untreated mares. In fact, Ransom et al. (2014b) actually found increased levels of band fidelity after treatment with GonaCon-Equine. Baker et al. (2018) reported that GonaCon-Equine treated mares received slightly more harem-social behaviors from stallions than untreated mares, but that most of those social behaviors were allo-grooming. When progesterone levels are low, small changes in estradiol concentration can foster reproductive estrous behaviors (Imboden et al. 2006). Owners of anti-GnRH vaccine treated mares reported a reduced number of estrous-related behaviors under saddle (Donovan et al. 2013). Treated mares may refrain from reproductive behavior even after ovaries return to cyclicity (Elhay et al. 2007). Studies in elk found that GonaCon treated cows had equal levels of precopulatory behaviors as controls (Powers et al. 2011), though bull elk paid more attention to treated cows late in the breeding season, after control cows were already pregnant (Powers et al. 2011).

Stallion herding of mares, and harem switching by mares are two behaviors related to reproduction that might change as a result of contraception. Ransom et al. (2014b) observed a 50% decrease in herding behavior by stallions after the free-roaming horse population at Theodore Roosevelt National Park was reduced via a gather, and mares there were treated with GonaCon-B. The increased harem tending behaviors by stallions were directed to both treated and control mores. It is difficult to separate any effect of GonaCon in this study from changes in horse density and forage following horse removals.

With respect to treatment with GonaCon or other anti-GnRH vaccines, it is probably less likely that treated mares will switch harems at higher rates than untreated animals, because treated mares are similar to pregnant mares in their behaviors (Ransom et al. 2014b). Indeed, Gray (2009a) found no difference in band fidelity in a free-roaming population of horses with GonaCon treated mares, despite differences in foal production between treated and untreated mares. Ransom et al. (2014b) actually found increased levels of band fidelity after treatment, though this may have been partially a result of changes in overall horse density and forage availability.

Gray (2009a) and Ransom et al. (2014b) monitored non-reproductive behaviors in GonaCon treated populations of free-roaming horses. Gray (2009a) found no difference between treated and untreated mares in terms of activity budget, sexual behavior, proximity of mares to stallions, or aggression. Ransom et al. (2014b) found only minimal differences between treated and untreated mare time budgets, but those differences were consistent with differences in the metabolic demands of pregnancy and lactation in untreated mares, as opposed to non-pregnant treated mares.

Genetic Effects of Fertility Control Vaccines
In HMAs where large numbers of wild horses have recent and / or an ongoing influx of breeding animals from other areas with wild or feral horses, contraception is not expected to cause an unacceptable loss of genetic diversity or an unacceptable increase in the inbreeding coefficient. In any diploid population, the loss of genetic diversity through inbreeding or drift can be prevented by large effective breeding population sizes (Wright 1931) or by introducing new potential breeding animals (Mills and Allendorf 1996). The NAS report (2013) recommended that single HMAs should not be considered as isolated genetic populations. Rather, managed herds of wild horses should be considered as components of interacting metapopulations, with the potential for interchange of individuals and genes taking place as a result of both natural and human-facilitated movements. Introducing 1-2 mares every generation (about every 10 years) is a standard management technique that can alleviated potential inbreeding concerns (BLM 2010).

In the last 10 years, there has been a high realized growth rate of wild horses in most areas administered by the BLM, such that most alleles that are present in any given mare are likely to already be well represented in that mare's siblings, cousins, and more distant relatives. With the exception of horses in a small number of well-known HMAs that contain a relatively high fraction of alleles associated with old Spanish horse breeds (NRC 2013), the genetic composition of wild horses in lands administered by the BLM is consistent with admixtures from domestic breeds. As a result, in most HMAs, applying fertility control to a subset of mares is not expected to cause irreparable loss of genetic diversity. Improved longevity and an aging population are expected results of contraceptive treatment that can provide for lengthening generation time; this result would be expected to slow the rate of genetic diversity loss (Hailer et al. 2006). In a relatively small population with empirically documented individual genotypes, Zimmerman et al. (2023) used projections to determine that adequate genetic diversity should be maintained despite immunocontraception and planned periodic gathers. Based on a population model, Gross (2000) found that a strategy to preferentially treat young animals with a contraceptive led to more genetic diversity being retained than either a strategy that preferentially treats older animals, or a strategy with periodic gathers and removals.

Even if it is the case that repeated treatment with a fertility control vaccine may lead to prolonged infertility, or even sterility in some mares, most HMAs have only a low risk of loss of genetic diversity if logistically realistic rates of contraception are applied to mares. Wild horses in most herd management areas are descendants of a diverse range of ancestors coming from many breeds of domestic horses. As such, the existing genetic diversity in the majority of HMAs does not contain unique or historically unusual genetic markers. Past interchange between HMAs, either through natural dispersal or through assisted migration (i.e., human movement of horses) means that many HMAs are effectively indistinguishable and interchangeable in terms of their genetic composition (i.e., see the table of Fst vales *in* NRC 2013, and several analyses in Cothran et al. 2024). Roelle and Oyler-McCance (2015) used the VORTEX population model to simulate how different rates of mare sterility would influence population persistence and genetic diversity, in populations with high or low starting levels of genetic diversity, various starting population sizes, and various annual population growth rates. Their results show that the risk of the loss of genetic heterozygosity is extremely low except in case where all of the following conditions are met: starting levels of genetic diversity are low, initial population size is 100 or less, the intrinsic population growth rate is low (5% per year), and very large fractions of the female population are permanently sterilized.

It is worth noting that, although maintenance of genetic diversity at the scale of the overall population of wild horses is an intuitive management goal, there are no existing laws or policies that require BLM to maintain genetic diversity at the scale of the individual herd management area or complex. Also, there is no Bureau-wide policy that requires BLM to allow each female in a herd to reproduce before treatment with contraceptives.

Fertility Control Vaccines and the Evolution of Immune Response
One concern that has been raised with regards to genetic diversity is that treatment with immunocontraceptives could possibly lead to an evolutionary increase in the frequency of individuals whose genetic composition fosters weak immune responses (Cooper and Larson 2006, Ransom et al. 2014a). Based on principles of population genetics, likely application rates in wild horse and burro metapopulations, and on currently available knowledge, it appears unlikely that BLM's application of fertility control vaccines would cause biologically significant, population-level evolutionary changes in the capacity to mount healthy immune responses, for reasons noted below.

In well-monitored wild horse herds that have been treated with PZP vaccine for many years, there have been a small number of mares that are 'non-responders' – that is, they continue to be fertile despite multiple treatments with ZonaStat-H PZP vaccine (i.e., BLM 2023). To the extent that this outcome may be partly attributable to genes, then for such 'non-responder' genes to spread widely in the population, both heritability and the selection coefficient must be high. Many factors influence the strength of a vaccinated individual's immune response, potentially including genetics, but also nutrition, body condition, and prior immune responses to pathogens or other antigens (Powers et al. 2011). The premise of the concern (Cooper and Larson 2006, Ransom et al. 2014a) is based on an assumption that lack of immune response to any given fertility control vaccine is a highly heritable trait, that the great majority of mares in a population would be treated with immunocontraceptives, that treated 'non-responder' mares would give birth to a far greater number of foals than other treated mares, and that the result would be an increasing frequency of the poor immune response associated trait over time in a population of vaccine-treated animals. Cooper and Herbert (2001) reviewed the topic, in the context of concerns about the long-term effectiveness of immunocontraceptives as a control agent for exotic eutherian species in Australia. They argue that imunocontraception could be a strong selective pressure, and that selecting for reproduction in individuals with poor immune response could lead to a general decline in immune function in populations where such evolution takes place. Other authors have also speculated that differences in antibody titer responses could be partially due to genetic differences between animals (Curtis et al. 2002, Herbert and Trigg 2005). However, Magiafoglou et al. (2003) clarify that if the variation in immune response is due to environmental factors (i.e., body condition, social rank) and not due to genetic factors, then there will be no expected effect of the immune phenotype on future generations. It is possible that general health, as measured by body condition, can have a causal role in determining immune response, with animals in poor condition demonstrating poor immune reactions (NRC 2013).

Correlations between physical factors and immune response would not preclude, though, that there could also be a heritable response to immunocontraception. In studies not directly related to immunocontraception, immune response has been shown to be heritable (Kean et al. 1994, Sarker et al. 1999). Predictions about the long-term, population-level evolutionary response to immunocontraceptive treatments have been largely speculative up to this point, with outcomes likely to depend on several factors, including: the strength of the genetic predisposition to not respond to the fertility control vaccine; the heritability of that gene or genes; the initial prevalence of that gene or genes; the number of mares treated with a primer dose of the vaccine (which generally has a short-acting effect); the number of mares treated with one or more booster doses of the vaccine; and the actual size of the genetically-interacting metapopulation of horses within which the vaccine treatment takes place.

One recent study attempted to quantify the heritability of a decreased response to fertility control vaccine-induced duration of infertility and the pattern of single nucleotide polymorphisms (SNPs) in the genomes of feral mares in Theodore Roosevelt National Park. SNPs can be associated with DNA variants in nearby coding regions, due to linkage. 53 mares were treated with the GonaCon-Equine immunocontraception vaccine, and 25 were not. Almost all of the GonaCon treated mares became infertile for at least one year. The researchers found a correlation between a more rapid return to fertility and several SNPs. The SNPs that were correlated with a more rapid return to fertility are not known to be located in coding regions of genes that influence immune response, but based on the location of those SNPs the researchers suggested that there may be an association with genes that may influence immune response. The researchers estimated that the heritability for genetic effects on the duration of GonaCon effectiveness in feral horse mares was $h^2 = 0.27$ (SE = 0.23). They characterized this level of heritability as 'moderate.' There are several reasons to expect that in any single managed herd of wild horses, there would be the potential for only a relatively low strength of selection promoting the genes identified in the paper. Almost all of those treated mares became infertile for some time, even though certain SNPs were correlated with a marginally faster return to fertility. The fact that immunocontraception with GonaCon still reduced fertility in treated mares is indicative of a weaker selection potential than if treated mares with those SNPs had remained entirely fertile. These reasons include the only 'moderate' levels of heritability identified by Thompson et al. (2022), the expectation that mares treated multiple times should experience additional duration of effect after each dose, the likelihood that an essentially random selection of mares in the herd would not be treated at all with an immunocontraceptive, the possible non-genetic causes that treated mares may return to fertility, and the large genetic effective population size of wild horse metapopulations that is characterized across multiple HMAs and complexes. The results from Thompson et al. (2022) would not be expected substantively to change expectations about the effects of potentially heritable immune responses to immuncontraceptive vaccines. Thompson et al. (2022) based their results on mares that were treated twice with GonaCon-Equine. While some treated mares may carry genes that marginally decrease vaccine effectiveness and cause them to return to fertility faster, there may also be other treated mares who do not carry those genes but experience poor vaccine due to environmental or other causes. Of course, any mares that are not treated with immunocontraceptives would be expected to contribute more foals to the herd than treated mares, and the choice of which mares happen to be treated or not be treated would be essentially random with respect to the SNPs identified. In their conclusions, Thompson et al. (2022) suggest that wild horse managers should not rely solely on immunocontraceptive methods for herd management; in the three HMAs under consideration in this EA, gathers and immunocontraception are both considered for use in the Proposed Action. Therefore, the continued presence of untreated and other reproducing mares is likely to reduce any risk of long-term evolutionary reduction in immune function in these herds.

Although a few, generally isolated, feral horse populations have been treated with high fractions of mares receiving PZP immunocontraception for long-term population control (e.g., Assateague Island National Park, and Pryor Mountains Herd Management Area), the BLM is unaware of any studies that tested for changes in immune competence in those areas.

Sex Ratio Manipulation

Skewing the sex ratio of a herd so that there are more males than females is an established BLM management technique for reducing population growth rates. As part of a wild horse and burro gather process, the number of animals returned to the range may include more males, the number removed from the range may include more females, or both. By reducing the proportion of breeding females in a population (as a fraction of the total number of animals present), the technique leads to fewer foals being born, relative to the total herd size.

Sex ratio can vary in local populations of wild horses, with many having approximately equal numbers of males and females, some having more females, and some more males. Basic principles of wildlife demography posit that for populations where there is no major influence of any sex-biased immigration or emigration, the realized sex ratio is expected to be a result of sex ratios at birth and sex-specific survival rates at different ages.

Across many herds of federally managed wild horses and feral horses, there can be substantial variation in the sex ratio at birth. Ransom et al (2016) summarized information about sex ratio at birth across all wild equid species, in a meta-analysis of demographic studies that were available up to that time. Across all wild equid species, Ransom et al. (2016) documented a sex ratio at birth that was slightly skewed toward males on average, with 1.1 male foal born for every 1 female foal. However, the 95% confidence interval for that ratio across wild equid populations was from 0.93:1 to 1.29:1. The actual value of sex ratio at birth can vary from herd to herd and over time, and appears to be influenced by environmental conditions. Ransom et al. (2016) cited studies indicating that female equids tend to give birth to female foals at higher rates when they are living in conditions with inadequate natural resources, when they are in relatively poorer body condition (Cameron et al. 1999), or when they give birth for the first time at very young ages. When free-roaming mares were experiencing improving body condition, they tended to give birth to male foals at high rates (Cameron and Linklater 2007), consistent with predictions of the Trivers-Willard hypothesis that mares in better condition will tend to invest more effort into the sex with higher variance in reproductive success.

The following is not an exhaustive review of all available studies that document adult sex ratio in wild or free-roaming horses, but a conclusion that can be drawn from across many studies is that there is a range of observed sex ratios; there is no single typical sex ratio typical in either unmanaged or managed herds. In a comprehensive 1973-1987 study of 74 management areas that did not have any fertility control applications, Garrott (1991) documented that over half had male to female ratios that were very close to 50:50 (not statistically different from equal numbers of males and females). Among the others, many herds did have more females than males. Over 84% of those areas had male to female parity in horses under 1 year old (Garrott 1991). Survival of foals appears to be, on average, equal between male and female foals. In herds without fertility control, Garrott (1991) concluded that young adult male horses had lower survival than young female horses, but that older adult male horses had higher survival than older adult female horses.

The realized overall sex ratio in any given wild horse or burro herd will also be influenced by age-specific and sex-specific survival rates. Mare fertility control application in wild horses increases adult mare survival (Turner and Kirkpatrick 2002, Ransom et al. 2014a). This is expected cause an increase in adult females over time in a herd that has been treated with mare fertility control. During 1993-2007, wild horses in the Pryor Mountains were studied intensively; during that time adult sex ratio varied in the range from 44% to 55% male. The contemporary Pryor Mountain herd sex ratio is an example of where long use of fertility control vaccine has likely affected the sex ratio, which is ~57% female. However, this is largely driven by high mare longevity in the 20+ year-old age class (20 mares vs. only 2 studs), that is most likely caused by those mares having relatively few foals. Discounting that age class, the sex ratio at Pryor Mountains herd is ~52% female (BLM 2023). Before helicopter gathers or fertility control treatments began at Sheldon national wildlife refuge, the sex ratio of adults (3 years old or older) was 55% male (424 stallions to 353 mares; Collins and Kasbahm 2016). On an Atlantic barrier island in Georgia, Goodloe et al (2000) documented overall adult sex ratio that was 62% male. On Sable Island (Canada) where resources are limited and there is relatively high post-natal mare mortality, sex ratios have been over 60% male (Regan et al. 2020).

In BLM management actions that include it, sex ratio is typically adjusted so that up to 60 percent of the horses are male. In the absence of other fertility control treatments, this 60:40 sex ratio can temporarily reduce population growth rates from approximately 20% to approximately 15% (Bartholow 2004). While such a decrease in growth rate may not appear to be large or long-lasting, the net result can be that fewer foals being born, at least for a few years – this can extend the time between gathers, and reduce impacts on-range, and costs off-range. Any impacts of sex ratio manipulation are expected to be temporary because the sex ratio of wild horse and burro foals at birth is approximately equal between males and females (NRC 2013), and it is common for female foals to reproduce by their second year (NRC 2013). Thus, within a few years after a gather and selective removal that leads to more males than females, the sex ratio of reproducing wild horses and burros will be returning toward a 50:50 ratio.

Having a larger number of males than females is expected to lead to several demographic and behavioral changes as noted in the NAS report (2013), including the following. Having more fertile males than females should not alter the fecundity of individual fertile females. Wild mares may be distributed in a larger number of smaller harems (as documented by Regan et al 2020). Singer and Schoeneker (2000) found that increases in the number of males on Pryor Mountain Wild Horse Range herd management area lowered the breeding male age but did not alter the birth rate among females. If females are distributed among a larger number of smaller harems, it is expected that genetic effective population size (Ne) should increase relative to a herd of the same number of mares, but with 50:50 sex ratio. Competition and aggression between males may cause a decline in male body condition. Female foraging may be somewhat disrupted by elevated male-male aggression. With a greater number of males available to choose from, females may have opportunities to select more genetically fit sires. There would also be an increase the genetic effective population size because more stallions would be breeding and existing females would be distributed among many more small harems. This last beneficial impact is one reason that skewing the sex ratio to favor males is listed in the BLM wild horse and burro handbook (BLM 2010) as a method to consider in herds where there may be concern about the loss of genetic diversity; having more males fosters a greater retention of genetic diversity.

Changes in which stallions mate with mares are a natural part of the wild horse behavioral repertoire. Berger (1983) reported forced copulations after band stallion changes, but these were not related to sex ratio per se, considering that the sex ratio in the populations he studied were approximately 43% male (Grange et al 2009). Kirkpatrick and Turner (1991) looked for but did not find any forced copulation or induced abortions after stallion changes in wild horse bands. Infanticide is a natural behavior that has been observed in wild equids (Feh and Munkhtuya 2008, Gray 2009), but there are no published accounts of infanticide rates increasing as a result of having a skewed sex ratio in wild horse or wild burro herds. Any comment that implies such an impact would be speculative.

The BLM wild horse and burro management handbook (BLM 2010) discusses this method. The handbook acknowledges that there may be some behavioral impacts of having more males than females. The handbook includes guidelines for when the method should be applied, specifying that this method should be considered where the low end of the AML is 150 animals or greater, and with the result that males comprise 60-70 percent of the herd. Having more than 70 percent males may result in unacceptable impacts in terms of elevated male-male aggression. In NEPA analyses, BLM has chosen to follow these guidelines in some cases, for example:

- In the 2015 Cold Springs HMA Population Management Plan EA (DOI-BLM-V040-2015-022), the low end of AML was 75. Under the preferred alternative, 37 mares and 38 stallions would remain on the HMA. This is well below the 150 head threshold noted above.
- In the 2017 Hog Creek HMA Population Management Plan EA (DOI-BLM-ORWA-V000-2017-0026-EA), BLM clearly identified that maintaining a 50:50 sex ratio was appropriate because the herd size at the low end of AML was only 30 animals.

It is relatively straightforward to speed the return of skewed sex ratios back to a 50:50 ratio. The BLM wild horse and burro handbook (BLM 2010) specifies that, if post-treatment monitoring reveals negative impacts to breeding harems due to sex ratio manipulation, then mitigation measures could include removing males, not introducing additional males, or releasing a larger proportion of females during the next gather.

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Effects of Female Sterilization and Male Neutering

Various forms of fertility control can be used in wild horses and burros, with the goals of maintaining herds at or near AML, reducing fertility rates, and reducing the frequency of gathers and removals. The WFRHBA of 1971 specifically provides for contraception and sterilization (16 U.S.C. 1333 section 3.b.1). Fertility control measures have been shown to be a cost-effective and humane treatment to slow increases in wild horse populations or, when used in combination with gathers, to reduce horse population size (Bartholow 2004, de Seve and Boyles-Griffin 2013, Fonner and Bohara 2017). Population growth suppression becomes less expensive if fertility control is long-lasting (Hobbs et al. 2000), such as with sterilization methods. Even though physical female sterilization methods are not part of any action alternative for the Blue Wing Complex, those effects are included in this review for comparative purposes. Sterilizing a female horse (mare) or burro (jenny) can be accomplished by several methods, some of which are minimally invasive, and others of which are surgical. In this review, 'spaying' is defined to be surgical sterilization, usually accomplished by removal of the ovaries, but other surgical methods such as tubal ligation that lead to sterility may also be considered by some readers to be a form of spaying. Minimally invasive, physical forms of sterilization, such as trans-cervical methods that occlude the oviduct, are not labeled as spaying in this review, but may have similar physiological outcomes as surgical methods that leave the ovaries intact. In this review, 'neutering' is defined to be the sterilization of a male horse (stallion) or burro (jack), either by removal of the testicles (castration, also known as gelding) or by vasectomy, where the testicles are retained but no sperm leave the body by severing or blocking the vas deferens or epididymis.

In the context of BLM wild horse and burro management, sterilization is expected to be successful to the extent that it reduces the number of reproducing females. By definition, sterilizing a given female is 100% effective as a fertility control method for that female. Neutering males may be effective in one of two ways. First, neutered males may continue to guard fertile females, preventing the females from breeding with fertile males. Second, if neutered males are included in a herd that has a high male-to-female sex ratio, then the neutered males may comprise some of the animals within the appropriate management level (AML) of that herd, which would effectively reduce the number of females in the herd. Although these and other fertility control treatments may be associated with a number of potential physiological, behavioral, demographic, and genetic effects, those impacts are generally minor and transient, do not prevent overall maintenance of a self-sustaining population, and do not generally outweigh the potential benefits of using contraceptive treatments in situations where it is a management goal to reduce population growth rates (Garrott and Oli 2013).

Peer-reviewed scientific literature details the expected impacts of sterilization methods on wild horses and burros. No finding of excess animals is required for BLM to pursue sterilization in wild horses or burros, but NEPA analysis has been required. This review focuses on peer-reviewed scientific literature. The summary that follows first examines effects of female sterilization, then neuter use in males. This review does not examine effects of fertility control vaccines. Cited studies are generally limited to those involving horses and burros, except where including studies on other species helps in making inferences about physiological or behavioral questions not exhaustively addressed in horses or burros specifically. While there are notable differences between the species in their anatomy, diet, behaviors and metabolism (Burden and Thiemann 2015), the essential endocrine controls of the hypothalamic-pituitary-gonadal axis and the function of the zona pellucida in fertility are the same. While most studies reviewed are based on results from horses, burros are similar enough in their reproductive physiology and immunology (i.e., Turini et al. 2021) that expected effects of immunocontraception are comparable.

On the whole, the identified impacts at the herd level are generally transient. The principle impact to individuals treated is sterility, which is the intended outcome. Sterilization that affects individual horses and burros does not prevent BLM from ensuring that there will be self-sustaining populations of wild horses and burros in single HMAs, in complexes of HMAs, and at regional scales of multiple HMAs and complexes. Under the WFRHBA of 1971, BLM is charged with maintaining self-reproducing populations of wild horses and burros. The WFRHBA makes clear that BLM is not explicitly charged with ensuring the fertility of any given individual wild horse or burro. The National Academies of Sciences (NRC 2013) encouraged BLM to manage wild horses and burros at the spatial scale of "metapopulations" – that is, across multiple HMAs and complexes in a region. In fact, many HMAs have historical and ongoing genetic and demographic connections with other HMAs, and BLM routinely moves animals from one to another to improve local herd traits and maintain high genetic diversity.

Discussions about herds that include some 'non-reproducing' individuals, or even those that are entirely non-reproducing, should be considered in the context of this 'metapopulation' structure, where the 'self-sustaining' nature of herds is not necessarily to be measured at the scale of single HMAs. So long as the definition of what constitutes a self-sustaining herd includes the larger set of HMAs that have past or ongoing demographic and genetic connections – as is recommended by the NRC 2013 report – it is clear that particular HMAs can be managed as non-reproducing in whole or in part while still allowing for a self-sustaining population of wild horses or burros at the broader spatial scale. Wild horses are not an endangered species (USFWS 2015), nor are they rare. Over 64,000 adult wild horses and over 17,000 adult burros roamed BLM lands as of March 1, 2022, and those numbers do not include at least 9,000 WH&Bs on US Forest Service lands, nor at least 100,000 feral horses on tribal lands in the Western United States (Schoenecker et al. 2021).

All fertility control methods affect the behavior and physiology of treated animals (NRC 2013), and are associated with potential risks and benefits, including effects of handling, frequency of handling, physiological effects, behavioral effects, and reduced population growth rates (Hampton et al. 2015). Contraception methods alone do not remove excess horses from an HMA's population, so one or more gathers are usually needed in order to bring the herd down to a level close to AML. Horses are long-lived, potentially reaching 20 years of age or more in the wild. Except in cases where extremely high fractions of mares are rendered infertile over long time periods of (i.e., 10 or more years), spaying and neutering are not very effective at reducing population growth rates to the point where births equal deaths in a herd. However, even modest levels of fertility control activities can reduce the frequency of horse gather activities, and costs to taxpayers. Population growth suppression becomes less expensive if fertility control is long-lasting (Hobbs et al. 2000), such as with sterilization. Because sterilizing animals requires capturing and handling, the risks and costs associated with capture and handling of horses may be comparable to those of gathering for removal, but with expectedly lower adoption and long-term holding costs.

Effects of handling and marking

Sterilization techniques, while not reversible, may control horse reproduction without the kind of additional handling or darting that can be needed to administer contraceptive vaccines. In this sense, sterilization can be used to achieve herd management objectives with a relative minimum level of animal handling and management over the long term. The WFRHBA (as amended) indicates that management should be at the minimum level necessary to achieve management objectives (CFR 4710.4), and if sterilizing mares or neutering some stallions can lead to a reduced number of handling occasions and removals of excess horses from the range, then that is consistent with legal guidelines. Other fertility control options that may be temporarily effective on male horses, such as the injection of GonaCon-Equine immunocontraceptive vaccine, apparently require multiple handling occasions to achieve longer-term male infertility. Similarly, some formulations of PZP immunocontraception that is currently available for use in female wild horses and burros require handling or darting every year (though longer-term effects may result after 4 or more treatments; Nuñez et al. 2017). By some measures, any management activities that require multiple capture operations to treat a given individual could be seen as more intrusive for wild horses and potentially less sustainable than an activity that requires only one handling occasion.

It is prudent for sterilized animals to be readily identifiable, either via freeze brand marks or unique coloration, and uniquely numbered RFID chips inserted in the nuchal ligament, so that their treatment history is easily recognized (e.g., BLM 2010). Markings may also be useful into the future to determine the approximate fraction of geldings in a herd, and could provide additional insights about gather efficiency. BLM has instituted capture and animal welfare program guidelines to reduce the sources of handling stress in captured animals (BLM 2021). Handling may include freeze-marking, for the purpose of identifying an individual. Some level of transient stress is likely to result in newly captured horses that are not previously marked. Under past management practices, captured horses experienced increased, transient stress levels from handling (Ashley and Holcombe 2001). It is difficult to compare that level of temporary stress with long-term stress that can result from food and water limitation on the range (e.g., Creel et al. 2013), which could occur in the absence of herd management.

Most horses recover from the stress of capture and handling quickly once released back to the range, and none are expected to suffer serious long term effects from gelding, other than the direct consequence of becoming infertile.

Observations of the long term outcomes of sterilization may be recorded during routine resource monitoring work. Such observations could include but not be limited to band size, social interactions with other geldings and harem bands, distribution within their habitat, forage utilization and activities around key water sources. Periodic population inventories and future gather statistics could provide additional anecdotal information.

Neutering Males

Whether or not stallion sterilization methods are considered in any of the action alternatives in this EA, they are included here for comparison and for the sake of completeness in the review. Castration (the surgical removal of the testicles, also called gelding or neutering) is a surgical procedure for the horse sterilization that has been used for millennia. Vasectomy involves severing or blocking the vas deferens or epididymis, to prevent sperm from being ejaculated. The procedures are fairly straight forward, and has a relatively low complication rate. As noted in the review of scientific literature that follows, the expected effects of gelding and vasectomy are well understood overall, even though there is some degree of uncertainty about the exact quantitative outcomes for any given individual (as is true for any natural system).

Including a portion of neutered males in a herd can lead to a reduced population-level per-capita growth rate if they cause a marginal decrease in female fertility or if the neutered males take some of the places that would otherwise be occupied by fertile females. By having a skewed sex ratio with fewer females than males (fertile stallions plus neutered males), the result will be that there will be a lower number of breeding females in the population. Including neutered males in herd management is not new for BLM and federal land management. Geldings have been released on BLM lands as a part of herd management in the Barren Valley complex in Oregon (BLM 2011), the Challis HMA in Idaho (BLM 2012), and the Conger HMA in Utah (BLM 2016). Vasectomized males and geldings were also included in US Fish and Wildlife Service management plans for the Sheldon National Wildlife Refuge that relied on sterilization and removals (Collins and Kasbohm 2016). Taking into consideration the literature available at the time, the National Academies of Sciences concluded in their 2013 report that a form of vasectomy was one of the three most promising methods for WH&Bs fertility control (NRC 2013). However, BLM is not pursuing the chemical vasectomy method. The NAS panel noted that, even though chemical vasectomy had been used in dogs and cats up to that time, “There are no published reports on chemical vasectomy in horses...” and that, “Only surgical vasectomy has been studied in horses, so side effects of the chemical agent are unknown.” The only known use of chemical vasectomy in horses was published by Scully et al. (2015); this was part of a study cited in the EA (Collins and Kasbohm 2016). They injected chlorhexidine into the stallions’ epididymis. That is the same chemical agent as had been used to chemically vasectomize dogs. Scully et al. (2015) found that the chemical vasectomy method failed to prevent fertile sperm from being located in the vas deferens seminal fluid. Stallions treated with the chemical vasectomy method still had viable sperm and were still potentially as fertile as untreated ‘control’ stallions in that study. Thus, the method did was not effective.

Nelson (1980) and Garrott and Siniff (1992) modeled potential efficacy of male-oriented contraception as a population management tool, and both studies agreed that while slowing growth, sterilizing only dominant males (i.e., harem-holding stallions) would result in only marginal reduction in female fertility rates. Eagle et al. (1993) and Asa (1999) tested this hypothesis on HMAs where dominant males were vasectomized. Their findings agreed with modeling results from previous studies, and they also concluded that sterilizing only dominant males would not provide the desired reduction in female fertility and overall population growth rate, assuming that the numbers of fertile females is not changed. While bands with vasectomized harem stallions tended to have fewer foals, breeding by bachelors and subordinate stallions meant that population growth still occurred – female fertility was not dramatically reduced. Collins and Kasbohm (2016) demonstrated that there was a reduced fertility rate in a feral horse herd with both spayed and vasectomized horses – some geldings were also present in that herd. Statistically significant reductions in mare fertility rates were only observed in the first year after geldings were introduced to a herd in Utah (King et al. 2022). Garrott and Siniff (1992) concluded from their modeling that male sterilization would effectively cause there to be zero population growth (the point where births roughly equal deaths) only if a large proportion of males (i.e., >85%) could be sterilized. In cases where the goal of harem stallion sterilization is to reduce population growth rates, success appears to be dependent on a stable group structure, as strong bonds between a stallion and mares reduce the probability of a mare mating an extra-group stallion (Nelson 1980, Garrott and Siniff 1992, Eagle et al. 1993, Asa 1999). At Conger HMA a fraction of geldings that were returned to the range with their social band did continue to live with females, apparently excluding fertile stallions, for at least 2 years (King et al. 2022).

Despite these studies, neutered males can be used to reduce overall growth rates in a management strategy that does not rely on any expectation that geldings will retain harems or lead to a reduction in per-female fertility rates. The primary goal of including neutered males in a herd need not necessarily be to reduce female fertility (although that may be one result). Rather, by including some neutered males in a herd that also has fertile mares and stallions, the neutered males would take some of the spaces toward AML that would otherwise be taken by fertile females. If the total number of horses is constant but neutered males are included in the herd, this can reduce the number of fertile mares, therefore reducing the absolute number of foals produced. Put another way, if neutered males occupy spaces toward AML that would otherwise be filled by fertile mares, that will reduce growth rates merely by the fact of causing there to be a lower starting number of fertile mares.

Direct Effects of Neutering

No animals which appear to be distressed, injured, or in poor health or condition would be selected for gelding. Stallions would not typically be neutered within 72 hours of capture. The surgery would be performed by a veterinarian using general anesthesia and appropriate surgical techniques. The final determination of which specific animals would be gelded would be based on the professional opinion of the attending veterinarian in consultation with the Authorized Officer (i.e., See the SOPs for neutering in the Antelope / Triple B gather EA, DOI-BLM-NV-E030-2017-010-EA).

Though neutering males is a common surgical procedure, especially gelding, some level of minor complications after surgery may be expected (Getman 2009), and it is not always possible to predict when postoperative complications would occur. Fortunately, the most common complications are almost always self-limiting, resolving with time and exercise. Individual impacts to the stallions during and following the gelding process should be minimal and would mostly involve localized swelling and bleeding. Complications may include, but are not limited to: minor bleeding, swelling, inflammation, edema, infection, peritonitis, hydrocele, penile damage, excessive hemorrhage, and eventration (Schumacher 1996, Searle et al. 1999, Getman 2009). A small amount of bleeding is normal and generally subsides quickly, within 2-4 hours following the procedure. Some degree of swelling is normal, including swelling of the prepuce and scrotum, usually peaking between 3-6 days after surgery (Searle et al. 1999). Swelling should be minimized through the daily movements (exercise) of the horse during travel to and from foraging and watering areas. Most cases of minor swelling should be back to normal within 5-7 days, more serious cases of moderate to severe swelling are also self-limiting and are expected to resolve with exercise after one to 2 weeks. Older horses are reported to be at greater risk of post-operative edema, but daily exercise can prevent premature closure of the incision, and prevent fluid buildup (Getman 2009). In some cases, a hydrocele (accumulation of sterile fluid) may develop over months or years (Searle et al. 1999). Serious complications (eventration, anesthetic reaction, injuries during handling, etc.) that result in euthanasia or mortality during and following surgery are rare (e.g., eventration rate of 0.2% to 2.6% noted in Getman 2009, but eventration rate of 4.8% noted in Shoemaker et al. 2004) and vary according to the population of horses being treated (Getman 2009). Normally one would expect serious complications in less than 5% of horses operated under general anesthesia, but in some populations these rates have been as high as 12% (Shoemaker 2004). Serious complications are generally noted within 3 or 4 hours of surgery but may occur any time within the first week following surgery (Searle et al. 1999). If they occur, they would be treated with surgical intervention when possible, or with euthanasia when there is a poor prognosis for recovery. There was no observed mortality in geldings at the Conger HMA study, and geldings retained good body condition (King et al. 2022). Vasectomized stallions may remain fertile for up to 6 weeks after surgery, so it is optimal if that treatment occurs well in advance of the season of mare fertility starting in the spring (NRC 2013). The NAS report (2013) suggested that chemical vasectomy, which has been developed for dogs and cats, may be appropriate for wild horses and burros.

For intact stallions, testosterone levels appear to vary as a function of age, season, and harem size (Khalil et al 1998). It is expected that testosterone levels will decline over time after castration. Testosterone levels should not change due to vasectomy. Vasectomized stallions should retain their previous levels of libido. Domestic geldings had a significant prolactin response to sexual stimulation, but lacked the cortisol response present in stallions (Colborn et al. 1991). Although libido and the ability to ejaculate tends to be gradually lost after castration (Thompson et al. 1980), some geldings continue to mount mares and intromit (Rios and Houpt 1995, Schumacher 2006).

Indirect Effects of Neutering
Other than the short-term outcomes of surgery, neutering is not expected to reduce males' survival rates. Castration is actually thought to increase survival as males are released from the cost of reproduction (Jewell 1997). In Soay sheep castrates survived longer than rams in the same cohort (Jewell 1997), and Misaki horse geldings lived longer than intact males (Kaseda et al. 1997, Khalil and Murakami 1999). Moreover, it is unlikely that a reduced testosterone level will compromise gelding survival in the wild, considering that wild mares survive with low levels of testosterone. Consistent with geldings not expending as much energy toward in attempts to obtain or defend a harem, it is expected that wild geldings may have a better body condition that wild, fertile stallions. King et al. (2022) noted that geldings maintained good body condition in the wild. In contrast, vasectomized males may continue to defend or compete for harems in the way that fertile males do, so they are not expected to experience an increase in health or body condition due to surgery.

Depending on whether an HMA is non-reproducing in whole or in part, reproductive stallions may or may not still be a component of the population's age and sex structure. The question of whether or not a given neutered male would or would not attempt to maintain a harem in the long run is not germane to population-level management. It is worth noting, though, that the BLM is not required to manage populations of wild horses in a manner that ensures that any given individual maintains its social standing within any given harem or band. Neutering a subset of stallions would not prevent other fertile stallions and mares from continuing with the typical range of social behaviors for sexually active adults. For fertility control strategies where gelding is intended to reduce growth rates by virtue of sterile males defending harems, the NAS (2013) suggested that the effectiveness of gelding on overall reproductive rates may depend on the pre-castration social roles of those animals. Having a post-gather herd with some neutered males and a lower fraction of fertile mares necessarily reduces the absolute number of foals born per year, compared to a herd that includes more fertile mares. An additional benefit is that geldings that would otherwise be permanently removed from the range (for adoption, sale or other disposition) may be released back onto the range where they can engage in free-roaming behaviors.

Behavioral Effects of Neutering
Feral horses typically form bands composed of an adult male with 1 to 3 adult females and their immature offspring (Feist and McCullough 1976, Berger 1986, Roelle et al. 2010). In many populations subordinate 'satellite' stallions have been observed associating with the band, although the function of these males continues to be debated (see Feh 1999, and Linklater and Cameron 2000). Juvenile offspring of both sexes leave the band at sexual maturity (normally around two or three years of age (Berger 1986), but adult females may remain with the same band over a span of years. Group stability and cohesion is maintained through positive social interactions and agonistic behaviors among all members, and herding and reproductive behaviors from the stallion (Ransom and Cade 2009). Group movements and consortship of a stallion with mares is advertised to other males through the group stallion marking dung piles as they are encountered, and over-marking mare eliminations as they occur (King and Gurnell 2006). Burro jacks tend to not have as stable of relations with jennies and foals, as compared to what is most often seen in horses; wild burro social structure is more typically of a fission-fusion type nature (King et al. 2016).

In horses, males play a variety of roles during their lives (Deniston 1979): after dispersal from their natal band they generally live as bachelors with other young males, before associating with mares and developing their own breeding group as a harem stallion or satellite stallion. In any population of horses not all males will achieve harem stallion status, so all males do not have an equal chance of breeding (Asa 1999). Stallion behavior is thought to be related to androgen levels, with breeding stallions having higher androgen concentrations than bachelors (Angle et al. 1979, Chaudhuri and Ginsberg 1990, Khalil et al. 1998). A bachelor with low libido had lower levels of androgens, and two-year-old bachelors had higher testosterone levels than two year olds with undescended testicles who remained with their natal band (Angle et al. 1979).
Vasectomized males continue to attempt to defend or gain breeding access to females. It is generally expected that vasectomized WH&Bs will continue to behave like fertile males, given that the only physiological change in their condition is a lack of sperm in their ejaculate. If a vasectomized stallion retains a harem, the females in the harem will continue to cycle until they are fertilized by another stallion, or until the end of the breeding season. As a result, the vasectomized stallion may be involved in more aggressive behaviors to other males through the entire breeding season (Asa 1999), which may divert time from foraging and cause him to be in poorer body condition going into winter. Ultimately, this may lead to the stallion losing control of a given harem. A feral horse herd with high numbers of vasectomized stallions retained typical harem social structure (Collins and Kasbohm 2016). Again it is worth noting that the BLM is not required to manage populations of wild horses in a manner that ensures that any given individual maintains its social standing within any given harem or band.

Neutering males by gelding adult male horses is expected to result in reduced testosterone production, which is expected to directly influence reproductive behaviors (NRC 2013). However, testosterone levels alone are not a predictor of masculine behavior (Line et al. 1985, Schumacher 2006). In domestic geldings, 20-30% continued to show stallion-like behavior, whether castrated pre- or post-puberty (Line et al. 1985). Gelding of domestic horses most commonly takes place before or shortly after sexual maturity, and age-at-gelding can affect the degree to which stallion-like behavior is expressed later in life. In intact stallions, testosterone levels peak increase up to an age of ~4-6 years, and can be higher in harem stallions than bachelors (Khalil et al 1998). It is assumed that free roaming wild horse geldings would generally exhibit reduced aggression toward other horses, and reduced reproductive behaviors (NRC 2013). In a herd that included some geldings and some fertile stallions, there were few behavioral differences between those groups, other than that geldings engaged in more affiliative and less marking and reproductive behaviors (King et al. 2022). The behavior of wild horse geldings in the presence of intact stallions has not otherwise been well documented, but the literature review below can be used to make reasonable inferences about their likely behaviors.

Despite livestock being managed by neutering males for millennia, there was relatively little published research on castrates' behaviors (Hart and Jones 1975) until recently. Stallion behaviors in wild or pasture settings are better documented than gelding behaviors, but it inferences about how the behaviors of geldings will change, how quickly any change will occur after surgery, or what effect gelding an adult stallion and releasing him back in to a wild horse population will have on his behavior and that of the wider population may be surmised from the existing literature. There was a BLM-supported study in Utah focused on the individual and population-level effects of including some geldings in a free-roaming horse population (BLM 2016, King et al. 2022). Additional inferences about likely behavioral outcomes of gelding can be made based on available literature.

The effect of castration on aggression in horses has not often been quantified. One report has noted that high levels of aggression continued to be observed in domestic horse geldings who also exhibited sexual behaviors (Rios and Houpt 1995). Stallion-like behavior in domestic horse geldings is relatively common (Smith 1974, Schumacher 1996), being shown in 20-33% of cases whether the horse was castrated pre- or post-puberty (Line et al. 1985, Rios and Houpt 1995, Schumacher 2006). While some of these cases may be due to cryptorchidism or incomplete surgery, it appears that horses are less dependent on hormones than other mechanisms for the maintenance of sexual behaviors (Smith 1974). Domestic geldings exhibiting masculine behavior had no difference in testosterone concentrations than other geldings (Line et al. 1985, Schumacher 2006), and in some instances the behavior appeared context dependent (Borsberry 1980, Pearce 1980).

Dogs and cats are commonly neutered, and it is also common for them to continue to exhibit reproductive behaviors several years after castration (Dunbar 1975). Dogs, ferrets, hamsters, and marmosets continued to show sexually motivated behaviors after castration, regardless of whether they had previous experience or not, although in beagles and ferrets there was a reduction in motivation post-operatively (Hart 1968, Dunbar 1975, Dixson 1993, Costantini et al. 2007, Vinke et al. 2008). Ungulates continued to show reproductive behaviors after castration, with goats continuing to respond to females even a year later, although mating time and the ejaculatory response was reduced (Hart and Jones 1975).

The likely effects of castration on geldings' social interactions and group membership can be inferred from available literature. In a pasture study of domestic horses, Van Dierendonk et al. (1995) found that social rank among geldings was directly correlated to the age at which the horse was castrated, suggesting that social experiences prior to sterilization may influence behavior afterward. Of the two geldings present in a study of semi-feral horses in England, one was dominant over the mares whereas a younger gelding was subordinate to older mares; stallions were only present in this population during a short breeding season (Tyler 1972). A study of domestic geldings in Iceland held in a large pasture with mares and sub-adults of both sexes, but no mature stallions, found that geldings and sub-adults formed associations amongst each other that included interactions such as allo-grooming and play, and were defined by close proximity (Sigurjónsdóttir et al. 2003). These geldings and sub-adults tended to remain in a separate group from mares with foals, similar to castrated Soay sheep rams (Ovis aries) behaving like bachelors and grouping together, or remaining in their mother's group (Jewell 1997). In Japan, Kaseda et al. (1997) reported that young males dispersing from their natal harem and geldings moved to a different area than stallions and mares during the non-breeding season. Although the situation in Japan may be the equivalent of a bachelor group in natural populations, in Iceland this division between mares and the rest of the horses in the herd contradicts the dynamics typically observed in a population containing mature stallions. Sigurjónsdóttir et al. (2003) also noted that in the absence of a stallion, allo-grooming between adult females increased drastically. Other findings included increased social interaction among yearlings, display of stallion-like behaviors such as mounting by the adult females, and decreased association between females and their yearling offspring (Sigurjónsdóttir et al. 2003). In the same population in Iceland the presence of geldings did not appear to affect the social behavior of mares (Van Dierendonck et al. 2009) or negatively influence parturition, mare-foal bonding, or subsequent maternal activities (Van Dierendonck et al. 2004). Additionally, the welfare of broodmares and their foals was not affected by the presence of geldings in the herd (Van Dierendonck et al. 2004). These findings are important because treated geldings will be returned to the range in the presence of pregnant mares and mares with foals of the year.

The likely effects of castration on geldings' home range and habitat use can also be surmised from available literature. Bands of horses tend to have distinct home ranges, varying in size depending on the habitat and varying by season, but always including a water source, forage, and places where horses can shelter from inclement weather or insects (King and Gurnell 2005). By comparison, bachelor groups tend to be more transient, and can potentially use areas of good forage further from water sources, as they are not constrained by the needs of lactating mares in a group. The number of observations of gelded wild stallion behavior are still too few to make general predictions about whether a particular gelded stallion individual will behave like a harem stallion, a bachelor, or form a group with geldings that may forage and water differently from fertile wild horses.

Sterilizing wild horses does not change their status as wild horses under the WFRHBA (as amended). In terms of whether geldings will continue to exhibit the free-roaming behavior that defines wild horses, BLM does expect that geldings would continue to roam unhindered once they are returned to the range. Wild horse movements may be motivated by a number of biological impulses, including the search for forage, water, and social companionship that is not of a sexual nature. As such, a gelded animal would still be expected to have a number of internal reasons for moving across a landscape and, therefore, exhibiting 'free-roaming' behavior. Despite marginal uncertainty about subtle aspects of potential changes in habitat preference, there is no expectation that gelding wild horses will cause them to lose their free-roaming nature. It is worth noting that individual choices in wild horse group membership, home range, and habitat use are not protected under the WFRHBA. BLM acknowledges that geldings may exhibit some behavioral differences after surgery, compared to intact stallions, but those differences are not be expected to remove the geldings' rebellious and feisty nature, or their defiance of man. While it may be that a gelded horse could have a different set of behavioral priorities than an intact stallion, the expectation is that geldings will choose to act upon their behavioral priorities in an unhindered way, just as is the case for an intact stallion. In this sense, a gelded male would be just as much 'wild' as defined by the WFRHBA as any intact stallion, even if his patterns of movement differ from those of an intact stallion. Unpublished USGS results from the Conger study herd indicate that geldings' movement patterns were not qualitatively different from those of fertile stallions, when controlling for social status as bachelor or harem stallion. Congress specified that sterilization is an acceptable management action (16 USC §1333.b.1). Sterilization is not one of the clearly defined events that cause an animal to lose its status as a wild free-roaming horse (16 USC §1333.2.C.d). Several academics have offered their opinions about whether gelding a given stallion would lead to that individual effectively losing its status as a wild horse (Rutberg 2011, Kirkpatrick 2012, Nock 2017). Those opinions are based on a semantic and subjective definition of 'wild,' while BLM must adhere to the legal definition of what constitutes a wild horse, based on the WFRHBA (as amended). Those individuals have not conducted any studies that would test the speculative opinion that gelding wild stallions will cause them to become docile. BLM is not obliged to base management decisions on such opinions, which do not meet the BLM's principle and practice to "Use the best available scientific knowledge relevant to the problem or decision being addressed, relying on peer reviewed literature when it exists" (Kitchell et al. 2015).

Mare Sterilization

Sterilizing mares has already been shown to be an effective part of feral horse management that reduced herd growth rates on federal lands (Collins and Kasbohm 2016). Herd-level birth rate is expected to decline in direct proportion to the fraction of sterile mares in a herd because sterile mares cannot become pregnant. A number of methods are available, with potentially differing effects.

Current Methods of Sterilization

This literature review of mare sterilization impacts focuses on 4 methods: pharmacological or immunocontraceptive methods, minimally invasive physical sterilization, ovariectomy via colpotomy, and ovariectomy via flank laparoscopy. The range of anticipated effects may be both physical and behavioral. Whether or not surgical mare sterilization methods are considered in any of the action alternatives in this EA, they are included here for comparison and for the sake of completeness in the review.

Pharmacological or immunocontraceptive sterilization methods would use a drug or vaccine to cause sterilization. BLM has not yet identified a pharmacological or immunocontraceptive method to sterilize mares that has been proven to reliably and humanely sterilize wild horse mares. However, there is the possibility that current or future development and testing of new methods could make an injectable sterilant available for wild horse mares. An oocyte growth factor OGF vaccine is currently under testing, for its ability to cause long-term infertility or, potentially, sterility (BLM 2020, Bruemmer et al. 2023). Mares that received 5 or more doses of ZonaStat-H vaccine have been shown to have reduced ovarian function, and to be effectively infertile for life (Nuñez et al. 2017), and it is conceivable that the contraceptive effects of repeated treatment with GonaCon-Equine may last longer than a mare's lifespan, depending on the mare's age at treatment and the number of doses received (Baker et al. 2018, 2023). While the physiological effects of various potential methods may differ, the herd-level effects of having sterile mares as a part of a wild horse herd would be expected to be similar for minimally invasive and surgical methods. Salient differences in individual breeding behavior that result from either retaining functioning ovaries, or having no or reduce ovarian function, are discussed below.

Minimally Invasive Mare Sterilization Procedures
Population growth suppression becomes less expensive if fertility control is long-lasting (Hobbs et al. 2000), such as with spaying and neutering. For the purposes of this EA, 'minimally invasive sterilization' is defined to be the minimally invasive sterilization of a female horse (mare) by physical means. The physical means considered here include forms of oviduct blockage; for the purposes of this analysis, these are considered minimally invasive insofar as no incisions are required. Unlike in dog and cat spaying, these minimally invasive forms of mare sterilization do not entail removal of the ovaries or uterus. Only healthy mares in BCS score of 3 or greater would be considered.

The specific minimally invasive sterilization procedures could include any form of procedure that leads a mare to be unable to become pregnant, or to maintain a pregnancy, but that does not entail incision by scalpel. The two transcervical procedures analyzed below are physical, minimally invasive sterilization methods that cause long-term blockage of the oviduct, so that fertile eggs cannot go from the ovaries to the uterus. A detailed analysis of those methods and their expected effects is included in Appendix D.

As is the case for IUDs, candidate mares for minimally-invasive sterilization procedure treatment would need to be screened by a veterinarian to ensure they are not pregnant, because any transcervical procedures can cause a pregnancy to terminate. If palpation or ultrasound indicate that the mare is pregnant, then that mare would not be considered for the minimally invasive sterilization procedure.

One form of minimally invasive oviduct blockage procedure, "endoscopic oviduct ablation," infuses medical-grade N-butyl cyanoacrylate glue into the oviduct (Bigolin et al. 2009). In the procedure, the veterinarian passes an endoscope through the cervix, to visualize the interior of the uterus. Treated mares would stand in a padded, hydraulic chute. Banamine may be administered intravenously prior to the procedure to minimize transient colic (abdominal cramping) following the procedure. Ketamine may be added on an as needed basis for additional standing chemical restraint. Fecal material is removed from the rectum, the tail is wrapped and suspended, the perineal and vaginal areas are cleansed. A sterilized, flexible endoscope would be placed into the vaginal vault and advanced through the cervix in an atraumatic manner. A veterinary team is required to manipulate and operate the endoscope monitor, insert and hold the endoscope, manipulate and position the fine-tipped catheter into the oviduct, and infuse the fluid into the oviduct. The uterus would be partially inflated with filtered room air to visualize the oviduct papilla located at the proximal end of the uterine horn. A sterile catheter is guided to each uterotubal junction (which is the entrance to the oviduct), and medical-grade glue (N-butyl cyanoacrylate) is introduced to the oviduct, where it causes blockage. After the procedure, the uterus could be infused with an antibiotic and saline to minimize the potential for infection secondary to any unintended bacterial contamination. The mares are monitored initially for 10 minutes, and observed by a veterinarian twice per day for 10-14 days, but no further pain management is expected to be needed. Any mare showing signs of postoperative complications would receive treatment as indicated by a veterinarian. The total duration of the procedure per mare is expected to be less than 30 minutes. After receiving support from the California legislature (California Legislature 2019), researchers at the UC Davis School of Veterinary Medicine used a similar method in burros, but with electrocauterization of the utero-tubular junction. A five-person team completed the procedure in 20-30 minutes total time which included a short wait for onset of light anesthesia and 5-6 minutes use of the endoscope to guide an elecotrocautery device to the uterotubal junction and apply enough heat to cause scarring.

Another form of minimally invasive oviduct blockage procedure, “endoscopic laser ablation of the oviduct papilla,” is similar to the procedure described above, except that the oviducts are blocked via heating from a laser to ablate the oviduct papilla. The diode laser is expected to immediately “seal” the oviduct opening and the resulting inflammatory reaction is expected to result in additional scar tissue formation, forming a barrier to the passage of eggs from the ovary to the uterus. Local anesthesia could be dripped directly onto each oviduct papilla to minimize any discomfort. This method has been used successfully in Georgia (Edwards et al. 2021).

Neither of these minimally invasive procedures damages the ovaries. The mare would be sterile, although the mare would continue to have estrus cycles. Because of the retention of estrus cycles, it is expected that behavioral outcomes of either method would be similar to those observed for PZP vaccine treated mares. Namely, mares would continue with hormonal cycles and associated breeding behaviors during the typical breeding season.

If the minimally invasive sterilization techniques are either of the two noted above, then mares chosen for the minimally invasive sterilization procedure could include adult females and immature females estimated to be older than 8 months. Immature females could be included because there are no concerns regarding space for instruments, as an endoscope and associated instruments used along with the endoscope are the only tools used, and only open (non-pregnant) females would receive the procedure.

Minimally invasive, physical sterilization procedure could include any physical form of sterilization that does not involve removal of the ovaries, and entail only minimal or no incisions. Such procedures could include any form of physical procedure that leads a mare to be unable to become pregnant, or to maintain a pregnancy. For example, in endoscopic oviduct ablation, minimally invasive sterilization causes a long-term blockage of the oviduct by infusion of a surgical-grade glue into the oviducts, so that fertile eggs cannot go from the ovaries to the uterus (i.e., Bigolin et al. 2009). Or, in endoscopic laser ablation of the oviduct papilla, scarring caused by heat applied at the uterotubal junction prevents eggs from reaching the uterus (Edwards et al. 2021). These two procedures use trans-cervical endoscopy, so any treated mares would first need to have been screened by a veterinarian (e.g., using trans-rectal ultrasonography) to ensure they are not pregnant. Endoscopic approaches also require temporary insufflation of the uterus, to allow the veterinarian to fully visualize the internal structures. The result of such minimally invasive procedures that prevent pregnancy but do not harm the ovaries is that the mare would be sterile, although the mare would continue to have estrus cycles.

Ovariectomy via colpotomy is a surgical technique in which there is no external incision, reducing susceptibility to infection. Ovariectomy via colpotomy, has been an established veterinary technique since 1903 (Loesch and Rodgerson 2003, NRC 2013). Spaying via colpotomy has the advantage of not leaving any external wound that could become infected. For this reason, it has been identified as a good choice for sterilization of feral or wild mares (Rowland et al. 2018). The procedure has a relatively low complication rate, although post-surgical mortality and morbidity are possible, as with any surgery. For this reason, ovariectomy via colpotomy has been identified as a good choice for feral or wild horses (Rowland et al. 2018). Ovariectomy via colpotomy is a relatively short surgery, with a relatively quick expected recovery time. In 1903, Williams first described a vaginal approach, or colpotomy, using an ecraseur to ovariectomize mares (Loesch and Rodgerson 2003). The ovariectomy via colpotomy procedure has been conducted for over 100 years, normally on open (non-pregnant), domestic mares. It is expected that the surgeon should be able to access ovaries with ease in mares that are in the early- or mid-stage of pregnancy. The anticipated risks associated with the pregnancy are described below. When wild horses are gathered or trapped for fertility control treatment there would likely be mares in various stages of gestation. Removal of the ovaries is permanent and 100 percent effective, however the procedure is not without risk.

Ovariectomy via flank laparoscopy (Lee and Hendrickson 2008, Devick et al. 2018, Easley et al. 2018) is commonly used in domestic horses for application in mares due to its minimal invasiveness and full observation of the operative field. Ovariectomy via flank laparoscopy was seen as the lowest risk method considered by a panel of expert reviewers convened by USGS (Bowen 2015). In a review of unilateral and bilateral laparoscopic ovariectomy on 157 mares, Röcken et al. (2011) found that 10.8% of mares had minor post-surgical complications, and recorded no mortality. Mortality due to this type of surgery, or post-surgical complications, is not expected, but is a possibility. In two studies, ovariectomy by laparoscopy or endoscope-assisted colpotomy did not cause mares to lose weight, and there was no need for rescue analgesia following surgery (Pader et al. 2011, Bertin et al. 2013). This surgical approach entails three small incisions on the animal's flank, through which three cannulae (tubes) allow entry of narrow devices to enter the body cavity: these are the insufflator, endoscope, and surgical instrument. The surgical procedure involves the use of narrow instruments introduced into the abdomen via cannulas for the purpose of transecting or sealing (Easley 2018) the ovarian pedicle, but the insufflation should allow the veterinarian to navigate inside the abdomen without damaging other internal organs. The insufflator blows air into the cavity to increase the operating space between organs, and the endoscope provides a video feed to visualize the operation of the surgical instrument. This procedure can require a relatively long duration of surgery, but tends to lead to the lowest post-operative rates of complications. Flank laparoscopy may leave three small (<5 cm) visible scars on one side of the horse's flank, but even in performance horses these scars are considered minimal. It is expected that the tissues and musculature under the skin at the site of the incisions in the flank will heal quickly, leaving no long-lasting effects on horse health. Monitoring for up to two weeks at the facility where surgeries take place will allow for veterinary inspection of wound healing. The ovaries may be dropped into the abdomen, but this is not expected to cause any health problem; it is usually done in ovariectomies in cattle (e.g., the Willis Dropped Ovary Technique) and Shoemaker et al. (2014) found no problems with revascularization or necrosis in a study of young horses using this method.

Effects of Sterilization on Pregnancy and Foal

The physical, behavioral, and herd-level effects of immunocontraceptives have been addressed elsewhere in this review. In the case of repeated PZP vaccine or GonaCon applications that cause infertility through the duration of a given mare's life, that effects of that form of treatment have been discussed previously; neither vaccine appears to disrupt pregnancy or foal development. OGF vaccine effects on fetal development, if any, have not been described, as no studies on the effects of vaccinating pregnant mares have yet been published; use on pregnant mares may be limited until further information is available.

Trans-cervical, minimally-invasive sterilization methods are not suitable for pregnant mares, because disruption of the cervix may lead to termination of the pregnancy. Therefore, any mares under consideration for such methods must first be screened for pregnancy, such as via transrectal ultrasound.

The average mare gestation period ranges from 335 to 340 days (Evans et al. 1977, p. 373). There are few peer reviewed studies documenting the effects of surgical ovariectomy on the success of pregnancy in a mare. A National Research Council of the National Academies of Sciences committee that reviewed research proposals in 2015 explained, "The mare's ovaries and their production of progesterone are required during the first 70 days of pregnancy to maintain the pregnancy" (NRC 2015). In female mammals, less progesterone is produced when ovaries are removed, but production does not cease (Webley and Johnson 1982). In 1977, Evans et al. stated that by 200 days, the secretion of progesterone by the corpora lutea is insignificant because removal of the ovaries does not result in abortion (p. 376). "If this procedure were performed in the first 120 days of pregnancy, the fetus would be resorbed or aborted by the mother. If performed after 120 days, the pregnancy should be maintained. The effect of ovary removal on a pregnancy at 90–120 days of gestation is unpredictable because it is during this stage of gestation that the transition from corpus luteum to placental support typically occurs" (NRC 2015). In

1979, Holtan et al. evaluated the effects of bilateral ovariectomy at selected times between 25 and 210 days of gestation on 50 mature pony mares. Their results show that abortion (resorption) of the conceptus (fetus) occurred in all 14 mares ovariectomized before day 50 of gestation, that pregnancy was maintained in 11 of 20 mares after ovariectomy between days 50 and 70, and that pregnancy was not interrupted in any of 12 mares ovariectomized on days 140 to 210. Those results are similar to the suggestions of the NAS committee (2015). For those pregnancies that are maintained following an ovariectomy procedure, likely those past approximately 120 days, the development of the foal is not expected to be affected. However, because this procedure is not commonly conducted on pregnant mares the rate of complications to the fetus has not yet been quantified. There is the possibility that entry to the abdominal cavity could cause premature births related to inflammation. However, after five months the placenta should hormonally support the pregnancy regardless of the presence or absence of ovaries. Gestation length was similar between ovariectomized and control mares (Holtan et al. 1979).

Direct Effects of Sterilization

The direct effects of immunocontraceptive PZP vaccines and GonaCon-Equine have been discussed previously. In cases where PZP vaccines have been administered enough times to cause effective sterility, the mechanism of action may be related to long-term reduction in ovarian activity (i.e., Nolan et al 2018c). The direct effects of OGF vaccine treatment were discussed by BLM (2020) and may include an injection site reaction that is comparable to that of GonaCon-Equine; a brief period of heightened inflammation and mild fever that is characteristic of a successful immune response; development of an immune response against GDF9 and BMP15, with related reductions in the concentration of those proteins; and a reduction in estrus activity.

The direct effects of successful minimally invasive mare sterilization procedures are sterility, for example through occlusion of the oviduct with surgical glue and associated tissue damage, or creation of scar tissue in part of the oviduct. Hysteroscopy is a common procedure in humans (i.e., WebMD 2014). Because such minimally invasive procedures do not involve major incisions or removal of ovaries, there is no risk of hemorrhage, failure of sutures, or prolonged discomfort. There is the potential for mild, transient colic (abnormal cramping) after the procedure due to temporary inflation and expansion of the uterus. Use of analgesics prior to any procedure should minimize this incidence. Side effects of minimally invasive sterilization procedures may include mild discomfort in the short term, for example at the location where the oviduct is blocked. For example, if surgical grade glue is placed in the oviduct or if a laser is used to ablate the oviduct papilla, that may cause transient irritation. For this reason, systemic and / or topical analgesics are generally provided before or during the procedure. An NAS review of the endoscopic laser ablation of the oviduct papilla technique concluded that the method is relatively non-invasive, with a relatively low risk of complications (NRC 2015); the expected severe complication rate for the laser ablation procedure may be lower than 1 percent. Ablation of the oviduct via cyanoacrylate glue has been performed successfully in mares at UC Davis, and laser ablation of the oviduct papilla has been performed successfully in burros and horses, in California and Georgia. In addition, other transcervical endoscopic procedures (including the use of a laser diode) are not uncommon in mares (Blikslager et al. 1993, Griffin and Bennet 2002, Ley et al. 2002, Brinsko 2014).

Between 2009 and 2011, the Sheldon NWR in Nevada conducted ovariectomy via colpotomy surgeries (August through October) on 114 feral mares and released them back to the range with a mixture of sterilized stallions and untreated mares and stallions (Collins and Kasbohm 2016). Gestational stage was not recorded, but a majority of the mares were pregnant (Gail Collins, US Fish and Wildlife Service (USFWS), pers. comm.). Only a small number of mares were very close to full term. Those mares with late term pregnancies did not receive surgery as the veterinarian could not get good access to the ovaries due to the position of the foal (Gail Collins, USFWS, pers. comm.). After holding the mares for an average of 8 days after surgery for observation, they were returned to the range with other treated and untreated mares and stallions (Collins and Kasbohm 2016). During holding the only complications were observed within 2 days of surgery. The observed mortality rate for ovariectomized mares following the procedure was less than 2 percent (Collins and Kasbohm 2016, Pielstick pers. comm.). During the Sheldon NWR ovariectomy study, mares generally walked out of the chute and started to eat; some would raise their tail and act as if they were defecating; however, in most mares one could not notice signs of discomfort (Bowen 2015). In their discussion of ovariectomy via colpotomy, McKinnon and Vasey (2007) considered the procedure safe and efficacious in many instances, able to be performed expediently by personnel experienced with examination of the female reproductive tract, and associated with a complication rate that is similar to or less than male castration. Nevertheless, all surgery is associated with some risk. Loesch et al. (2003) lists that following potential risks with colpotomy: pain and discomfort; injuries to the cervix, bladder, or a segment of bowel; delayed vaginal healing; eventration of the bowel; incisional site hematoma; intraabdominal adhesions to the vagina; and chronic lumbar or bilateral hind limb pain. Most horses, however, tolerate ovariectomy via colpotomy with very few complications, including feral horses (Collins and Kasbohm 2016). Evisceration is also a possibility, but these complications are considered rare (Prado and Schumacher, 2017). Mortality due to surgery or post-surgical complications is not anticipated, but it is a possibility and therefore every effort would be made to mitigate risks.

In September 2015, the BLM solicited the USGS to convene a panel of veterinary experts to assess the relative merits and drawbacks of several surgical ovariectomy techniques that are commonly used in domestic horses for potential application in wild horses. A table summarizing the various methods was sent to the BLM (Bowen 2015) and provides a concise comparison of several methods. Of these, ovariectomy via colpotomy was found to be relatively safe when practiced by an experienced surgeon and was associated with the shortest duration of potential complications after the operation. The panel discussed the potential for evisceration through the vaginal incision with this procedure. In marked contrast to a suggestion by the NAS report (2013), this panel of veterinarians identified evisceration as not being a probable risk associated with ovariectomy via colpotomy and "none of the panel participants had had this occur nor had heard of it actually occurring" (Bowen 2015).

Most ovariectomy surgeries on mares have low morbidity[7] and with the help of medications, pain and discomfort can be mitigated. Pain management is an important aspect of any ovariectomy (Rowland et al. 2018); according to surgical protocols that would be used, a long-lasting direct anesthetic would be applied to the ovarian pedicle, and systemic analgesics in the form of butorphanol and flunixin meglumine would be administered, as is compatible with accepted animal husbandry practices. In a study of the effects of bilateral ovariectomy via colpotomy on 23 mares, Hooper and others (1993) reported that postoperative problems were minimal (1 in 23, or 4%). Hooper et al. (1993) noted that four other mares were reported by owners as having some problems after surgery, but that evidence as to the role the surgery played in those subsequent problems was inconclusive. In contrast Röcken et al. (2011) noted a morbidity of 10.8% for mares that were ovariectomized via a flank laparoscopy. "Although 5 mares in our study had problems (repeated colic in 2 mares, signs of lumbar pain in 1 mare, signs of bilateral hind limb pain in 1 mare, and clinical signs of peritonitis in 1 mare) after surgery, evidence is inconclusive in each as to the role played by surgery" (Hooper et al. 1993). A recent study showed a 2.5% complication rate where one mare of 39 showed signs of moderate colic after laparoscopic ovariectomy (Devick et al. 2018).

Behavioral Effects of Mare Sterilization

All fertility control methods affect physiology or behavior of a mare (NRC 2013). Any action taken to alter the reproductive capacity of an individual has the potential to affect hormone production and

[7] Morbidity is defined as the frequency of the appearance of complications following a surgical procedure or other treatment. In contrast, mortality is defined as an outcome of death due to the procedure.

therefore behavioral interactions and ultimately population dynamics in unforeseen ways (Ransom et al. 2014). The health and behavioral effects of sterilizing wild horse mares that live with other fertile and infertile wild horses has not been well documented, but the literature review below can be used to make reasonable inferences about their likely behaviors.

The behavioral effects of PZP vaccines and GonaCon-Equine have been discussed previously. For the OGF vaccine, a paired immune reaction to two proteins (GDF9 and BMP15) can prevent the completion of oocyte development, with the result being that successfully treated mares do not exhibit estrus cycles (Bruemmer et al. 2023). As a result, the behavioral and herd-level effects of OGF vaccine treatment are expected to be similar to those documented for GonaCon-Equine; namely, a reduced incidence of breeding behaviors, but a continuation of affiliative behaviors within the social band (see previous discussion of effects of GonaCon-Equine).

Horses are anovulatory (do not ovulate/express estrous behavior) during the short days of late fall and early winter, beginning to ovulate as days lengthen and then cycling roughly every 21 days during the warmer months, with about 5 days of estrus (Asa et al. 1979, Crowell-Davis 2007). Estrus in mares is shown by increased frequency of proceptive behaviors: approaching and following the stallion, urinating, presenting the rear end, clitoral winking, and raising the tail towards the stallion (Asa et al. 1979, Crowell-Davis 2007). In most mammal species other than primates estrus behavior is not shown during the anovulatory period, and reproductive behavior is considered extinguished following spaying (Hart and Eckstein 1997). However mares may continue to demonstrate estrus behavior during the anovulatory period (Asa et al. 1980).

The behavioral effects of minimally invasive mare sterilization methods that cause no change in ovarian functionality would be expected to be similar to those observed in mares treated with a small number of doses of PZP vaccine (i.e., those in which ovarian functionality is not impaired). Those behavioral outcomes are discussed previously, but include a continuation of estrus cycling, and associated proceptive and breeding behaviors, including copulation. As a result of the expectation that the minimally invasive procedures would have similar behavioral effects as treatment with PZP, BLM does not anticipate any need to study the behavioral effects of minimally invasive mare sterilization, in which functional ovaries are retained. Sterile mares with functional ovaries would be expected to continue to engage in breeding activities, although they would not become pregnant. There is the possibility that such mares may change social bands at a greater rate than fertile mares (e.g., Nuñez et al. 2017).

Ovariectomized mares may continue to exhibit estrous behavior (Scott and Kunze 1977, Kamm and Hendrickson 2007, Crabtree 2016), with one study finding that 30% of mares showed estrus signs at least once after surgery (Roessner et al 2015) and only 60 percent of ovariectomized mares cease estrous behavior following surgery (Loesch and Rodgerson 2003). Mares continue to show reproductive behavior following ovariectomy due to non-endocrine support of estrus behavior, specifically steroids from the adrenal cortex. Continuation of this behavior during the non-breeding season has the function of maintaining social cohesion within a horse group (Asa et al. 1980, Asa et al. 1984, NRC 2013). This may be a unique response of the horse (Bertin et al. 2013), as spaying usually greatly reduces female sexual behavior in companion animals (Hart and Eckstein 1997). In six ponies, mean monthly plasma luteinizing hormone[8] levels in ovariectomized mares were similar to intact mares during the anestrous season, and during the breeding season were similar to levels in intact mares at mid-estrus (Garcia and Ginther 1976).

[8] Luteinizing hormone (LH) is a glycoprotein hormone produced in the pituitary gland. In females, a sharp rise of LH triggers ovulation and development of the corpus luteum. LH concentrations can be measured in blood plasma.

The likely effects of spaying on mares' social interactions and group membership can be inferred from available literature, even though wild horses have rarely been spayed and released back into the wild, resulting in few studies that have investigated their behavior in free-roaming populations. Wild horses and burros are instinctually herd-bound and this behavior is expected to continue. Overall the BLM anticipates that some spayed mares may continue to exhibit estrus behavior which could foster band cohesion. If free-ranging ovariectomized mares show estrous behavior and occasionally allow copulation, interest of the stallion may be maintained, which could foster band cohesion (NRC 2013). This last statement could be validated by the observations of group associations on the Sheldon NWR where feral mares were ovariectomized via colpotomy and released back on to the range with untreated horses of both sexes (Collins and Kasbohm 2016). No data were collected on inter- or intra-band behavior (e.g. estrous display, increased tending by stallions, etc.), during multiple aerial surveys in years following treatment, all treated individuals appeared to maintain group associations, and there were no groups consisting only of treated males or only of treated females (Collins and Kasbohm 2016). In addition, of solitary animals documented during surveys, there were no observations of solitary treated females (Collins and Kasbohm 2016). These data help support the expectation that ovariectomized mares would not lose interest in or be cast out of the social dynamics of a wild horse herd. As noted by the NAS (2013), the ideal fertility control method would not eliminate sexual behavior or change social structure substantially.

A study conducted for 15 days in January 1978 (Asa et al. 1980), compared the sexual behavior in ovariectomized and seasonally anovulatory (intact) pony mares and found that there were no statistical differences between the two conditions for any measure of proceptivity or copulatory behavior, or days in estrous. This may explain why treated mares at Sheldon NWR continued to be accepted into harem bands; they may have been acting the same as a non-pregnant mare. Five to ten percent of pregnant mares exhibit estrous behavior (Crowell-Davis 2007). Although the physiological cause of this phenomenon is not fully understood (Crowell-Davis 2007), it is thought to be a bonding mechanism that assists in the maintenance of stable social groups of horses year round (Ransom et al. 2014b). The complexity of social behaviors among free-roaming horses is not entirely centered on reproductive receptivity, and fertility control treatments that suppress the reproductive system and reproductive behaviors should contribute to minimal changes to social behavior (Ransom et al. 2014b, Collins and Kasbohm 2016).

BLM expects that wild horse harem structures would continue to exist under the proposed action because fertile mares, stallions, and their foals would continue to be a component of the herd. It is not expected that sterilizing a subset of mares would significantly change the social structure or herd demographics (age and sex ratios) of fertile wild horses.

'Foal stealing,' where a near-term pregnant mare steals a neonate foal from a weaker mare, is unlikely to be a common behavioral result of including sterilized mares in a wild horse herd, no matter the method of sterilization. McDonnell (2012) noted that "foal stealing is rarely observed in horses, except under crowded conditions and synchronization of foaling," such as in horse feed lots. Those conditions are not likely in the wild, where pregnant mares will be widely distributed across the landscape, and where the expectation is that parturition dates would be distributed across the normal foaling season.

Indirect Effects of Mare Sterilization

The free-roaming behavior of wild horses is not anticipated to be affected by mare sterilization, as the definition of free-roaming is the ability to move without restriction by fences or other barriers within a HMA (BLM H-4700-1, 2010) and there are no permanent physical barriers being proposed.

In domestic animals, sterilization is often associated with weight gain and associated increase in body fat (Fettman et al 1997, Becket et al 2002, Jeusette et al. 2006, Belsito et al 2009, Reichler 2009, Camara et al. 2014). Spayed cats had a decrease in fasting metabolic rate, and spayed dogs had a decreased daily energy requirement, but both had increased appetite (O'Farrell & Peachey 1990, Hart and Eckstein 1997, Fettman et al. 1997, Jeusette et al. 2004). In wild horses, contracepted mares tend to be in better body condition that mares that are pregnant or that are nursing foals (Nuñez et al. 2010); the same improvement in body condition is likely to take place in spayed mares. In horses, surgical sterilization through ovariectomy has the potential to increase risk of equine metabolic syndrome (leading to obesity and laminitis), but both blood glucose and insulin levels were similar in mares before and after ovariectomy over the short-term (Bertin et al. 2013). In wild horses the quality and quantity of forage, and frequent exercise, is unlikely to be sufficient to promote over-eating and obesity.

Coit et al. (2009) demonstrated that spayed dogs have elevated levels of LH-receptor and GnRH-receptor mRNA in the bladder tissue, and lower contractile strength of muscles. They noted that urinary incontinence occurs at elevated levels in spayed dogs and in post-menopausal women. Thus, it is reasonable to suppose that some ovariectomized mares could also suffer from elevated levels of urinary incontinence.

Sterilization had no effect on movements and space use of feral cats or brushtail possums (Ramsey 2007, Guttilla & Stapp 2010), or greyhound racing performance (Payne 2013). Rice field rats (*Rattus argentiventer*) tend to have a smaller home range in the breeding season, as they remain close to their litters to protect and nurse them. When surgically sterilized, rice field rats had larger home ranges and moved further from their burrows than hormonally sterilized or fertile rats (Jacob et al. 2004). Spayed possums and foxes (*Vulpes vulpes*) had a similar core range area after spay surgery compared to before, and were no more likely to shift their range than intact females (Saunders et al. 2002, Ramsey 2007).

The likely effects of sterilization on mares' home range and habitat use can also be surmised from available literature. Bands of horses tend to have distinct home ranges, varying in size depending on the habitat and varying by season, but always including a water source, forage, and places where horses can shelter from inclement weather or insects (King and Gurnell 2005). It is unlikely that sterilized mares will change their spatial ecology, but not having constraints of gestation and lactation may mean they can spend more time away from water sources and increase their home range size. Lactating mares need to drink every day, but during the winter when snow can fulfill water needs or when not lactating, horses can traverse a wider area (Feist & McCullough 1976, Salter 1979). During multiple aerial surveys in years following the mare ovariectomy study at the Sheldon NWR, it was documented that all treated individuals appeared to maintain group associations, no groups consisted only of treated females, and none of the solitary animals observed were treated females (Collins and Kasbohm 2016). Given that treated females maintained group associations, this indicates that their movement patterns and distances may be unchanged.

Sterilizing wild horses does not change their status as wild horses under the WFRHBA (as amended). In terms of whether sterile mares would continue to exhibit the free-roaming behavior that defines wild horses, BLM does expect that sterile mares would continue to roam unhindered. Wild horse movements may be motivated by a number of biological impulses, including the search for forage, water, and social companionship that is not of a sexual nature. As such, a sterilized animal would still be expected to have a number of internal reasons for moving across a landscape and, therefore, exhibiting 'free-roaming' behavior. Despite marginal uncertainty about subtle aspects of potential changes in habitat preference, there is no expectation that sterilizing wild horses will cause them to lose their free-roaming nature.

In this sense, a sterilized wild mare would be just as much 'wild' as defined by the WFRHBA as any fertile wild mare, even if that mare's patterns of movement did differ slightly. Congress specified that sterilization is an acceptable management action (16 USC §1333.b.1). Sterilization is not one of the clearly defined events that cause an animal to lose its status as a wild free-roaming horse (16 USC §1333.2.C.d). As noted in the discussion of neutering, any opinions based on a semantic and subjective definition of what constitutes a 'wild' horse are not legally binding for BLM, which must adhere to the legal definition of what constitutes a wild free-roaming horse[9], based on the WFRHBA (as amended). BLM is not obliged to base management decisions on personal opinions, which do not meet the BLM's principle and practice to "Use the best available scientific knowledge relevant to the problem or decision being addressed, relying on peer reviewed literature when it exists" (Kitchell et al. 2015).

Sterilization is not expected to reduce mare survival rates on public rangelands. Individuals receiving fertility control often have reduced mortality and *increased* longevity due to being released from the costs of reproduction (Kirkpatrick and Turner 2008). Similar to contraception studies, in other wildlife species a common trend has been higher survival of sterilized females (Twigg et al. 2000, Saunders et al. 2002, Ramsey 2005, Jacob et al. 2008, Seidler and Gese 2012). Observations from the Sheldon NWR provide some insight into long-term effects of ovariectomy on feral horse survival rates. The sterilized mares in Sheldon NWR were returned to the range along with untreated mares. Between 2007 and 2014, mares were captured, a portion treated, and then recaptured. There was a minimum of 1 year between treatment and recapture; some mares were recaptured a year later and some were recaptured several years later. The long-term survival rate of treated wild mares appears to be the same as that of untreated mares (Collins and Kasbohm 2016). Recapture rates for released mares were similar for treated mares and untreated mares.

Effects on Bone Histology

There is no known mechanism by which bone development would change in mares treated with pharmacological or immunological sterilization methods, or with minimally invasive sterilization methods. The BLM knows of no scientific, peer-reviewed literature that documents bone density loss in mares following ovariectomy. A concern has been raised in an opinion article (Nock 2013) that ovary removal in mares could lead to bone density loss. That opinion article was not peer reviewed nor was it based on research in wild or domestic horses, so it does not meet the BLM's standard for "best available science" on which to base decisions (Kitchell et al. 2015). Hypotheses that are forwarded in Nock (2013) appear to be based on analogies from modern humans leading sedentary lives. Post-menopausal women appear to have a greater chance of developing osteoporosis (Scholz-Ahrens et al. 1996), but BLM is not aware of any research examining bone loss in horses following ovariectomy. Bone loss in humans has been linked to reduced circulating estrogen. There have been conflicting results when researchers have attempted to test for an effect of reduced estrogen on animal bone loss rates in animal models; all experiments have been on laboratory animals, rather than free-ranging wild animals. While some studies found changes in bone cell activity after ovariectomy leading to decreased bone strength (Jerome et al. 1997, Baldock et al. 1998, Huang et al. 2002, Sigrist et al. 2007), others found that changes were moderate and transient or minimal (Scholz-Ahrens et al. 1996, Lundon et al. 1994, Zhang et al. 2007), and even returned to normal after 4 months (Sigrist et al. 2007).

Consistent and strenuous use of bones, for instance using jaw bones by eating hard feed, or using leg bones by travelling large distances, may limit the negative effects of estrogen deficiency on micro-architecture (Mavropoulos et al. 2014). The effect of exercise on bone strength in animals has been known for many years and has been shown experimentally (Rubin et al. 2001). Dr. Simon Turner, Professor Emeritus of the Small Ruminant Comparative Orthopaedic Laboratory at Colorado State University, conducted extensive bone density studies on ovariectomized sheep, as a model for human osteoporosis. During these studies, he did observe bone density loss on ovariectomized sheep, but those sheep were confined in captive conditions, fed twice a day, had shelter from inclement weather, and had very little distance to travel to get food and water (Simon Turner, Colorado State University Emeritus,

[9] "wild free-roaming horses and burros" means all unbranded and unclaimed horses and burros on public lands of the United States.

written comm., 2015). Dr. Turner indicated that an estrogen deficiency (no ovaries) could potentially affect a horse's bone metabolism, just as it does in sheep and human females when they lead a sedentary lifestyle, but indicated that the constant weight bearing exercise, coupled with high exposure to sunlight ensuring high vitamin D levels, are expected to prevent bone density loss (Simon Turner, Colorado State University Emeritus, written comm., 2015).

Home range size of horses in the wild has been described as 4.2 to 30.2 square miles (Green and Green 1977) and 28.1 to 117 square miles (Miller 1983). A study of distances travelled by feral horses in "outback" Australia shows horses travelling between 5 and 17.5 miles per 24-hour period (Hampson et al. 2010a), travelling about 11 miles a day even in a very large paddock (Hampson et al. 2010b). Thus extensive movement patterns of wild horses are expected to help prevent bone loss. The expected daily movement distance would be far greater in the context of larger pastures typical of BLM long-term holding facilities in ORPs. A horse would have to stay on stall rest for years after removal of the ovaries in order to develop osteoporosis (Simon Turner, Colorado State University Emeritus, written comm., 2015) and that condition does not apply to any wild horses turned back to the range or any wild horses that go into ORPs.

Genetic Effects of Mare Sterilization and Neutering

It is true that sterile females and neutered males are unable to contribute to the genetic diversity of the herd. BLM is not obligated to ensure that any given individual in a herd has the chance to sire a foal and pass on genetic material. Management practices in the BLM Wild Horse and Burro Handbook (2010) include measures to increase population genetic diversity in reproducing herds where monitoring reveals a cause for concern about low levels of observed heterozygosity. These measures include increasing the sex ratio to a greater percentage of fertile males than fertile females (and thereby increasing the number of males siring foals), and bringing new animals into a herd from elsewhere. In a hypothetical herd that is managed to be entirely, permanently non-reproducing, it would not be a concern to maintain genetic diversity because the management goal would be that animals in such a herd would not breed.

In reproducing herds where large numbers of wild horses have recent and / or an ongoing influx of breeding animals from other areas with wild or feral horses, mare sterilization and neutering at the levels proposed in this EA are not expected to cause an unacceptable loss of genetic diversity or an unacceptable increase in the inbreeding coefficient. In any diploid population, the loss of genetic diversity through inbreeding or drift can be prevented by large effective breeding population sizes (Wright 1931) or by introducing new potential breeding animals (Mills and Allendorf 1996). The NAS report (2013) recommended that single HMAs should not be considered as isolated genetic populations. Rather, managed herds of wild horses should be considered as components of interacting metapopulations, with the potential for interchange of individuals and genes taking place as a result of both natural and human-facilitated movements. It is worth noting that, although maintenance of genetic diversity at the scale of the overall population of wild horses is an intuitive management goal, there are no existing laws or policies that require BLM to maintain genetic diversity at the scale of the individual herd management area or complex. Also, there is no Bureau-wide policy that requires BLM to allow each female in a herd to reproduce before treatment with contraceptives. Introducing 1-2 mares every generation (about every 10 years) is a standard management technique that can alleviated potential inbreeding concerns (BLM 2010). The NAS report (2013) recommended that managed herds of wild horses would be better viewed as components of interacting metapopulations, with the potential for interchange of individuals and genes taking place as a result of both natural and human-facilitated movements.

In the last 10 years, there has been a high realized growth rate of wild horses in most areas administered by the BLM. As a result, most alleles that are present in any given mare are likely to already be well represented in that mare's siblings, cousins, and more distant relatives on the HMA. With the exception of horses in a small number of well-known HMAs that contain a relatively high fraction of alleles associated with old Spanish horse breeds (NRC 2013), the genetic composition of wild horses in lands administered by the BLM is consistent with admixtures from domestic breeds. The NAS report (2013) includes information (pairwise genetic 'fixation index' values for sampled WH&B herds) confirming that WH&Bs in the vast majority of HMAs are genetically similar to animals in multiple other HMAs. As a result, in most HMAs, applying fertility control to a subset of mares is not expected to cause irreparable loss of genetic diversity. Improved longevity and an aging population are expected results of contraceptive treatment that can provide for lengthening generation time; this result would be expected to slow the rate of genetic diversity loss (Hailer et al. 2006). Based on a population model, Gross (2000) found that a strategy to preferentially treat young animals with a contraceptive led to more genetic diversity being retained than either a strategy that preferentially treats older animals, or a strategy with periodic gathers and removals.

Roelle and Oyler-McCance (2015) used the VORTEX population model to simulate how different rates of mare sterility would influence population persistence and genetic diversity, in populations with high or low starting levels of genetic diversity, various starting population sizes, and various annual population growth rates. Although those results are specific to mares, some inferences about potential effects of stallion sterilization may also be made from their results. Roelle and Oyler-McCance (2015) showed that the risk of the loss of genetic heterozygosity is extremely low except in cases where all of the following conditions are met: starting levels of genetic diversity are low, initial population size is 100 or less, the intrinsic population growth rate is low (5% per year), and very large fractions of the population are permanently sterilized. Given that 94 of 102 wild horse herds sampled for genetic diversity did not meet a threshold for concern (NRC 2013), the starting level of genetic diversity in most wild-horse herds is relatively high.

In a breeding herd where more than 85% of males in a population are sterile, there could be genetic consequences of reduced heterozygosity and increased inbreeding coefficients, as it would potentially allow a very small group of males to dominate the breeding (e.g., Saltz et al. 2000). Such genetic consequences could be mitigated by natural movements or human-facilitated translocations (BLM 2010). Garrott and Siniff's (1992) model predicts that gelding 50-80% of mature males in the population would result in reduced, but not halted, mare fertility rates. However, neutering males tends to have short-lived effects, because within a few years after any male sterilization treatment, a number of fertile male colts would become sexually mature stallions who could contribute genetically to the herd.

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Effects of Intrauterine Devices (IUDs)

Based on promising results from published, peer-reviewed studies in domestic mares, BLM has begun to use IUDs to control fertility as a wild horse and burro fertility control method on the range. The initial management use was in mares from the Swasey HMA, in Utah. The BLM has supported and continues to support research into the development and testing of effective and safe IUDs for use in wild horse mares (Baldrighi et al. 2017, Holyoak et al. 2021). However, existing literature on the use of IUDs in horses allows for inferences about expected effects of any management alternatives that might include use of IUDs, and support the apparent safety and efficacy of some types of IUDs for use in horses. Overall, as with other methods of population growth suppression, use of IUDs and other fertility control measures are expected to help reduce population growth rates, extend the time interval between gathers, and reduce the total number of excess animals that will need to be removed from the range.

The 2013 National Academies of Sciences (NRC) report considered IUDs, and suggested that research should test whether IUDs cause uterine inflammation, and should also test how well IUDs stay in mares that live and breed with fertile stallions. Since that report, a recent study by Holyoak et al. (2021) indicate that a flexible, inert, y-shaped, medical-grade silicone IUD design prevented pregnancies in all the domestic mares that retained the device, even when exposed to fertile stallions. Domestic mares in that study lived in large pastures, mating with fertile stallions. Biweekly ultrasound examinations showed that IUDs stayed in 75% of treated mares over the course of two breeding seasons. The IUDs were then removed so the researchers could monitor the mares' return to fertility. In that study, uterine health, as measured in terms of inflammation, was not seriously affected by the IUDs, and most mares became pregnant within months after IUD removal. The overall results are consistent with results from an earlier study (Daels and Hughes 1995), which used O-shaped silicone IUDs. Similarly, a flexible IUD with three components connected by magnetic force (the 'iUPOD') was retained over 90 days in mares living and breeding with a fertile stallion; after IUD removal, the majority of mares became pregnant in the following breeding season (Hoopes et al. 2021).

IUDs are considered a temporary fertility control method that does not generally cause future sterility (Daels and Hughes 1995). Use of IUDs is an effective fertility control method in women, and IUDs have historically been used in livestock management, including in domestic horses. Insertion of an IUD can be a very rapid procedure, but it does require the mare to be temporarily restrained, such as in a squeeze chute. IUDs in mares may cause physiological effects including discomfort, infection, perforation of the uterus if the IUD is hard and angular, endometritis, uterine edema (Killian et al. 2008), and pyometra (Klabnik-Bradford et al. 2013). In women, deaths attributable to IUD use may be as low as 1.06 per million (Daels and Hughes 1995). The effects of IUD use on genetic diversity in a given herd should be comparable to those of other temporary fertility control methods; use should reduce the fraction of mares breeding at any one time, but does not necessarily preclude treated mares from breeding in the future, as they survive and regain fertility.

The exact mechanism by which IUDs prevent pregnancy is uncertain, but may be related to persistent, low-grade uterine inflammation (Daels and Hughes 1995, Gradil et al. 2021, Hoopes et al. 2021), Turner et al. (2015) suggested that the presence of an IUD in the uterus may, like a pregnancy, prevent the mare from coming back into estrus. However, some domestic mares did exhibit repeated estrus cycles during the time when they had IUDs (Killian et al. 2008, Gradil et al. 2019, Lyman et al. 2021, Hoopes et al. 2021). The main cause for an IUD to not be effective at contraception is its failure to stay in the uterus (Daels and Hughes 1995, NRC 2013). As a result, one of the major challenges to using IUDs to control fertility in mares on the range is preventing the IUD from being dislodged or otherwise ejected over the course of daily activities, which could include, at times, frequent breeding.

At this time, it is thought that any IUD inserted into a pregnant mare may cause the pregnancy to terminate, which may also cause the IUD to be expelled. For that reason, it is expected that IUDs would only be inserted in non-pregnant (open) mares. Wild mares receiving IUDs would be checked for pregnancy by a veterinarian prior to insertion of an IUD. This can be accomplished by transrectal palpation and/or ultrasound performed by a veterinarian. Pregnant mares would not receive an IUD. Only a veterinarian would apply IUDs in any BLM management action. The IUD is inserted into the uterus using a thin, tubular applicator similar to a shielded culture tube, and would be inserted in a manner similar to that routinely used to obtain uterine cultures in domestic mares. If a mare has a zygote or very small, early phase embryo, it is possible that it will fail to be detected in screening, and may develop further, but without causing the expulsion of the IUD. Wild mares with IUDs would be individually marked and identified, so that they can be monitored occasionally and examined, if necessary, in the future, consistent with other BLM management activities.

Using metallic or glass marbles as IUDs may prevent pregnancy in horses (Nie et al. 2003), but can pose health risks to domestic mares (Turner et al. 2015, Freeman and Lyle 2015). Marbles may break into shards (Turner et al. 2015), and uterine irritation that results from marble IUDs may cause chronic, intermittent colic (Freeman and Lyle 2015). Metallic IUDs may cause severe infection (Klabnik-Bradford et al. 2013).

In domestic ponies, Killian et al. (2008) explored the use of three different IUD configurations, including a silastic polymer O-ring with copper clamps, and the “380 Copper T” and “GyneFix” IUDs designed for women. The longest retention time for the three IUD models was seen in the “T” device, which stayed in the uterus of several mares for 3-5 years. Reported contraception rates for IUD-treated mares were 80%, 29%, 14%, and 0% in years 1-4, respectively. They surmised that pregnancy resulted after IUD fell out of the uterus. Killian et al. (2008) reported high levels of progesterone in non-pregnant, IUD-treated ponies.

Soft or flexible IUDs may cause relatively less discomfort than hard IUDs (Daels and Hughes 1995). Daels and Hughes (1995) tested the use of a flexible O-ring IUD, made of silastic, surgical-grade polymer, measuring 40 mm in diameter; in five of six breeding domestic mares tested, the IUD was reported to have stayed in the mare for at least 10 months. In mares with IUDs, Daels and Hughes (1995) reported some level of uterine irritation, but surmised that the level of irritation was not enough to interfere with a return to fertility after IUD removal.

More recently, several types of soft or flexible IUDs have been tested for use in breeding mares. When researchers attempted to replicate the O-ring study (Daels and Hughes 1995) in an USGS / Oklahoma State University (OSU) study with breeding domestic mares, using various configurations of silicone O-ring IUDs, the IUDs fell out at unacceptably high rates over time scales of less than 2 months (Baldrighi et al. 2017, Lyman et al. 2021). Subsequently, the USGS / OSU researchers tested a Y-shaped IUD to determine retention rates and assess effects on uterine health; retention rates were greater than 75% for an 18-month period, and mares returned to good uterine health and reproductive capacity after removal of the IUDs (Holyoak et al. 2021). These Y-shaped silicone IUDs are considered a pesticide device by the EPA, in that they work by physical means (EPA 2020). It is possible that some individual mares may become permanently infertile as a result of IUD use, even after IUD removal or expulsion; however, available evidence indicates that flexible IUDs should be considered a reversible fertility control method for most mares.

In a presentation to the wild horse and burro Advisory Board (BLM 2025), the BLM summarized some preliminary, unpublished results from monitoring a subset of wild mares that were gathered, examined by a veterinarian and determined to be not pregnant, treated by a veterinarian with a flexible Y-shaped silicone IUD, and then released back to their herd management areas of origin in Swasey HMA and White Mountain HMA. Because results are not yet peer-reviewed, the methods are described briefly here. GPS radio collared, IUD treated wild mares at Swasey HMA were monitored every 30 days after release to determine their survival and the presence of a foal, until the GPS collars were dropped from the mares. No detrimental effects of flexible IUD treatment on mare survival were observed among these collared mares. The mares were not pregnant when released, so none had foals in the first foaling season after release. In the second foaling season after release, 25% were observed with a foal at side, indicating that the IUD had fallen out by that time (n=8; SE=0.15), Four years after release, all IUD-treated mares at Swasey HMA were re-gathered and examined; 50% had no foal and still had an IUD in the uterus (n=8, SE=0.18), and the other four were either nursing foals and/ or were pregnant. One of the mares that still had an IUD was diagnosed with pyometra and was euthanized. All others were assessed to have normal uterine conditions (no evidence of systemic infection, and any fluid present was mild to moderate with all margins of the uterus being palpable and visible on ultrasound). At White Mountain HMA, 7 mares that had been treated with an IUD four years previously were re-gathered and examined by a veterinarian. Of those, 57% still had an IUD in the uterus (SE=0.16). Of the three without an IUD, one was pregnant. The veterinarian assessed that all re-gathered, IUD-treated mares from White Mountain HMA had normal uterine conditions. The IUD retention rates based on this monitoring are generally consistent with rates in Holyoak et al. (2021).

The University of Massachusetts has developed a magnetic IUD that has been effective at prolonging estrus and preventing pregnancy in domestic mares (Gradil et al. 2019, Joonè et al. 2021, Gradil et al. 2021, Hoopes et al. 2021). After insertion in the uterus, the three subunits of the device are held together by magnetic forces as a flexible triangle. A metal detector can be used to determine whether the device is still present in the mare. In an early trial, two sizes of those magnetic IUDs fell out of breeding domestic mares at high rates (Holyoak et al. 2021), but more recent trials have shown that the magnetic IUD was retained even in the presence of breeding with a fertile stallion (Hoopes et al. 2021). The magnetic IUD was used in two trials where mares were exposed to stallions, and in one where mares were artificially inseminated; in all cases, the IUDs were reported to stay in the mares without any pregnancy (Joonè et al. 2021, Gradil et al. 2021, Hoopes et al. 2021).

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APPENDIX XIII- PROPOSED BLUE WING COMPLEX HERD MANAGEMENT AREA PLAN

INTRODUCTION

The Bureau of Land Management (BLM) Humboldt River Field Office (HRFO) proposes in this Herd Management Area Plan (HMAP) to establish management goals and objectives for the Blue Wing Complex. The overriding objective is to maintain a thriving natural ecological balance (TNEB) and multiple-use relationship.

The Blue Wing Wild Horse Complex (Complex) includes the Blue Wing Mountains, Kamma Mountains, Lava Beds Seven Troughs, and Shawave Mountains Herd Management Areas (HMA) and the Antelope, Eugene Mountains, Selenite, Trinity, and Truckee Herd Areas (HA).

The Blue Wing Complex HMAP would establish short- and long-term management and monitoring objectives for wild horse and burro (WH&B) herds and their habitat. These objectives would guide management within the Complex. The primary purpose of the plan is to outline and implement management actions necessary to achieve and maintain a thriving natural ecological balance and multiple-use relationships[10]. These actions would include conducting gathers and removals of excess WH&Bs and/or implement population growth suppression measures, outline habitat goals, monitoring methods, and ensure adequate genetic diversity of the WH&Bs for the Complex.

Under the 2015 Winnemucca District Resource Management Plan (Winnemucca RMP), no WH&Bs are to be managed within the Antelope, Eugene Mountains, Selenite, Trinity, and Truckee HAs based on the BLM's analysis of monitoring data and its determination about habitat suitability, which indicated (and currently indicates) that the HAs have insufficient forage, water, space, cover, and reproductive viability to maintain healthy wild horses and burros and rangelands over the long-term. For that reason, the aforementioned HAs would not be analyzed in the Herd Management Area Plan (HMAP).

The Winnemucca District Office's goal for the Complex with regards to WH&B management is to manage and maintain healthy wild horses and herds inside HMAs in a thriving natural ecological balance within the productive capacity of their habitat while preserving multiple use relationships.

RELATIONSHIP TO STATUTES, REGULATIONS, POLICIES, OR PLANS

See section 1.3 and 1.4 of the Blue Wing Complex Gather and HMAP Environmental Assessment (DOI-BLM-NV-W010-2024-0027-EA).

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[10] The Interior Board of Land Appeals (IBLA) explained the statutory directive to manage wild horse and burro populations in a thriving natural balance as follows: "As the court stated in Dahl v. Clark, supra at 594, the 'benchmark test' for determining the suitable number of wild horses and burros on the public range is "thriving ecological balance.' In the words of the conference committee which adopted this standard: "The goal of wild horse and burro management…should be to maintain a thriving ecological balance between wild horse and burro populations, wildlife, livestock and vegetation, and to protect the range from the deterioration associated with overpopulation of wild horses and burros." (Animal Protection Institute of America v. Nevada BLM, 109 IBLA 115 [1989]).

Implementation of the HMAP is consistent with the authority provided in 43 CFR 4700 and the 1971 Wild Free-Roaming Horses and Burros Act (WFRHBA), as amended. The HMAP is needed to manage WH&Bs within the Blue Wing Complex to maintain the WH&B herd as a self-sustaining population of healthy animals in balance with other uses and the productive capacity of their habitat and attain the objectives within this document.

CURRENT CONDITIONS

A Blue Wing Complex HMAP Management Evaluation Report was made available to interested individuals, agencies and groups for a 30-day public review and scoping period that opened on May 2, 2024, and closed on June 1, 2024. The report can be found in Appendix XV of the Blue Wing Complex Gather and HMAP Environmental Assessment (DOI-BLM-NV-W010-2024-0027-EA).

APPROPRIATE MANAGEMENT LEVEL (AML)

The AML is defined as the number of WH&Bs that can be sustained within a designated HMA which achieves and maintains a TNEB in keeping with the multiple-use management concept for the area. The Complex currently has a cumulative AML range of 333-553 horses and 55-90 burros, which was set through the Blue Wing – Seven Troughs Allotment Evaluation/Multiple Use Decision process in 1994 and established as a population range in the 2015 Winnemucca RMP. This population range was established at a level that would maintain healthy WH&Bs, and rangelands, over the long-term based on monitoring data collected over time as well as an in-depth analysis of habitat suitability.

The 2015 Winnemucca RMP states that "When evaluating AML, assess the suitability of existing HMAs to sustain healthy, genetically diverse populations of WH&Bs in balance with their habitat and other multiple uses (TNEB), using the multi-tiered process outlined in BLM Handbook 4700-1 and adjust AML as applicable" and "In HMAs with both wild horse and burro AMLs, conversion from wild horses to burros and from burros to wild horses may occur to ensure healthy populations and a thriving natural ecological balance is maintained while managing for species most appropriate for available habitat." At present, existing and historical monitoring data do not indicate that an increase or decrease of the existing AML is warranted. Achieving and maintaining AML is critical for the conservation of rangeland resources and healthy WH&Bs. The population within these HMAs can fluctuate depending on the seasonal movement of these WH&Bs across HMA and HA boundary lines within the complex.

Herd Management Area	Total Acres Private/Public land	Appropriate Management Level	2025 population estimate including net growth 2024 and 2025
Kamma Mountains HMA	57,391	46-77 H, 0 B	77 H, 0 B
Lava Beds HMA	233,000	89-148 H, 10-16 B	179 H, 42 B
Blue Wing Mountains HMA	17,854	22-36 H, 17-28 B	10 H, 28 B
Seven Troughs HMA	148,885	94-156 H, 28-46 B	161 H, 46 B
Shawave Mountains HMA	140,099	82-136 H, 0 B	150 H, 0 B
Selenite Range HA	125,306	0 H,0 B	32 H, 0 B
Antelope Range HA	131,581	0 H,0 B	0 H, 0 B
Trinity Range HA	161,457	0 H,0 B	0 H, 0 B
Truckee Range HA	171,214	0 H,0 B	0 H, 0 B

Herd Management Area	Total Acres Private/Public land	Appropriate Management Level	2025 population estimate including net growth 2024 and 2025
Blue Wing Complex Totals	**1,186,787***	**333-553 horses, 55-90 burros**	**609 horses 116 burros**

* The total amount of land managed within the Blue Wing Complex, which only includes HMA and HA units is ap-proximately 1,186,787 acres.

The BLM conducted a population inventory flight in March 0f 2023 to help confirm WH&B numbers within the Blue Wing Complex. A map of the 2023 flight survey can be found in Appendix XI of the Blue Wing Complex Gather and HMAP Environmental Assessment (DOI-BLM-NV-W010-2024-0027-EA).

The table reflects the total number of adult wild horses. Population inventories are usually conducted in the early spring (March – early April) when very few new foals are present. See Appendix XV of the Blue Wing Complex Gather and HMAP Environmental Assessment (DOI-BLM-NV-W010-2024-0027-EA) for historic horse inventories and removal data.

Fertility Control was implemented in 2006 and PZP vaccine was administered to mares following the 2006 gather, and GonaCon-Equine vaccine was administered to mares following the 2020 and 2024 gathers.

GENETIC DIVERSITY

Periodically sampled contemporaneous measures of genetic diversity sampling will continue to be useful for informing the BLM about the current status of wild horses and burros in the complex. The BLM could use updated information to help with decisions about whether and when to introduce any wild horses or burros into the complex from outside herd management areas.

After the 2004 and 2005 gathers in the Complex, a total of 28 blood samples from Lava Beds, Kamma Mountains, and Seven Troughs HMAs were analyzed for genetic diversity, and in 2008, Cothran analyzed a number of biochemical genetic markers from these blood samples. In summary, the genetic variability of the Blue Wing Complex herd was below the feral mean for blood-based genetic analyses, but above the critical low level. No unique variants were recorded in the samples. The herd ancestry was most similar to Oriental breeds closely followed by the North American group. In comparison to other Nevada feral herds and the three HMAs sampled for this study were closer to each other than to any other NV herd but also were the most divergent of all the other herds. This may be due to the small sample size from each HMA (fewer than 10). Although the Shawave Mountains HMA herd had been sampled in 2003 and was included in a dendrogram of relatedness based on available data at the time, that herd did not cluster directly with the three herds that had samples analyzed in the Cothran (2008) report.

Similarity levels to major domestic breed groups showed no clear ancestral relationships, other than that the Blue Wing complex herd appeared to be of highly mixed origins (Cothran 2008). A west-wide analysis of wild horse herd genetic structure also indicated that WH&Bs of the Blue Wing Complex herd are highly similar to a large number of other BLM-managed herds (Cothran et al. 2024).

Using the blood-based markers from Lava Beds, Kamma Mountains, and Seven Troughs HMAs, Cothran (2008) reported that genetic variability (observed heterozygosity, Ho, was 0.320) was below the feral average for blood based markers (0.360); for two of the HMAs Cothran indicated that Ho was more than one standard error below the mean among feral horse herds, suggesting that was most likely due to small population size. In contrast, microsatellite DNA-marker based analysis of genetic samples from Shawave Mountains HMA in 2003 (reported in NAS 2013) led to an observed heterozygosity estimate of 0.783, which is more than one standard error higher than the mean for DNA-based markers among feral horse herds (0.716). The herd appeared to be of mixed origins, possibly with some Arabian type ancestry but most likely mainly of North American stock (Cothran 2008).

Cothran (2008) suggested that the AML of herds sampled n 2004-2005 was individually very small and that the already low variability could decline rapidly if no action was taken, the herd size remained small, and if the herds were isolated from other herds. Cothran (2008) suggested that horse movements have the capacity to reduce the rate of genetic diversity loss from herds and suggested that the southern HMAs such as Shawave Mountains might be considered as a source for adding horses from outside the immediate area of the three herds sampled in 2004-2005. However, wild horse herd sizes in the Blue Wing complex have been substantially larger than AML for many years since 2004-2005, and it is expected that large herd sizes probably foster genetic admixture across the complex. The BLM may introduce wild horses or burros into the complex from outside HMAs if future genetic diversity monitoring indicates that it would be prudent, to help reduce loss of genetic diversity.

Separately, the 2013 National Academies of Sciences report included other evidence that shows that wild horses in the Blue Wing complex are not genetically unusual, with respect to other wild horse herds. Specifically, Appendix F of the 2013 NRC report is a table showing the estimated 'fixation index' (Fst) values between 183 pairs of samples from wild horse herds, and the Shawave Mountains HMA was one. Fst is a measure of genetic differentiation, in this case as estimated by the pattern of microsatellite allelic diversity analyzed by Dr. Cothran's laboratory. Low values of Fst indicate that a given pair of sampled herds has a shared genetic background. The lower the Fst value, the more genetically similar are the two sampled herds. Values of Fst under approximately 0.05 indicate virtually no differentiation. Values of 0.10 indicate very little differentiation. Only if values are above about 0.15 are any two sampled subpopulations considered to have evidence of elevated differentiation (Frankham et al 2010). Pairwise Fst values for 2003 Shawave Mountains HMA samples were less than 0.05 with 121 other sampled sets. These results, along with new analyses in Cothran et al. (2024), suggest that wild horse herds in and near the Blue Wing Complex were extremely similar to one-third to two-thirds of other BLM-managed herds, supporting the interpretation that Blue Wing Complex horses are components in a highly connected metapopulation that includes horse herds in many other HMAs. Pairwise Fst values for Blue Wing HMA wild burros indicated a higher level of differentiation than for horses in the complex; they had very little differentiation with three of 24 other sampled wild burro herds (NAS 2013).

HERD MANAGEMENT AREA PLAN

The Blue Wing Complex HMAP would adopt and implement a management strategy to incorporate a number of habitat and monitoring objectives. Under this strategy, WH&Bs would be managed under the LUP and HMAP objectives and goals and for the life of the plan.

No Action Alternative: Under the No Action Alternative, continue existing management, gather events to remove excess WH&Bs would not occur. There would be no active management to control population growth rates, the size of the WH&B population or to bring the WH&B population to AML. See Management Objectives with Proposed Alternatives.

Proposed Action (Alternative A). See Management Objectives with Proposed Alternatives

- Implement HMAP with a management strategy which would include several population growth suppression methods.
- The Complex would be managed for 333-553 wild horses and 55-90 burros

- Excess animals would be removed to the low-range of the AML upon a determination that excess WH&Bs exist.
- Immediately gather and remove excess animals in order to reach low AML as expeditiously as possible through an initial gather, and if necessary, a follow-up gather or gathers, in order to achieve and maintain the population within AML range. Follow-up gathers to remove excess animals to achieve low AML would be conducted as promptly as appropriate to allow sufficient time for the animals to settle after a helicopter gather and to provide for safe, efficient, and effective follow-up gather operations. [11]
- Apply fertility control methods (vaccines or other approved method of fertility control) to released mares.
- Maintain a sex ratio adjustment of 60% male and 40% female
- Population inventories and routine resource/habitat monitoring would continue to be completed every two to three years to document current population levels, growth rates, and areas of continued resource concerns (WH&B concentrations, riparian impacts, over-utilization, etc.)
- Once AML is achieved, selective removal would occur and WH&Bs that are 10+ years old; that display good conformation and a variety of colors would be selected first to be placed back in the complex.
- Preserve and perpetuate a frequency of the unique spotted and pinto burros in the population.
- WH&Bs from the Complex would be sampled for genetic diversity at the time of the first gather, and periodically after that. If genetic diversity declines, a few mares/jennies from another HMA outside the Complex would be introduced to the Complex.
- Fertility control methods may be used as directed through the most recent direction of the National Wild Horse and Burro Program. The use of any fertility control methods would use the most current best management practices and humane procedures available for the implementation of the controls.
- Manage a portion of the population as permanently non-reproducing. This would be no more than approximately ¼ of the population at low AML and refers only to mares that are sterilized with a minimally-invasive physical procedure and/or stallions that have been gelded.
- The existing water development projects within the Blue Wing Complex would be maintained as needed to ensure that water availability is adequate to disperse WH&B use and ensure that water is available for WH&Bs year-round.
- Subject to funding and time availability: develop Unnamed Spring 78-40, build exclosure to protect the springhead from damage, and pipe the water to a trough in the valley bottom in order to better disperse WH&B use and add available water within the Blue Wing Complex. See Appendix XIV of the Blue Wing Complex Gather and HMAP Environmental Assessment (DOI-BLM-NV-W010-2024-0027-EA) for proposed project map.
- When AML is achieved and maintained it could be re-evaluated, as needed, based upon the collection of monitoring data such as actual use, forage utilization, use pattern mapping, range condition and trend.
- The Blue Wing HMAP would remain in effect until superseded by another document.

Alternative B: Alternative B is the same as Alternative A but would not manage a portion of the population as permanently non-reproducing (sterilized mares, geldings).

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[11] While the BLM's plan would be to immediately remove all excess animals above low AML and include enough mare fertility control treatments to slow population growth, it is possible that a single gather would not achieve this because of limitations such as on gather efficiency, logistics, space capacity for holding removed animals, or contractor availability. The result would be a need to conduct a follow-up gather or gathers to achieve low AML.

Alternative C: Under Alternative C, Implement HMAP with management strategy, gather and remove excess animals to within the AML range without fertility control, sex ratio adjustments or permanently non-reproducing component. See Management Objectives with Proposed Alternatives.

MANAGEMENT ACTIONS

- Future gather operations would be conducted in accordance with the SOPs described in and outlined in appendices of the Blue Wing Complex Gather and HMAP Environmental Assessment (DOI-BLM-NV-W010-2024-0027-EA) and/or the National Wild Horse and Burro Gather Contract.
- Future gather operations would be conducted in accordance with the most current direction and policies from the Washington Office and Nevada State Office.
- WH&B gathers would be conducted during the gather season from July 1- March 1 except in unforeseen emergency, to reduce stress on the younger animals. The helicopter drive method and helicopter assisted roping from horseback would be the primary gather methods used although water and or bait trapping may be used in some circumstances for isolated issues that may arise.
- To the extent possible gather sites (traps) would be located in previously disturbed areas.
- During gathers, when space and funding allow an attempt would be made to gather all of the excess WH&Bs within the Complex to achieve a population within the range of AML. All WH&Bs residing outside of the HMA boundary would also be gathered and removed.
- An Animal and Plant Inspection Service (APHIS) or other licensed veterinarian would be on-site or on call as needed during gathers, to examine animals and make recommendations to BLM for the care and treatment of the WH&Bs. Decisions to humanely euthanize animals in field situations would be made in conformance with BLM policy.
- Data including sex and age distribution, condition class information (using the Henneke rating system), color, and other information may be recorded (for animals being released).
- Any horses gathered and determined, with consultation between BLM and Nevada Livestock Board brand inspectors, to be domestic animals would be turned over to the local brand inspector in accordance with state law.

Management Objectives with Proposed Alternatives.

Management Objective(s)	Monitoring Objective(s)	Implementation Objective(s)
Proposed Action Alternative A • Implement HMAP with a management strategy which would include several population growth suppression methods. • Complex would be managed for 333-553 wild horses and 55-90 burros • Excess animals would be removed to the low-range of the AML upon a determination that excess WH&Bs exist. • Immediately gather and remove excess animals in order to reach low AML as expeditiously as possible through an initial gather, and if necessary, a follow-up gather or gathers, in order to achieve and maintain the population within AML range. Follow-up gathers to remove excess animals to achieve low AML shall be conducted as promptly as appropriate to allow sufficient time for the animals to settle after a helicopter gather and to provide for a safe, efficient, and effective follow-up gather operation. [12] • Apply fertility control methods (vaccines or other approved method of fertility control) to released mares • Maintain a sex ratio adjustment of 60% male and 40% female • Population inventories and routine resource/habitat monitoring would continue to be completed every two to three years to document current population levels, growth rates, and areas of continued resource concerns (WH&B concentrations, riparian impacts, over-utilization, etc.) • Once AML is achieved selective removal would occur and WH&Bs that are 10+ years old; that display good conformation and a variety of colors would be selected first to be placed back in the complex. • Preserve and perpetuate a frequency of the unique spotted and pinto burros in the population. • WH&Bs from the Complex would be sampled for genetic diversity at the time of the first gather, and periodically after that. If genetic diversity declines, a few mares/jennies from another HMA would be introduced to the Complex. • Fertility control methods may be used as directed through the most recent direction of the National Wild Horse and Burro Program. The use of any fertility control methods would use the most current best management practices and humane procedures available for the implementation of the controls. • Manage a portion of the population as permanently non-reproducing. This would be no more than approximately ¼ of the population at low AML and could include mares that are sterilized with a minimally-invasive physical sterilization procedure and/or stallions that have been gelded. • The existing water development projects within the Blue Wing Complex would be maintained as needed to ensure that water availability is adequate to disperse wild horse and burro use and ensure that water is available for WH&Bs year-round. • Subject to funding and time availability: develop Unnamed Spring 78-40, build exclosure to protect the springhead from damage, and pipe the water to a trough in the valley bottom in order to better disperse WH&B use and add available water within the Blue Wing Complex. See Appendix XIV of the Blue Wing Complex Gather and HMAP Environmental Assessment (DOI-BLM-NV-W010-2024-0027-EA) for proposed project map. • When AML is achieved and maintained it could be re-evaluated, if needed, based upon the collection of monitoring data such as actual use, forage utilization, use pattern mapping, range condition and trend. • The Blue Wing HMAP would remain in effect until superseded by another document.		

[12] While the BLM's plan would be to immediately remove all excess animals above low AML and include enough mare fertility control treatments to slow population growth, it is possible that a single gather would not achieve this because of limitations such as on gather efficiency, logistics, space capacity for holding removed animals, or contractor availability. The result would be a need to conduct a follow-up gather or gathers to achieve low AML.

Management Objective(s)	Monitoring Objective(s)	Implementation Objective(s)
A. Control Population Numbers Manage WH&B populations within the AML range to protect the range from deterioration associated with overpopulation.	Conduct population inventories a minimum of once every 3 years. Conduct gathers and additional inventories as funding and time allow. Determine wild horse and burro herd size.	Schedule gathers to remove excess wild horses and burros when the total population exceeds the Upper AML for the Complex (about every 5-6 years), when animals routinely reside on lands outside the Blue Wing Complex boundary (i.e. use is more than seasonal drift), or whenever animal health/condition is at risk.
B. Additional Population Control Measures **Objective 1:** When low AML is achieved consider population control methods as needed. **Objective 2:** Adjust the sex ratio of the breeding population slightly in favor of males.	Monitor annual population growth rate. Document the number of stallions/mares released following each gather.	Manage a population of 333-553 horses and 55-90 burros within the Complex. New population control vaccines and/or population growth suppression methods may be used within the Complex as directed through the most recent direction of the National Wild Horse and Burro Program. The use of any new fertility control methods and/or population growth suppression methods would use the most current best management practices and humane procedures available for the implementation of the new controls. Manage a portion of the population as permanently non-reproducing. This would be no more than approximately ¼ of the population at low AML and could include mares that are sterilized with a minimally-invasive physical sterilization procedure and/or stallions that have been gelded. Within the population, achieve a sex ratio of 60 males to 40 females immediately following gathers.
C. Age Distribution Assure all age classes are represented post-gather.	Monitor post-gather results.	Manage wild horse and burros to achieve the following approximate relative age distribution following gathers: • 20% Young Age Class (Ages 0-4) • 50% Middle Age Class (Age 5-10) • 30% Old Age Class (Age 11+)
D. Additional Selective Removal Criteria After achieving AML maintain or improve animal conformation and color.	Monitor herd health and genetic diversity levels during gather. Monitor wild horses and burros released back into the Complex.	Selective removal criteria after achieving AML. (1) First Priority: Age Class Four Years and Younger (2) Second Priority: Age Class Eleven to Nineteen Years Old (3) Third Priority: Age Class Five to Ten Years Old

Management Objective(s)	Monitoring Objective(s)	Implementation Objective(s)
		Once AML is achieved selective removal would occur and focus on returning animals to the range post-gather that are 10+ years old; that display good conformation; and a variety of colors would be selected first to be placed back in the Complex, which may include the following herd characteristics such as pintos, roans, and a variety of colors from grey to black in horses, and spotted or pinto burros.
Alternative B: Same as Alternative A but would not include a permanently non-reproducing component. Under alternative B, Management objectives would be the same but would not include managing a portion of the population as permanently non-reproducing.		
Alternative C: Under Alternative C, gather and remove excess animals to within the AML range without fertility control, sex ratio adjustments, or permanently non-reproducing component.		
Gate Cut removal	Monitor and document the population of WH&Bs for range capacity of TNEB.	Capture and remove all WH&Bs to AML. Implementation of fertility control, sex ratio adjustments or non-reproductive component would not take place.
Alternatives A, B, and C		
E. Assure Genetic Diversity Maintain adequate levels of genetic diversity within the herd, so as to avoid excessive levels of inbreeding.	Collect hair samples every regularly scheduled gather to detect any changes in observed heterozygosity (H_o=0.431 in 2000 and H_o=0.320 in 2004-2005 using blood-based markers; H_o=0.783 at Shawave Mountains HMA using DNA-based markers).	If genetic diversity declines, wild horses and/or burros may be introduced from similar complexes.
F. Sustain Healthy Populations of Wild Horses Manage wild horses and burros to achieve an average body condition class score of 3+.	Visually observe WH&B body condition (Henneke Condition Class Method) throughout the year. Record average body condition and document during periodic gather and population inventory operations.	Maintain existing water developments to assist in limiting the distance WH&Bs trail to and from water sources. Develop Unnamed Spring 78-40 when funding and time becomes available. Conduct emergency removals when needed if animal body condition is less than Henneke Condition Class Score 3 due to lack of forage, water, drought, wildfire, or unplanned/unforeseen event.
G. Rangeland Health	Locate additional key	Achieve and maintain AML.

Management Objective(s)	Monitoring Objective(s)	Implementation Objective(s)
Objective 1. Achieve and maintain AML. **Objective 2.** Assess rangeland health on BLM administered lands. **Objective 3.** Limit utilization by all herbivores to 50% of the current year's above ground primary production for key species. In GRSG habitat, limit utilization to 40% of current year production on herbaceous key plant species and 35% on shrub key species species.	monitoring areas within the Complex as needed. Measure forage utilization at key areas for wild horses and burros, with use pattern mapping Bi-annually to the extent possible.	Continue to assess and work on Rangeland Health Assessments. Analyze rangeland health through the collection of vegetative trend, cover, precipitation, forage utilization and use pattern mapping periodically. Establish additional site-specific resource management objectives for key areas, as needed. Based on above, re-adjust AML or conduct wild horse and burro removals to address/resolve rangeland health issues, as needed/appropriate. Re-adjustments in AML would be based on vegetation monitoring, herd monitoring and water availability as the limiting factors.
H. Riparian Area Health Achieve and maintain AML, Maintain / Improve riparian condition throughout the Complex.	Re-evaluate riparian functionality. Use the Proper Functioning Condition (PFC) method on heavily impacted areas within the complex.	Gather horses and burros to within the AML range to reduce users and maintain existing water sources or develop new water sources as needed to lessen wild horse use of the riparian areas.
No Action Alternative Under the No Action Alternative, a gather to remove excess WH&Bs would not occur. There would be no active management to control population growth rates, the size of the wild horse and burro population or to bring the wild horse and burro population to AML.		
I. Under the No Action alternative BLM would not comply with the WFRHBA and would not meet the purpose and need for the HMAP or E.A. No gather would occur, wild horse and burro populations would continue to grow at an estimated 15-20% annually.	Conduct WH&B inventories. Rangeland Health Assessment.	WH&B population and health inventories would continue every 3 years. Rangeland Health would continue to be monitored and assessed.

Management Objective(s)	Monitoring Objective(s)	Implementation Objective(s)

MONITORING PLAN

Population Management Monitoring				
Monitoring Item	**How**	**Who**	**When**	**Actions to Take (Adaptive Management)**
Manage WH&B populations within the established AML range to protect the range from further deterioration associated with overpopulation.	Population Inventories through aerial flights following established protocols. Determine population number and annual growth rate.	BLM WH&Bs Specialist, with assistance from State and National WH&Bs Staff and other Field Office Staff	Conduct Population Inventories in the HMA a minimum of every three years. Schedule flights in February- April when possible, to utilize snow cover to obtain better tracking conditions and complete counts before peak foaling season.	Schedule gathers to remove excess WH&Bs when the total population exceeds the Upper AML, when animals permanently reside outside the Blue Wing Complex, or when animal health/condition is at risk.
Assure all age classes are represented post gather.	Record ages of animals released post-gather.	BLM WH&Bs Specialist	Every gather.	Adjust age class distribution during future gathers if the desired approximate age distribution cannot be achieved during the current gather.
Maintain genetic diversity (avoid inbreeding depression).	Hair follicle samples would be collected during regularly scheduled gathers to detect any changes from the baseline genetic diversity, and to determine whether BLM's management is maintaining acceptable genetic diversity levels (avoiding inbreeding depression).	BLM WH&Bs Specialist	Every regularly scheduled gather.	If needed, introduce mares/jennies from another Nevada HMA displaying similar or desired characteristics of the horses and burros within the complex to improve the genetic diversity.
Manage WH&Bs to achieve an average	Visually observe WH&B body condition (Henneke	BLM WH&Bs	Annually, at key water locations particularly	Conduct emergency removals when needed if animal body condition is less than Henneke body condition

Population Management Monitoring				
Monitoring Item	**How**	**Who**	**When**	**Actions to Take (Adaptive Management)**
Henneke body condition class score of 3+.	condition class method). Record average body condition and document other health conditions (i.e. lameness, clubfoot etc.) during periodic gather operations.	Specialist	during periods of hot weather/drought. Every gather and population inventory.	score 3 due to drought, wildfire, or other unplanned/unforeseen event.
Following achievement of AML, apply population growth suppression, adjust the sex ratio of the breeding population slightly in favor of males following future gathers.	Document population growth suppression and the number of stallions/mares released following each gather. Monitor individual and herd behavior following the gather.	BLM WH&Bs Specialist	Following achievement of AML every gather.	Apply population growth suppression to animals being released. Adjust the sex ratio to 60 males / 40 females following future gathers pending monitoring results.
Habitat Management Monitoring				
Monitoring Item	**How**	**Who**	**When**	**Actions to Take (Adaptive Management)**
Assess Rangeland Health approximately every 10 years on BLM administered lands with the objective to meet the Rangeland Health Standards.	Assess rangeland health using procedures outlined in the rangeland health technical reference adopted by the local district office. Re-evaluate riparian functionality using the Proper Functioning Condition (PFC) method.	BLM WH&Bs Specialist Range Specialist and or and HRFO ID team.	Approximately every 10 years	Monitor existing key areas, establish new key areas as needed. Based on the above, re-adjust AML or conduct gather/removal actions to address/resolve identified rangeland health issues, as needed/appropriate.
Limit utilization by all herbivores to 50% of the current year's above	Measure utilization at key areas.	BLM WH&Bs Specialist	Biannually, in the spring prior to the growing season.	Maintain the wild horse population within the AML range.

Population Management Monitoring				
Monitoring Item	**How**	**Who**	**When**	**Actions to Take (Adaptive Management)**
ground production for key species. In GRSG habitat, limit utilization to 40% on herbaceous key plant species and 35% on shrub key species species.				
Maintain or improve vegetative trend within the HMA.	Evaluate vegetative trend.	BLM WH&Bs Specialist	Evaluate overall health every approximately 5-10 years with data collected.	Adjust AML, as needed, pending evaluation of monitoring results.
Monitor/assess annual project maintenance needs.	Site visits at water sources.	BLM WH&Bs Specialist	As needed, throughout the year.	Schedule and complete any necessary maintenance work. Document maintenance activities.

TRACKING LOG/PROJECT IMPLEMENTATION SCHEDULE

Population Management Actions					
Description	**Who**	**Where**	**When**	**Completed**	**Remarks**
Conduct WH&B population inventories.	BLM	Blue Wing Complex	Every 2-3 years. Winter or early spring.		
Schedule gathers to remove excess WH&Bs when the total WH&B population exceeds the Upper AML for the Complex.	BLM	Blue Wing Complex	Gathers to remove excess WH&Bs would be dependent on funding, space availability and national gather schedule. Once Low end of AML is achieved it is anticipated Every 4-5 or as soon as possible once population exceeds High AML.		
Gather within the AML range and apply population growth suppression to any animals being released back into the complex. Adjust the sex ratio of the breeding population slightly in favor of males. Manage a Portion of the population as a non-reproductive herd.	BLM	Blue Wing Complex	When post gather population is within the AML range.		
Assure all age classes are represented post-gather.	BLM	Blue Wing Complex	Every gather.		
Prioritize euthanasia/ removal of any injured, sick, and/or lame WH&Bs from the herd.	BLM	Blue Wing Complex	Every gather.		
Collect hair follicle samples to determine whether BLMs management is maintaining acceptable genetic diversity (avoiding inbreeding depression).	BLM	Temporary holding facility and/or short-term holding facility.	Every regularly scheduled gather from a minimum of 25 animals, preferably from those animals that are being released back into the Complex.		

Population Management Actions					
Description	**Who**	**Where**	**When**	**Completed**	**Remarks**
Gather within the AML range and apply population growth suppression to any animals being released back into the complex. Selectively release animals post-gather in a ratio of 60 males /40 females.	BLM	Temporary holding facility.	Every gather.		

Habitat Management Actions					
Description	**Who**	**Where**	**When**	**Completed**	**Remarks**
Collect forage utilization data / conduct use pattern mapping.	BLM	Blue Wing Complex	Every other year.		
Assess the Complex for Conformance with the Rangeland Health Standards.	BLM	Blue Wing Complex	Periodically as resources allow.		
Maintain existing water sources and develop new water sources when funding becomes available.	BLM	Throughout Blue Wing Complex	Annually. Develop new as needed.		

HERD MANAGEMENT AREA PLANNING MONITORING AND EVALUATION

Proven mitigation and monitoring are incorporated through standard operating procedures (SOPs) that have been developed over time. These SOPs represent the "best methods" for reducing impacts associated with gathering, handling, transportation, and herd data collection. The Blue Wing Complex would be monitored as outlined in the Monitoring Plan. Management may be adjusted when monitoring data and/or other information indicates a need. In addition to monitoring, long-term evaluations would continue at roughly ten-year intervals, or as needed, based on the results of bi-annual evaluations. Monitoring objectives are outlined in the Monitoring Plan. Monitoring is designed to answer two primary questions:

"Did we do what we said we were going to do?"
"Was what we did effective in meeting/moving toward our objectives?"

The objective for the long-term evaluation is to determine:

"Are our objective(s) still current…or do they need to be modified?"
"Is our management on track…or do we need to make some changes?"

Significant changes needed as a result of annual or long-term evaluations may require appropriate NEPA analysis and documentation prior to implementation.

CONSULTATION AND COORDINATION

The consultation and coordination conducted in preparing this herd management area plan is summarized in the Blue Wing Complex Wild Horse Herd Management Area Plan and Gather Plan Environmental Assessment. Please refer to that environmental assessment for additional information and appendices.

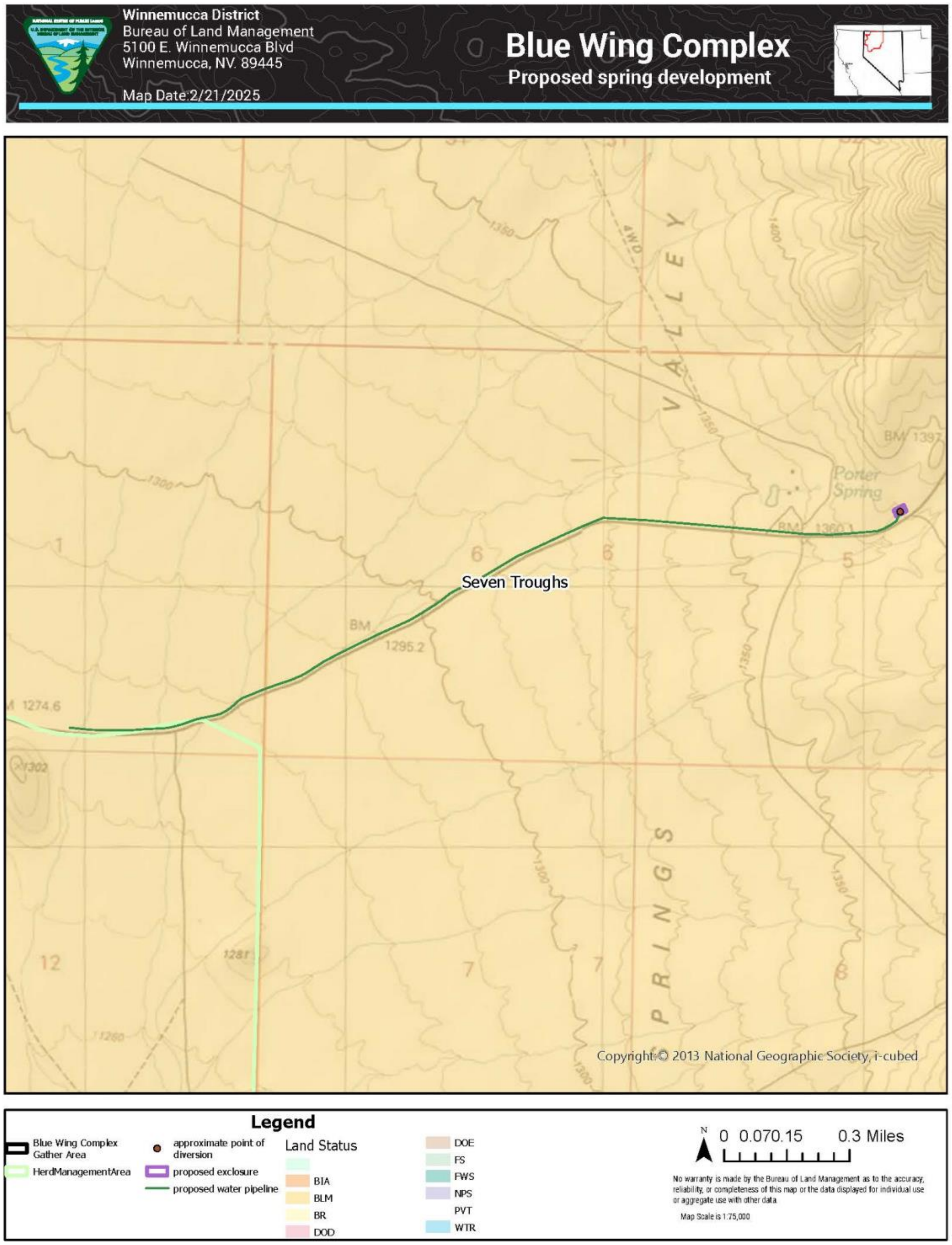
List of Preparers

Brianna Brodowski Wild Horse and Burro Specialist, HRFO

APPENDIX XIV- PROPOSED WATER DEVELOPMENT

Proposed development of Unnamed Spring 78-40.

Map 11. Proposed location of pipeline and exclosure for development of Unnamed Spring 78-40



Unnamed Spring 78-40, photo facing north

Unnamed Spring 78-40, photo facing east

Riparian area around Unnamed Spring 78-40, photo facing south towards spring source and road

APPENDIX XV- MANAGEMENT EVALUATION REPORT FOR BLUE WING COMPLEX

Blue Wing Complex Herd Management Areas
Management Evaluation Report
May 2024

INTRODUCTION

The Blue Wing Complex (Complex) is located in western Pershing County, approximately 65 miles northeast of Reno, Nevada. Elevation in the Complex ranges from 3,450 feet long the valley floor to over 8,200 feet. Summers are extremely hot, and winters can range from mild to bitterly cold. Annual precipitation is approximately 4 to 8 inches per year. About half of the precipitation falls during the winter season from October to February, with the remainder coming in high intensity summer thunderstorms. The Complex consists of the Blue Wing Mountains, Kamma Mountains, Lava Beds Seven Troughs, and Shawave Mountains Herd Management Areas (HMA) and the Antelope Range, Eugene Mountains, Selenite Range, Trinity Range, and Truckee Range Herd Areas (HA).

Blue Wing Complex Land Status

Ownership	Acres	Percent of HMA
Public	981,062	83%
Private	205,725	17%
Total	1,186,787*	100%

*This does not include lands outside the HMA and HA boundaries, the total Complex is 2,283,300 acres.

The HMAs and HAs were established in 1971, but the BLM determined that it would manage them as a Complex in 1986. Since then, the BLM has managed WHB in the Complex in accordance with the 1994 Final Multiple Use Decision, the 1999 Management Agreement, gather and population management plans, and the 2015 Winnemucca Resource Management Plan.

The goal of the Humboldt River Field Office (HRFO), which manages the Complex, is to protect, manage, and control healthy WHB populations within established HMAs at Appropriate Management Levels (AML) in a manner designed to achieve and maintain a Thriving Natural Ecological Balance (TNEB) and multiple-use relationship on public lands.

WILD HORSES AND BURROS

Following is the approximate wild horse and burro population in the Complex since 1999:

Year	Estimated Population	Year	Estimated Population	Year	Estimated Population
1999	1,024	2008	685	2017	3,270
2000	1,032	2009	836	2018	3,909
2001	847	2010	961	2019	4,633
2002	1,077	2011	1,059	2020	3,057
2003	1,675	2012	1,298	2021	3,668

2004	1,010	2013	1,577	2022	3,020
2005	1,112	2014	1,876	2023	2,493
2006	478	2015	1,065	2024	2,268
2007	567	2016	2,321		

The table above was created using formal wild horse and burro population inventory data, as well as ground-based observations and estimates in years that a formal population inventory was not conducted. Estimates reflect the total number of wild horses, not just adult horses. Population inventories are usually conducted in late fall or winter, when it is very difficult to distinguish current year foals accurately. The BLM conducted gathers and removals of excess WHB in 1999, ~~200~~ 2000[13], 2003, 2005, 2013, 2019, 2020, 2021, and 2022, resulting in lower population numbers the following years.

The Blue Wing/Seven Troughs Final Multiple Use Decision (FMUD) (1994) and the subsequent Management Agreement (1999) set the Appropriate Management Level (AML) for WHB as follows:

Herd Management Area	Wild Horses	Wild Burros	Total Animals
Blue Wing Mountain	36	28	64
Kamma Mountains	77	0	77
Lava Beds	148	16	164
Seven Troughs	156	46	202
Shawave-Nightengale	136	0	136
Total	553	90	643

The approved Winnemucca District RMP (2015) established an AML range based on the previous decisions and AML is now set as follows:

Herd Management Area	Wild Horses	Wild Burros	Total Animals
Blue Wing Mountain	22-36	17-28	39-64
Kamma Mountains	46-77	0	46-77
Lava Beds	89-148	10-16	99-164
Seven Troughs	94-156	28-46	122-202
Shawave Mountains	82-136	0	83-136
Total	333-553	55-90	388-643

Genetic testing was completed on wild horses in the complex following gathers in 2004 and 2005. Genetic samples were analyzed by Dr. E. Gus Cothran, Department of Veterinary Science, Texas A&M University. His conclusions and recommendations regarding genetic diversity in the complex are summarized below:

> "Genetic variability is over below the feral average and for two of the HMAs below the critical level most likely due to small population size. Allelic diversity could decrease due to the number of rare alleles for these herds. The herd appears to be of mixed origins, possibly with some Arabian type blood but most likely mainly of North American stock."

[13] April 2025 Correction: Updated year from "200" to "2000"

> "The AML of these herds is very small and the already critically low variability could decline rapidly if no action is taken and the herd size remains small and if the herd is isolated from other herds. The ability of these herds to travel over the complex should help but does not seem to have done so at this point, at least for these three areas. The [southern] HMAs such a Shawave Mountain might be considered as a source for adding horses from outside the immediate herd area which should be considered."
>
> "Genetic Variation: Genetic variation, as indicated by heterozygosity, in the Blue Wing Complex is below the feral mean but is above the critical low level. Individual HMA *Ho* was 0.30 for Lava Beds, 0.31 for Seven Troughs and 0.38 for Kamma. Both Lava Beds and Seven Troughs have values at or below the critical low value. *Ho* is lower then *He* which is expected when populations are mixed."

Since the Complex was established, the WHB population has ranged from a low population of 478 total animals to a high of 4,633 as a high, to the current estimated population (as of March 1, 2024) of 1,912 wild horses and 356 wild burros or 2,268 total animals.

OTHER RESOURCES

The Complex provides habitat for a variety of wildlife species, including crucial winter and winter/yearlong habitat for mule deer and pronghorn antelope, wintering, breeding, nesting, foraging, and brood rearing habitats for sagebrush obligate bird species like greater sage-grouse, sage thrasher, sage and Brewer's sparrow. The Complex also provides suitable habitat for pygmy rabbits, big horn sheep and burrowing owls.

Rangelands within the Complex are permitted for 47,872 AUMs of domestic livestock grazing. Approximately half of this livestock grazing has been in voluntary non-use for many years due to the overpopulation of WHB. Actual livestock grazing in the Complex has averaged less than 60 percent of permitted use since 2013.

HISTORIC OBJECTIVES

The 1994 FMUD and the subsequent 1999 Management Agreement established the desired rangeland conditions and population levels for the Complex. Below is a description of the management objectives or desired condition for the herd and its habitat.

1. Maintain and improve the free-roaming behavior of wild horses by:
   a. Protecting their home range
   b. Assuring free access to water
2. Maintain or improve the rangeland ecological status within the HMAs utilizing the criteria and time frames established in the Blue Wing-Seven Troughs Monitoring Plan, 1985.
3. Maintain a healthy herd of animals within the established AML.
4. Establish forage use levels for WHB population through monitoring of habitat.
5. Preserve and perpetuate the unique spotted and pinto burro population.
6. Determine the dietary preferences of WHB within the complex.

Winnemucca District RMP Objectives:

1. Objective WHB 1: Administer HMAs to support healthy populations and achieve land health standards for WHB where a TNEB and multiple-use relationship can be achieved and maintained.
2. Objective WHB 2: Maintain the free-roaming nature of WHB within HMAs.
3. Objective WHB 3: Ensure WHB have safe, unencumbered access to water within HMAs.
4. Objective WHB 4: Protect WHB from harm, harassment, disease, and illegal capture.
5. Objective WHB 5: Maintain Appropriate Management Levels within HMAs.

MANAGEMENT ISSUES

The key components for maintaining a healthy WHB population are forage, water, cover, and space. Cover and space are plentiful for WHB within the Complex. Forage availability is a limiting factor due to the overpopulation of WHBs along with past drought conditions, particularly in preferred WHB use areas. The lack of fencing separating the HMAs and HAs within the Complex can lead to management issues, as WHB traversing the Complex with the seasons in search of forage and water. Much of the acreage outside of the HMA boundaries is in the checkerboard land status making management of WHB in these areas very difficult. Water is an extremely limited resource within the Complex and consequently water becomes a limiting factor when WH&B populations exceed high AML. Water availability is inconsistent across the Complex. There are springs, seeps, and perennial streams in the Complex; some water sources are experiencing decreased flows and a few have dried completely. There are range improvements (wells and troughs) developed for livestock management within the Complex; however, BLM does not have water rights on most of them. The natural and developed water sources available within the Complex are insufficient for the excess numbers of WH&Bs, and this situation is further exacerbated by drought conditions. Due to WH&Bs concentrating near limited available water sources, available forage is being negatively impacted. This is reflected in degraded range conditions in and outside HMAs and HAs within the Blue Wing Complex. Currently, vegetation is being heavily impacted by WH&B use up to 2 miles from water sources. This radius is growing as additional WH&B use increases in proximity to springs and wells. Additionally, heavy trailing to water sources is creating extreme dust conditions which can and has contributed to respiratory illness in WH&Bs. The conditions of many of the springs available to the wild horses and burros are muddy from being pawed out due to the low production of water. The BLM is not currently supplementing any natural water sources within the Complex for WH&Bs. Within the Complex, water has occasionally been provided by livestock permittees in order to meet the needs of their livestock as well as supplement the large numbers of WH&Bs in excess of the current established AML. During the winter months, many of the water sources will freeze and no longer be viable sources for WH&Bs in the area. Unless adequate snow events occur, this may cause the WH&Bs to travel much longer distances to water.

FUTURE MANAGEMENT

The HRFO intends to prepare an HMAP to guide management of the WHB within the Blue Wing Complex and their habitat into the future. The HMAP will address the following management objectives:

- Sustain healthy populations of WHB
- Disperse WHB use
- Control population numbers
- Assure rangeland and riparian health
- Maintain Greater Sage-Grouse habitat
- Other issues as identified

APPENDIX- XVI REFERENCES, GLOSSARY AND ACRONYMS

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Acronyms

AML- Appropriate Management Level
AUM – Animal Unit Month
BLM-Bureau of Land Management
BIA- Bureau of Indian Affairs
CFR-Code of Federal Regulations
DR-Decision Record
EA-Environmental Assessment
EIS-Environmental Impact Statement
FLPMA-Federal Land Policy and Management Act
FMUD- Final Multiple Use Decision
FONSI-Finding of No Significant Impact
HA – Herd Area
HMA – Herd Management Area
ID-Interdisciplinary
IM-Instructional Memorandum
NEPA-National Environmental Policy Act
RFS-Reasonably Foreseeable Future Action
RMP-Resource Management Plan
WFRHBA- Wild Free Roaming Wild Horses and Burros Act
WH&Bs- Wild Horses and Burros