BLM

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Stone Cabin Complex
Wild Horse Gather Plan
Preliminary
Environmental Assessment

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1.0 Introduction

This Environmental Assessment (EA) has been prepared to disclose and analyze the environmental effects of the Proposed Action or alternatives to the Proposed Action, which consists of gathering and removing excess wild horses from the Stone Cabin Herd Management Area (HMA) and Saulsbury HMA, referenced throughout this document as the “Stone Cabin Complex” or “the complex”, along with the application of population growth suppression methods. Refer to Map 1 below, which displays the gather area for the Stone Cabin Complex.

The Proposed Action gather plan would allow for an initial gather with subsequent, follow-up gathers to be conducted over the next 10 years from the date of the initial gather operation in order to achieve and maintain Appropriate Management Levels (AMLs) and continue fertility control management. This EA will assist the Bureau of Land Management (BLM) Tonopah Field Office (TFO) in project planning and ensuring compliance with the National Environmental Policy Act (NEPA), and in making a determination as to whether any significant effects could result from the analyzed actions. Following the requirements of NEPA (40 CFR 1508.9 (a)), this EA describes the potential impacts of a No Action Alternative and the Proposed Action for the Stone Cabin Complex. If the BLM determines that the Proposed Action for the Complex 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 conforms to the following documents:

- The Tonopah Resource Management Plan (RMP) and subsequent Record of Decision dated October 1997.
- Nevada and Northeastern California Greater Sage-Grouse Approved Resource Management Plan Amendment (BLM 2015).

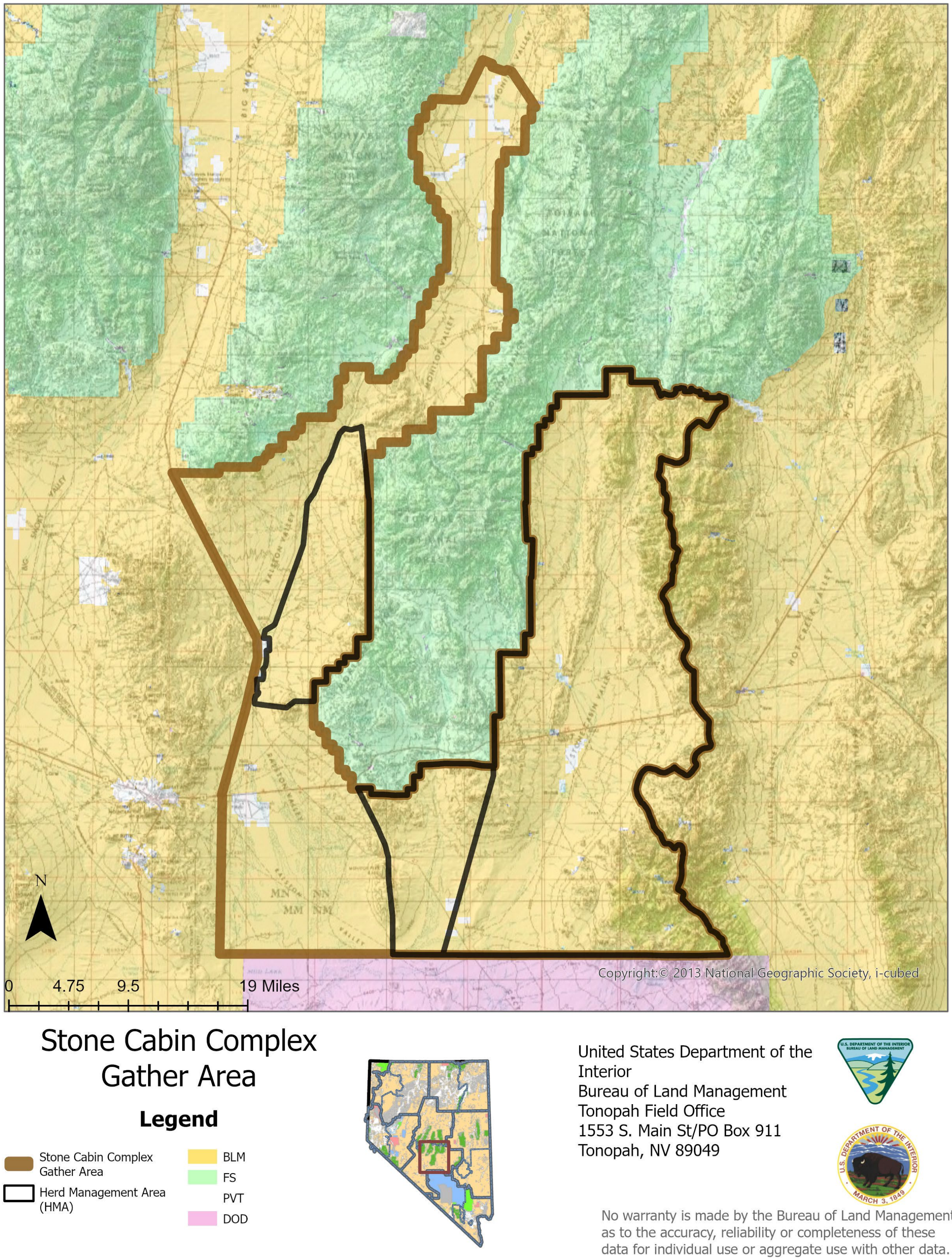
1.1 Background

The Stone Cabin Complex includes the Stone Cabin and Saulsbury Herd Management Areas. The proposed gather area includes the Stone Cabin HMA, the Saulsbury HMA and areas outside of HMA boundaries in the Ralston, Hunts Canyon, and Monitor grazing allotments. The Stone Cabin HMA is located approximately 30 miles east of Tonopah in Nye County, Nevada, and primarily includes Stone Cabin Valley, both north and south of Nevada State Highway 6, bordering the Nevada Test and Training Range and the Nevada Wild Horse Range to the south. The Saulsbury HMA is divided into 2 parcels. The southern unit of the HMA is located immediately west of the Stone Cabin HMA, south of Highway 6. This southern portion is bordered to the east by the Stone Cabin HMA and to the south by Nevada Test and Training Range. The northern parcel of Saulsbury HMA is north of Highway 6 and is bordered to the east by U.S. Forest Service Administered lands and the Monitor Wild Horse Territory (WHT). The proposed gather area includes areas within and outside of the HMA boundaries throughout the Stone Cabin, Ralston, Reveille, Hunts Canyon, and a portion of the Monitor Allotment. These areas fall under the jurisdictional boundaries of the BLM TFO. Though the Monitor WHT is located in between the Saulsbury and Stone Cabin HMAs, wild horse management on the Monitor WHT is conducted by the US Forest Service and thus is not included in the proposed gather area. Refer to Map 1 which displays the proposed gather area. The Stone Cabin HMA is 407,706 acres and Saulsbury HMA includes 135,018 acres. The total proposed gather area represents 542,724 acres within the Stone Cabin Complex HMAs, and 343,457 acres outside of designated HMAs, in areas primarily adjacent to HMAs where wild horses have moved or may move to during gather activities.

Since the passage of the *Wild Free-Roaming Horses and Burros Act of 1971* (WFRHBA), management knowledge regarding wild horse population levels has increased. For example, it has been determined that wild horses are capable of increasing their numbers by 15% to 25% annually, resulting in the doubling of wild horse populations about every 4 years (NRC 2013, Ransom et al. 2016). This has resulted in the BLM shifting program emphasis beyond just establishing AML and conducting wild horse gathers to include a variety of management actions that further facilitate the achievement and maintenance of stable wild horse populations and allow for a "thriving natural ecological balance". This includes issuing 10-year decisions to manage wild horse populations – rather than a single year gather decision. Because it can take many years for degraded resources to recover, a longer management time frame is needed to provide a sufficient period of time during which the wild horse population is managed at AML, in order to allow degraded range resources to slowly recover. Management actions resulting from shifting program emphasis include increasing fertility control, adjusting sex ratios and collecting genetic baseline data to support genetic diversity assessments.

Further evidence of the shift in program emphasis beyond just establishing AML can be seen when examining the Standards and Guidelines for Wild Horse and Burro Management from the Mojave-Southern Great Basin and Northeastern Great Basin Resource Advisory Council (RAC) standards and guidelines for rangeland health (section 1.3). Under the RAC, guidelines for the Wild Horses and Burros Standard guideline 4.7 states: "Wild horse and burro herd management practices should address improvement beyond this standard, significant progress toward achieving standards, time necessary for recovery, and time necessary for predicting trends".

The AML is defined as the number of wild horses that can be sustained within a designated HMA which achieves and maintains a thriving natural ecological balance[1] in keeping with the multiple-use management concept for the area. The AML for the Stone Cabin HMA, and a portion of the Saulsbury HMA were established through a Consent Decision signed by Administrative Law Judge David Torbet on May 11, 1992, through the Department of Interior Office of Hearings and Appeals, Hearings Division. The Consent Decision established an AML for the Stone Cabin Allotment (and HMA) of 364 wild horses, and the Ralston Allotment portion of the Saulsbury HMA at 10 wild horses. The AML for the portion of the Saulsbury HMA in the Hunts Canyon Allotment was established as 30 wild horses through a Final Multiple Use Decision (FMUD) in 1996. The FMUD was issued following an interdisciplinary analysis of monitoring data, the completion of an Allotment Evaluation for the allotment, and the involvement of interested public.



Map 1. Gather area for the Stone Cabin Complex wild horse gather.

Table 1. Herd Management Area name, Acres, AML, July 2021 Estimated Population, Fall 2022 Estimated Population, minimum number for removal to reach low AML within the proposed gather area under the Proposed Action (Alternative A).

HMA Name	Total Acres Private/Public land	Appropriate Management Level	2021 Estimated population	Fall 2022 Estimated population	Removal to Achieve Low AML
Stone Cabin HMA	403,736	218 - 364	864	651	433
Saulsbury HMA	81,152	24 - 40	233	280	256
Total	484,888	242 - 404	1,097	931	689

BLM has not issued a Herd Management Area Plan (HMAP) document for the Stone Cabin or Saulsbury HMAs. The Interior Board of Land Appeals has held that an HMAP is not a prerequisite to BLM conducting a gather operation (*Animal Protection Institute of America*, 109 IBLA 112, 127 (1989)), so long as the record otherwise substantiates compliance with the WFRHBA. Based on all available information, BLM has determined under the WFRHBA that excess wild horses are present and that a gather for removal of excess animals and application of population control measures is necessary to achieve a thriving natural ecological balance. While BLM has not prepared a formal HMAP document, all of the key components of an HMAP have nonetheless been addressed by BLM, including the establishment of the HMAs, AMLs and objectives for managing the complex (through the Tonopah RMP and other decision documents), monitoring and evaluating whether management objectives are being met (as summarized in this NEPA document), and establishing a ten-year management plan (through the Proposed Action and Alternatives being analyzed). The BLM is also providing an opportunity for public participation through the comment period for this EA.

Based upon all current information available at this time, the BLM has determined that at least 689 excess wild horses above the low end of AML are currently present in the Stone Cabin Complex. These excess wild horses need to be removed in order to achieve the established AML, restore a thriving natural ecological balance (TNEB) and prevent further degradation of rangeland resources. This assessment is based on factors including, but not limited to the following rationale:

- Stone Cabin Complex estimated populations far exceed the established AML range for the project area (Table 1).
- Moderate and heavy utilization is evident on key forage species within the complex (Appendix II), which, if sustained over time, interferes with vegetative regrowth and results in long term changes to rangeland health due to the loss of native vegetation.
- Monitoring and historical information indicate that future emergency removals will be necessary as a result of lack of water and/or forage if excess animals are not timely removed to bring the population back to AML.
- Wild horses are residing outside of HMA boundaries on public lands that are not managed for wild horses (documented during aerial inventories (2006-2017) and 2021 resource flights). Animals leaving the Complex boundary and remaining outside of HMAs is indicative of insufficient habitat within the Complex for the current population of horses.
- The overpopulation of wild horses is resulting in vehicle collisions with wild horses residing within and outside the HMA on Access Road 504 (Rocket Road) as vehicles travel to or from the Tonopah Test and Training Range, causing a public safety issue and risk of injury or death for the excess wild horses.
- Water sources on public lands that are available to wild horses are very limited in both HMAs, and riparian degradation is occurring due to the overpopulation of wild horses using these areas.

- Monitoring confirms the AMLs of 364 (Stone Cabin HMA) and 40 (Saulsbury HMA) must not be exceeded to achieve progress towards the Standards for Rangeland Health in accordance with the Mojave-Southern Great Basin RAC.

1.2 Purpose and Need

The purpose of the Proposed Action is to gather and remove excess wild horses from within and outside of the Stone Cabin Complex and to reduce the wild horse population growth rates to achieve and maintain established AML.

The need for the action is to prevent undue or unnecessary degradation of the public lands associated with excess wild horses, and to restore a TNEB and multiple-use relationship on public lands, consistent with the provisions of Section 1333(b) of the WFRHBA.

1.3 Land Use Plan Conformance and Consistency with Other Authorities

The Action Alternatives are in conformance with the Wild Horse and Burro Objectives of the Tonopah RMP Record of Decision dated 1997. Pertinent excerpts from that document are the following:

Objective: To manage wild horse and/or burro populations within Herd Management Areas at levels which will preserve and maintain a TNEB consistent with other multiple-use objectives (page 14).

1. Continue the following management determinations:
   a. Manage wild horses and/or burros in 16 HMAs listed in Table 3 of the RMP.
   b. Manage wild horses and/or burros at AML or interim herd size (IHS) for each HMA outlined in Table 3. Future herd size or AMLs within each HMA will be adjusted as determined through short-term and long-term monitoring data methods as outlined in the *Nevada Rangeland Monitoring Handbook* and BLM Technical References.
2. When the AML is exceeded, remove excess wild horses and/or burros to a point which may allow up to three years of population increase before again reaching the AML.

   Within the 1997 RMP the definition of AML is given as "*the maximum number of wild horses and/or burros to be managed within a herd management area and has been set through monitoring and evaluation or court order*" (page 15).

Approved RMP Amendments

In 2015, the BLM released a Record of Decision (ROD) and Approved Resource Management Plan Amendments (ARMPA) for the Great Basin Region, including the Greater Sage-Grouse (GRSG) Sub-Regions of Idaho and Southwestern Montana, Nevada and Northeastern California, Oregon, and Utah.

Management Decisions (MD):

MD Wild Horse and Burros (WHB) 1: For WHB management activities (e.g., gathers), review Objective Special Status Species (SSS) 4 and apply MDs SSS 1 through SSS 4 when reviewing and analyzing projects and activities proposed in GRSG habitat.

MD WHB 2: Manage HMAs in GRSG habitat within established AML ranges to achieve and maintain GRSG habitat objectives.

MD WHB 3: Complete rangeland health assessments for HMAs containing GRSG habitat using an interdisciplinary team of specialists (e.g., range, wildlife, and riparian). The priorities for conducting assessments are:

- HMAs containing Priority Habitat Management Areas (PHMAs), which include riparian areas.
- HMAs containing only General Habitat Management Area (GHMAs).
- HMAs containing sagebrush habitat outside of PHMA and GHMA mapped habitat.
- HMAs without GRSG habitat.

MD WHB 4: Prioritize gather and population growth suppression techniques in HMAs in GRSG habitat, unless removals are necessary in other areas to address higher priority environmental issues, including herd health impacts. Place higher priority on HAs not allocated as HMAs and occupied by wild horses and burros PHMAs.

MD WHB 5: In PHMAs, assess and adjust AMLs through the National Environmental Policy Act (NEPA) process within HMAs when wild horses or burros are identified as a significant causal factor in not meeting rangeland health standards, even if current AML is not being exceeded.

MD WHB 6: In PHMAs, monitor the effects of WHB use in relation to GRSG habitat objectives on an annual basis to help determine future management actions.

MD WHB 7: Develop or amend HMA plans to incorporate GRSG habitat objectives and management considerations for all HMAs within GRSG habitat, with emphasis placed on PHMAs.

MD WHB 8: Consider removals or exclusion of WHB during or immediately following emergency situations (such as fire, floods, and drought) to facilitate meeting GRSG habitat objectives where HMAs overlap with GRSG habitat.

MD WHB 9: When conducting NEPA analysis for wild horse/burro management activities, water developments, or other rangeland improvements for wild horses, address the direct and indirect effects to GRSG populations and habitat. Implement any water developments or rangeland improvements using the criteria identified for domestic livestock.

MD WHB 10: Coordinate with professionals from other federal and state agencies, researchers at universities, and others to utilize and evaluate new management tools (e.g., population growth suppression, inventory techniques, and telemetry) for implementing the WHB program.

<u>Mojave/Southern Great Basin Resource Advisory Council (RAC) Standards and Guidelines</u>

From the preamble to the Standards and Guidelines for Wild Horse and Burro Management:

"The standards for rangeland health will be reached and maintained by managing wild horse and burro numbers so as not to exceed Appropriate Management Levels (AML) for each HMA. Controlling wild horse and burro numbers through gathers and other control programs is essential."

Guidelines for the Wild Horses and Burros Standard include:

4.1 Wild horse and burro population levels in HMAs should not exceed AML.
…
4.7 Wild horse and burro herd management practices should address improvement beyond this standard, significant progress toward achieving standards, time necessary for recovery, and time necessary for predicting trends.

1.4 Relationship to Statutes, Regulations, or other Plans

The Federal Land Policy and Management Act of 1976 (FLPMA) 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 is also consistent with the WFRHBA of 1971, 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".*

Also the WFRHBA of 1971, as amended, sec 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 is consistent with all applicable at laws and regulations at Title 43 Code of Federal Regulations (43 CFR) 4700 and policies.

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 of 1971 (Public Law 92-195) 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 TNEB and multiple-use relationship in that area.

References to the CEQ regulations throughout this EA are to the regulations in effect prior to September 14, 2020. The revised CEQ regulations effective as of September 14, 2020, are not referred to in this EA because the NEPA process associated with the proposed action began prior to this date.

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:

- **Proposed Action (Alternative A).** Over a 10-year period, use gathers to remove excess animals residing outside of HMA and within the Complex in order to achieve low AML, adjust sex ratio in favor of males, apply population growth suppression treatments (i.e., fertility control vaccines, gelding, and/or IUDs), and maintain population at AML if after low AML has been achieved, population growth results in the AML being exceeded again.
- **Alternative B.** Under Alternative B, Gather and remove excess animals to within the AML range without population growth suppression treatments.
- **No Action Alternative.** Under the No Action Alternative, a gather to remove excess wild horses would not occur. There would be no active management to control population growth rates, the size of the wild horse population or to bring the wild horse population to AML.

Population modeling was completed for the proposed action and alternatives to analyze how the alternatives would affect the wild horse populations. 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. The No Action (no removal) Alternative was also modeled (Appendix III). 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 and B. Graphic and tabular results are displayed in detail in Appendix III.

2.2 Alternative A: Proposed Action Alternative

2.2.1 Population Management

The Proposed Action (Alternative A) would involve three distinct types of management activities over the 10-year life of the plan:

1. Initially, gather and remove excess wild horses to achieve low AML within the proposed gather area either in a single first gather or with a follow-up gather(s) if necessary because all excess animals could not be captured and removed in a single gather. Based on BLM's experience over the past decades, there are a number of factors that can affect BLM's ability to achieve AML with a single first gather, including: that gathers typically achieve less than a 100% gather efficiency (i.e., all wild horses in the herd cannot be gathered or observed to determine how many remain in an HMA since wild horses evade capture or remain hidden from view during a helicopter gather); the likely population undercount can result in additional excess wild horses being identified in a follow-up inventory even when the targeted numbers of estimated excess wild horses have been removed; weather conditions that may impede achieving the targeted removal numbers during gather operations, and limited contractor availability among other factors. For this reason, if AML cannot be achieved through a single first gather, a follow-up gather(s) may be necessary to achieve low AML.
2. Over the 10-year period, apply population growth suppression (fertility control) measures, including

administering booster doses, to gathered and released horses over multiple gathers, along with sex ratio adjustment, to slow population growth and maintain the wild horse population within AML to allow for resource recovery and reduce the number of excess animals that would have to be removed from the public range over time.

3. Over the 10-year period, manage for a population that remains within AML by conducting additional/maintenance gathers after the initial gather(s) to bring wild horse population back to low AML if the population grows to again exceed AML during the 10-year plan life after low AML was achieved, in order to provide a sufficient period of time for degraded range resources to recover.

At the current population size, if a single gather were to be immediately implemented to reach low AML, the BLM would need to gather and remove approximately 689 excess wild horses within the complex. However, the wild horse population grows each year and if an initial gather is delayed, or if multiple gathers are necessary to achieve low AML because all excess animals could not be captured and removed in a single gather, the number of excess wild horses needing gather and removal to achieve low AML would be higher. All three components of the Proposed Action would allow BLM to achieve management goals and objectives of attaining a herd size that will not exceed AML and that will result in a TNEB on the range as required under the WFRHBA.

It is expected that gather efficiencies and other factors discussed above, as well as off-range corral space availability may not allow for the attainment of low AML during a single initial gather (i.e., if not enough horses are successfully captured and removed to reach low AML). If low AML is not achieved with the first gather, the BLM Tonopah Field Office would return to the complex to remove remaining excess horses above low AML in one or, if necessary, more follow-up gathers. Multiple gathers will be used over a 10-year period to gather a sufficient number of wild horses as to implement (in a phased manner) the population control component of the Proposed Action, which includes sex ratio adjustment (so that the herd may be composed of as many as 60% males and as few as 40% females) and fertility control treatments (PZP vaccines, GonaCon-Equine, IUDs, or Gelding) for wild horses remaining in the complex. Because continued management of the Complex's wild horse population at AML over the 10-year period is necessary to allow degraded range resources to recover and to achieve a TNEB, BLM would maintain the population at AML through additional removals (during follow-up gathers) if the population should again exceed AML after low AML is reached. Prioritization of excess wild horse removals would be as follows: from areas where public health and safety issues have been identified, private land and non-HMA, areas where resource degradation/deficiency has been identified, and within the complex areas as needed to reach and maintain AML. Selective removal procedures would prioritize removal of younger excess wild horses after achieving AML within the complex, and allow older, less adoptable, wild horses to be released back to the complex. BLM could begin implementing the population control components (PZP vaccines, GonaCon, IUDs, Gelding) of this alternative as part of the initial gather if gather efficiencies allow. 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.

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.). Genetic diversity monitoring would take place as part of gather activities (BLM 2010). The BLM Tonopah Field Office does not have the discretion to decide when and how much funding out of the BLM's total national budget will be allocated toward the proposed action in any given year, and there are tens of thousands of excess wild horses that BLM has determined ought to be removed across dozens of HMAs. The timing and amount of funding from the national BLM budget for this action is outside the scope of this decision. Therefore, 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 Stone Cabin Complex is to achieve and maintain AML over the 10-year plan period. BLM would achieve this through gather and removal of excess animals along with use of population growth suppression measures that could include:

- Administration of fertility control measures (i.e., PZP vaccines, GonaCon or newly developed vaccine formulations, IUDs) to released mares.
- Gelding of no more than approximately ¼ of the overall herd size
- Adjustment of sex ratio to favor males

The fertility control component of the Proposed Action would reduce the total number of wild horses that would otherwise be permanently removed from the range over time. Using fertility control methods to reduce mare fertility over the 10-year timeframe of the proposed action will allow for time and continuity of operations that are needed, to ensure that an adequate number of mares is treated, so as to reduce herd-level growth rates sufficiently. Primary gather methods would include helicopter drive, bait, and water trapping. It is expected that not all horses would be able to be captured, as gather efficiencies rarely exceed 80-85%. As a result, it is expected that a proportion of wild horses (15-20%+) in the project area would not be captured or treated over the 10-year period of the Proposed Action.

While in the temporary holding corral, horses would be identified for removal or release based on age, gender and/or other characteristics. As a part of periodic sampling to monitor wild horse genetic diversity in both the Saulsbury and Stone Cabin HMAs, hair follicle samples would be collected from a minimum of 25 horses of the released population. Samples would be collected for analysis to assess the levels of observed heterozygosity, which is a measure of genetic diversity (BLM 2010), within the HMAs and may be analyzed to determine relatedness to established breeds and other wild horse herds. Mares identified for release may be screened by a veterinarian for pregnancy status, and 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.

2.2.2. Population Growth Suppression Methods

The Proposed Action would include population growth suppression methods such as fertility control vaccines, IUDs, gelding, and sex ratio adjustments so that the herd could be up to 60% males. In cases where a booster vaccine is required, mares could be held for approximately 30 days and given a booster shot prior to release. Over the course of multiple gathers over the 10-year time period, BLM would treat/retreat mares with fertility control to help limit herd growth rates and meet herd management objectives. The BLM will individually identify and keep track of the number and type of fertility control vaccine treatments any mare receives. The BLM would manage a portion of the herd as non-reproducing geldings (castrated stallions), which would be no more than approximately ¼ of the overall herd size at any time. Even with these treatments, the herd is expected to continue to have positive population growth (Appendix II). 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.

All mares that are trapped and selected for release would be treated with fertility control treatments (PZP vaccines [ZonaStat-H, PZP-22], GonaCon-Equine vaccine or most current formulation, IUDs) to prevent pregnancy in the following year(s). Detailed analysis on population growth suppression methods are discussed further in Appendices IV and V.

2.2.2.1. PZP

Porcine Zona Pellucida (PZP) Vaccine

Immunocontraceptive Porcine Zona Pellucida (PZP) vaccines are currently being used on over 75 areas managed for wild and feral horses by the National Park Service, US Forest Service, the Department of Defense, and the BLM and its use is appropriate for free-ranging wild horse herds (EPA 2012, NRC 2013. 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 wild horses and burros (NRC 2013). PZP vaccine use can reduce or eliminate 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 feral and wild 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, Grams 2022). It can easily be remotely administered (dart-delivered) in the field, but typically, only where mares are relatively approachable. Depending on their age and the specific timing of when an immune response to the vaccine wears off, mares that are treated multiple times with ZonaStat-H can become infertile until they die – that is, the vaccine use effectively sterilizes the mares (Nuñez et al. 2017). For an analysis of the effects of including fertility control-vaccine treated mares in the herd, see section 3.3; the herd is still expected to grow even with a high fraction of immunocontracepted mares (Appendix II).

Under the Proposed Action, mares being treated for the first time would receive a liquid primer dose along with time release pellets ("PZP-22"), if they are available. If no PZP-22 pellets are available at the time, the BLM would hold mares for up to 30 days and treat them with a booster dose of ZonaStat-H before release back to the complex. BLM would return to the complex 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 (ZonaStat-H and PZP-22), or through field darting (ZonaStat-H) 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 size of the population, the large size of the complex, gather efficiencies 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, currently in development by USGS Fort Collins Science Center) to determine the required frequency of re-treating mares with PZP or other fertility control methods.

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

Registration and safety of GonaCon-Equine

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, 2015). 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). GonaCon-Equine has been used on feral horses in Theodore Roosevelt National Park (Baker et al. 2018) and over the past 5 years, has also been applied to an increasing number of BLM-managed wild horses in over 15 HMAs throughout the west. GonaCon-Equine can be remotely administered in the field in cases where mares are relatively approachable, using a customized pneumatic dart (McCann et al. 2017). 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 treatment that is relatively inexpensive, meets BLM requirements for safety to mares and the environment, and is produced in a USDA-APHIS laboratory. As is the case with ZonaStat-H, its regulatory 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 only 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 2015) are followed, the product is safe for users and the environment (EPA 2009b). GonaCon was deemed to pose low risks to the environment, so long as the product label is followed (Wang-Cahill et al. in press 2017).

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 (Baker et al. 2018), 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 (based on results from Baker et al. 2018, 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. However, as is true for mares treated multiple times with the PZP vaccine ZonaStat-H (Nuñez et al. 2017), lifetime infertility (i.e., sterility) may result for some mares treated multiple times with GonaCon-Equine. Once the herd size in the project area is at AML and population growth seems to be stabilized, BLM would make a determination as to the required frequency of new mare treatments and mare re-treatments with GonaCon-Equine vaccine or other fertility control methods, to maintain the number of horses within AML.

2.2.2.3. Flexible Intrauterine Devices (IUDs)

Flexible IUDs are considered a temporary fertility control method that does not generally cause future sterility (Daels and Hughes 1995). It is expected that flexible 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. For horse and veterinarian safety, any candidate mares would need to be transported from the capture site to a wild horse handling facility with a hydraulic padded squeeze chute and a split rear door, such as at the BLM-contracted corrals at the Northern Nevada Correctional Center (Carson City, Nevada). BLM has used IUDs to control wild horse fertility in management applications in Utah and Wyoming. 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 supports the apparent safety and

efficacy of some types of IUDs for use in horses (Appendix IV).
Soft and flexible IUDs may cause relatively less discomfort than hard IUDs (Daels and Hughes 1995). The 2013 National Academies of Sciences (NAS) 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, 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, Lyman et al. 2021). Also, the University of Massachusetts has developed a magnetic IUD that has been effective at preventing estrus in non-breeding domestic mares (Gradil et al. 2019, Gradil et al. 2021, Hoopes et al. 2021). The overall results are consistent with results from an earlier study (Daels and Hughes 1995), which used O-shaped silicone IUDs.

2.2.2.4. Gelding

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. The procedure is relatively straight forward, 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. The USGS studied wild horse demography, habitat use, and behavior in a herd at Conger HMA, where 42% of adult males were gelded (King et al. 2022). Alternative A would allow for up to 25% of the total population to be geldings – that could be 41% of all males if the herd is 60% male. 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).

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. 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. 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. There was no observed mortality in geldings at the Conger HMA study, and geldings retained good body condition (King et al. 2022).

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. WinEquus (Appendix II) cannot represent the effects of gelding on female fertility rates but having about 40% or less of the herd as geldings is not expected to substantially change female fertility rates in the long term; King et al. (2022) recorded a slight decrease in female fertility rates for only one year.

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 V).

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. 32 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.

Gelded animals could be monitored periodically for complications for approximately 7-10 days post-surgery and release. This monitoring 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 the goal would be to detect complications if they are occurring and determine if the horses are freely moving about the HMA. Once released, it is expected that gelded stallions would resume free-roaming behaviors; some would be expected to acquire or defend harems for at least some number of years while over time it would be expected that they will tend to live in bachelor bands (King et al. 2022). Where it is possible during routine monitoring activities on the range, 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.

Surgical 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. See Appendix IV for a more detailed analysis on gelding effects.

2.3 Alternative B

Under this alternative, BLM would gather and remove excess animals to achieve low AML and maintain the population within AML without fertility control treatments. Impacts from this alternative would be similar to the gathering and handling impacts under the Proposed Action. Gathers conducted under Alternative B could be completed as gate-cut gathers where only enough horses are gathered and removed to achieve the AML goal, or as selective removal where more horses are gathered so removal criteria such as age and conformation could be utilized to choose which horses are to be released in order to improve wild horse health and characteristics and remove only adoptable horses while releasing the older horses back to the range.

2.4 Management Actions Common to Alternatives A and B

Gathering of horses and removal of excess wild horses to achieve and maintain the AML would occur as necessary for the next 10 years following the start date of the initial gather. All gather and handling activities would be conducted in accordance with the Comprehensive Animal Welfare Program (CAWP). CAWP guidelines can be found on the BLM website at https://www.blm.gov/programs/wild-horse-and-burro/comprehensive-animal-welfare-program.

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 wild horses 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 V) 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 gather and holding sites would be no larger than 0.5 acres. Bait or water trapping sites could remain in place up to one year. Temporary holding sites could be in place for up to 45 days depending on length of gather. 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.

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 Battle Mountain 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 V.

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 – July 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.
- Corrals would not be constructed within 1 mile of an active or pending lek.
- Prior to gathers, BLM would coordinate with the Nevada Department of Wildlife (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 at springs and seeps during brood-rearing timing restriction of May 1 – September 15 if determined by the BLM wildlife biologist the locations are considered Greater sage-grouse brood habitat.

2.4.1. 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 14 CFR § 91.119, WO.

Per BLM IM 2013-059 and BLM IM 2010-164 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 wild horses possible. The appropriate gather method would be decided by the Wild Horse and Burro Specialist based on the location, accessibility of the animals, local terrain, vegetative cover, and available sources of water and forage. The use of roping from horseback could also be used when necessary. Based on wild horse 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 wild horses into a temporary trap. The SOPs outlined in Appendix V, as well as standards set by the Comprehensive Animal Welfare Program (CAWP), 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 wild horses. Utilizing the topography, traps would be set in areas with high probability of horse access. This would assist with capturing excess wild horses 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 horses. The wings form an alley way used to guide the horses 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 wild horses 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 wild horses into the trap. Once horses 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 assure 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 wild horses. BLM staff would be present on the gather at all times to observe animal condition, ensure humane treatment of wild horses, and ensure contract requirements are met.

2.4.2. Bait/Water Trapping

Bait and/or water trapping would be used as appropriate to gather wild horses efficiently and effectively. Bait and water trapping may be utilized, when wild horses are in an area where there are limited resources (such as food or water). The use of bait and water trapping, though effective in specific areas and circumstances, would not be 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 Alternatives A-B throughout 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 wild horses 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 wild horse 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 adaptation of the horses creates a low stress trapping method. During this acclimation period the horses would experience some stress due to the panels being setup and perceived access restriction to the water/bait source. See Appendix V.

Gathering excess horses 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 wild horses, such trapping can continue into the foaling season without harming the mares or foals.

2.4.3. Gather-related Temporary Holding Facilities (Corrals)

Wild horses that are gathered would be transported from the gather sites to a temporary holding corral. At the temporary holding corral wild horses would be sorted into different pens. Mares would be identified for fertility control and treated at the corrals. The horses 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 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 American Veterinary Medical Association (AVMA).

Herd health and characteristics data would be collected as part of continued monitoring of the wild horse herds. Genetic baseline data would be collected to monitor the genetic diversity of the wild horse herds within the combined project area, as measured by observed heterozygosity values based on hair follicle DNA samples (Ho; BLM 2010). Additional samples may be collected to analyze ancestry.

Gathered wild horses would be transported to BLM off-range corrals where they would be prepared for adoption and/or sale to qualified individuals or transfer to off-range pastures or other disposition authorized by the WFRHBA.

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

All gathered wild horses would be removed and transported to BLM off range corrals (ORCs, formerly short-term holding facilities) 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. Wild horses removed from the range would be transported to the receiving ORC in a goose-neck stock trailer or straight-deck semi-tractor trailers. Trucks and trailers used to haul the wild horses would be inspected prior to use to ensure wild horses can be safely transported. Wild horses 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 wild horses is limited to a maximum of 10 hours.

Upon arrival, recently captured wild horses are off-loaded by compartment and placed in holding pens where they are provided good quality hay and water. Most wild horses 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. Wild horses in very thin condition, or animals with injuries, are sorted and placed in hospital pens, fed separately, and/or treated for their injuries.

After recently captured wild horses have transitioned to their new environment, they are prepared for adoption, sale, or transport to off-range pastures. 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.

2.4.5. Adoption

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

2.4.6. 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 is any animal that is more than 10 years old or has been offered unsuccessfully for adoption at least three times. The application and subsequent bill of sale specifies that buyers cannot directly sell the horse to a commercial processing plant or sell the horse to anyone whose intent is to sell the animals to a commercial processing plant. Sales of wild horses are conducted in accordance with the 1971 WFRHBA and congressional limitations.

2.4.7. Off-Range Pastures

When shipping wild horses for adoption, sale or Off-Range Pastures (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.

2.4.8. Euthanasia or Sale without Limitations

Under the WFRHBA, healthy excess wild horses 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 horses removed from the Complex over the next 10 years could potentially be euthanized or sold without limitation consistent with the provisions of the WFRHBA.

Any old, sick or lame horses 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 at off-range corrals. Decisions to humanely euthanize animals in field situations would be made in conformance with BLM policy (BLM Permanent Instruction Memorandum (PIM) 2021-007 or most current edition). Conditions requiring humane euthanasia occur infrequently and are described in more detail in PIM 2021-007.

2.4.9. Public Viewing Opportunities
Opportunities for public observation of the gather activities on public lands would be provided, when and where feasible, and would be consistent with BLM IM No. 2013-058 and the Visitation Protocol and Ground Rules for Helicopter WH&B Gathers within Nevada (Appendix VI). This protocol is intended to 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 wild horses), to the wild horses (e.g., by ensuring observers would not be in the line of vision of wild horses 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 wild horses. Observation locations would be located at gather or holding sites and would be subject to the same cultural resource requirements as those sites.

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

2.5 No Action Alternative
Although the No Action Alternative does not comply with the WFRHBA of 1971 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.

Under the No Action Alternative, a gather to remove excess wild horses would not occur. There would be no active management to control the size of the wild horse population or to bring the wild horse population to AML. The current wild horse population would continue to increase at a rate of 14%-22.7% per year (Appendix III). Within three years, the wild horse population could exceed 1100 animals, or nearly three times AML. Increasing numbers of excess wild horses will result in the continued deterioration of rangeland resources within the complex, wild horse health will deteriorate, and public safety concerns will increase along heavily traveled roads. There would also be an increase in emergency actions necessary to address the overpopulations of wild horses and limited water/forage resources in the complex.

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

2.6.1. Field Darting Horses with ZonaStat-H (Native PZP) or GonaCon-Equine
This alternative was eliminated from further consideration as the **sole** method of population reduction and control due to the difficulties inherent in darting wild horses in the project area. Field darting of wild horses typically works in small areas with good access where animals are acclimated to the presence of people who come to watch and photograph them. The presence of water sources on both private and public lands inside and outside the complex would make it almost impossible to restrict wild horse access to be able to dart horses consistently. Horse behavior limits their approachability/accessibility, so that the number of mares 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 also requires a booster given every year following treatment to maintain the highest level of efficacy. Annual darting of wild horses 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 for applying population controls to wild horses 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.

2.6.2. Control of Wild Horse 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 WinEquus software. Based on this modeling, this alternative would not result in attainment of the AML range for the complex and the wild horse population would continue to have an average population growth rate of 4.8% to 15.7%, adding to the current wild horse overpopulation, albeit at a slower rate of growth. Over the next 11 years an average of 3309 wild horse captures would need to take place, to allow for injection of vaccines for population control. Of those, 1012 mare captures would lead to treatment with PZP vaccine or other accepted fertility control vaccines. It is important to understand that in this scenario, each time a wild horse is gathered it is counted, even though the same wild horse may be gathered multiple times during the 11-year period. And each time a wild horse is treated with PZP-22, it is counted even though the same wild horse may be treated multiple times over the 11-year period. See Appendix III for population modeling.

This alternative would not bring the wild horse population to within the established AML range, would allow the wild horse 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 increased 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.

2.6.3. Chemical Immobilization
Chemical immobilization as a method of capturing wild horses is not a practicable alternative because it is a very specialized technique and is strictly regulated. Currently the BLM does not have sufficient expertise or policy to implement this method and it would be impractical to use given the size of the complex, access limitations and approachability of the horses.

2.6.4. Use of Wrangler on Horseback Drive-trapping
Use of wranglers on horseback drive-trapping to remove excess wild horses can be somewhat effective on a small scale but due to the number of horses to be gathered, the large geographic size of the complex, and lack of approachability of the animals, this technique would be ineffective and impractical as a substitute for helicopter trapping. Wild horses often outrun and outlast domestic horses carrying riders-utilizing wranglers on horseback as a gather method would not only be impractical but could also put domestic horses at risk if they are required to pursue wild horses over the long distances necessary to locate and gather those wild horses. In contrast, 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.

2.6.5. Designate the Stone Cabin Complex to be Managed Principally for Wild Horse Herds Under 43 C.F.R. 4710.3-2.
The areas that make up the Stone Cabin Complex are designated in the Land Use Planning process for the long-term management of wild horses. The (BLM) Tonopah Field Office and Humboldt-Toiyabe National Forest do 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. This alternative would involve no removal of wild horses and would instead address excess wild horse numbers through removal or reduction of livestock within the complex. In essence, this alternative would exchange use by livestock for use by wild

horses. Because this alternative would mean converting the HMAs to a wild horse Range 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 EA. This alternative was not brought forward for analysis because it is inconsistent with the 1997 Tonopah RMP and the WFRHBA which directs the Secretary to immediately remove excess wild horses where necessary to ensure a TNEB 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 wild horse gather decision. Furthermore, even with significantly reduced levels of livestock grazing within the gather area relative to the permitted levels authorized in the 1997 Tonopah RMP, there is insufficient habitat for the current population of wild horses, as confirmed by monitoring data. As a result, this alternative was not analyzed in detail.

2.6.6. Raising the Appropriate Management Levels for Wild Horses

Delay of a gather until the AMLs can be reevaluated is not consistent with the WFRHBA, Public Rangelands Improvement Act (PRIA) or FLPMA or the existing Tonopah RMP. 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 wild horses above AML to reverse downward range health trends, promote improvement of rangeland health and ensure safety and health of wild horses.

Severe range degradation would occur if an AML reevaluation process were initiated without gathering the excess animals and an even larger number of excess wild horses would ultimately need to be removed from the range in order to achieve the AMLs or under emergency conditions to prevent the death of individual animals due to insufficient water and forage resources for the current overpopulation of wild horses. 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 wild horses. Raising the AML where there are known resource degradation issues associated with an overpopulation of wild horses does not meet the Purpose and Need to Restore a TNEB or meet Rangeland Health Standards.

2.6.7. Remove or Reduce Livestock Within the Complex

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

The proposal to reduce livestock would not meet the Purpose and Need for action identified in Section 1.2: "to gather and remove excess wild horses from within and outside the Stone Cabin complex and to reduce the wild horse population growth rates to achieve and maintain established AML", and to "prevent undue or unnecessary degradation of the public lands, and protect rangeland resources from deterioration associated with excess wild horses within the HMAs, and to restore a TNEB and multiple use relationship on the public lands consistent with the provisions of Section 1333 (a) of the 1971 WFRHBA."

Eliminating or reducing grazing in order to shift forage use to wild horses 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 wild horses and burros as one of the many uses of the public lands, not a single use. Therefore, the BLM is required to manage wild horses and burros in a manner designed to achieve a TNEB between wild horse and burro 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 Animal Unit Months (AUMs) to increase the wild horse AMLs would not achieve a TNEB. Wild horses are unlike livestock which can be confined to specific pastures, limited to specific periods of use, and specific seasons-of-use so as to minimize impacts to vegetation during the critical growing season and to riparian zones during the summer months. Wild horses are present year-round and their impacts to rangeland resources cannot be controlled through establishment of a grazing system, such as for livestock. Thus, impacts from wild horses 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 § 4100 and must be consistent with multiple use allocations set forth in Land Use Plans (LUPs)/RMPs. Such changes to livestock grazing cannot be made through a wild horse gather decision and are only possible if BLM first revises the LUPs to allocate livestock forage to wild horses and to eliminate or reduce livestock grazing. Because this alternative is inconsistent with the Tonopah RMP, it would first require an amendment to the RMP, which is outside the scope of this EA.

2.6.8. Wild Horse 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 wild horses. 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 wild horses on western USA public lands are high (Ransom et al. 2016). In some cases, adult annual survival rates for wild horses exceed 95% (Ransom et al. 2016). 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 wild horse ranges in the western United States (Mountain lions are known to predate on horses, primarily foals, in a few herds (Andreasen et al. 2021), but predation contributes to biologically meaningful population limitation in only a handful of herds). In some cases, adult annual survival rates exceed 95% (ransom et al. 2016). Andreasen et al. (2021) concluded that "At landscape scales, cougar predation is unlikely to limit the growth of feral horse populations."

Many horse herds grow at sustained high rates of 15-25% per year and are not a self-regulating species (NRC 2013, Ransom et al. 2016). 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. This alternative would result in a steady increase in the wild horse populations which would continue to exceed the carrying capacity of the range resulting in a catastrophic mortality of wild horses in the Complex, and irreparable damage to rangeland resources.

While some members of the public have advocated "letting nature take its course", allowing horses to die of dehydration and starvation would be inhumane treatment and would be contrary to the WFRHBA, which mandates removal of excess wild horses. The damage to rangeland resources that results from excess numbers of wild horses 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*".

Title 43 CFR § 4700.0-6 (a) states "*Wild horses 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 wild horses for forage and water resources would be severe. Wild horses can be aggressive around water sources, and some wildlife may not be able to compete, which could lead to the death of individual animals. Wildlife habitat conditions would deteriorate as wild horse 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 wild horses at a greatly reduced level if BLM is able to manage for wild horses at all on the complex in the future. 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 wild horses from within and outside the complex and to reduce the wild horse population growth rates to manage wild horses within established AML ranges for a TNEB.

2.6.9. Gathering the Complex to the High end of AML

Under this Alternative, a gather would be conducted to gather and remove enough wild horses to achieve the high end of AML (404 in the complex) rather than to low AML for this HMA. A post-gather population size at high 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 119 (1989). The IBLA has also held that, "*Proper range management dictates removal of horses 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 AML established for the Saulsbury and Stone Cabin HMAs represents the maximum population for which TNEB would be maintained. Additionally, the Tonopah RMP objectives for wild horses and burros state: "*When the appropriate management level (or in some cases interim herd size) is exceeded, remove excess wild horses and/or burros to a point which may allow up to three years of population increase before again reaching the appropriate management level or interim herd size".* Gathering to AML (rather than low AML) would be counter to the Tonopah RMP and would not meet the objectives of the RMP.

Additionally, gathering only to 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 wild horses, as individuals and as entire herds.

This alternative would not meet the Purpose and Need for this EA which it is to remove excess wild horses from within and outside the Stone Cabin complex, to reduce the wild horse population growth rates to manage wild horses within established AML ranges, and to minimize the frequency of gathers needed to remove excess wild horses.

The need for the action is to prevent undue or unnecessary degradation of the public lands associated with excess wild horses, to restore a TNEB and multiple use relationship on public lands, consistent with the provisions of Section 1333(b) of the 1971 WFRHBA. For these reasons, this alternative was eliminated from further consideration.

2.6.10. Gathering the Complex after the Completion of a Rangeland Health Assessment
Under this Alternative the complex would not be gathered until after a Rangeland Health Assessment is completed. Currently excess wild horses in the complex are causing deterioration to rangeland resources and waiting to complete a Rangeland Health Assessment would only further the degradation of rangelands.

Furthermore, the Alternative would not meet the Purpose and Need for action identified in Section 1.2: "to achieve and maintain the AML through removal of excess wild horses from within and outside of the HMA boundaries, and to reduce the population growth rate to prevent undue or unnecessary degradation of the public lands, and protect rangeland resources from deterioration associated with excess wild horses within the HMAs, and to restore a TNEB and multiple use relationship on the public lands consistent with the provisions of Section 1333 (a) of the 1971 WFRHBA."

The need for the action is to prevent undue or unnecessary degradation of the public lands associated with excess wild horses, to restore a TNEB and multiple use relationship on public lands, consistent with the provisions of Section 1333(b) of the 1971 WFRHBA. For these reasons, this alternative was eliminated from further consideration.

3.0 AFFECTED ENVIRONMENT/ENVIRONMENTAL EFFECTS

3.1. Identification of Issues:
Internal scoping was conducted by an interdisciplinary (ID) team to analyze the potential consequences of the Proposed Action. Potential impacts to the following resources/concerns were evaluated in accordance with criteria listed in the NEPA Handbook H-1790-1 (2008) page 41, 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 Battle Mountain District BLM in particular.

Table 2. summarizes which of the supplemental authorities of the human environment and other resources of concern within the project area are present, not present or not affected by the Proposed Action.

Table 2. Summary of Supplemental Authorities and Other Elements of the Human Environment

Resource/Concern	Issue(s) Present? (Y/N)	Affected? (Y/N)	Rationale for Dismissal from Detailed Analysis or Issue(s) Requiring Detailed Analysis
Air Quality	N	N	The air quality status for the project analysis area in Nye County is termed "unclassifiable" by the State of Nevada. No data is collected in areas outside of Pahrump in southeastern Nye County due to the expectation that annual particulate matter would not exceed national standards. The proposed action or alternatives would not affect air quality in Nye County.
Areas of Critical	N	N	Not present in the designated Complex boundaries.

Resource/Concern	Issue(s) Present? (Y/N)	Affected? (Y/N)	Rationale for Dismissal from Detailed Analysis or Issue(s) Requiring Detailed Analysis
Environmental Concern (ACEC)			
Cultural Resources	Y	N	In accordance with the SOPs for Gather and Handling Activities in BLM Nevada and Nevada State Historic Preservation Office Protocol agreement, gather facilities would be placed in previously disturbed areas. Should new, previously undisturbed gather sites or holding facility locations be required, appropriate Class III cultural resource inventories would be conducted to avoid placing gather facilities in areas with cultural resources and to ensure that measures are taken to avoid any cultural resource impacts.
Forest and Rangelands	N	N	Project has a negligible impact directly, indirectly and cumulatively to forest health. Detailed analysis not required.
Fish Habitat	N	N	No effects from gather operation are anticipated to occur within potential fish habitat.
Migratory Birds	Y	Y	Effects to resource are analyzed in this EA.
Native American Religious and other Concerns	N	N	No affected traditional religious or cultural sites of importance have been identified in the project area.
Species Threatened, Endangered or Proposed for listing under the Endangered Species Act.	N	N	No known T&E or their habitats exist in the Complex.
Wastes, Hazardous or Solid	N	N	No hazardous or solid wastes exist in the designated HMA boundaries, nor would any be introduced.
Water Quality, Drinking/Ground	N	N	The proposed action or alternatives would not affect drinking or groundwater quality. The project design would avoid surface water and riparian systems and no water wells would be affected.
Wild and Scenic Rivers	N	N	Not Present.
Wilderness/WSA	Y	Y	Effects to resource are analyzed in this EA.
Environmental Justice and Socioeconomics	N	N	The Proposed Action would not have disproportionately high or adverse effects on low income or minority populations. Health and environmental statues would not be compromised. The Proposed Action would not disproportionately impact social or economic values.
Floodplains	N	N	The project analysis area was not included on FEMA flood maps.
Farmlands, Prime and Unique	N	N	Resource not present.
Wetlands/Riparian Zones	Y	Y	Effects to resource are analyzed in this EA.
Non-native Invasive and Noxious Species	Y	Y	Impacts under each alternative could result in increasing weed populations. Analysis in Section 3.9.
Land Use Authorizations	Y	N	The proposed actions and alternatives would not affect land use authorizations.

Resource/Concern	Issue(s) Present? (Y/N)	Affected? (Y/N)	Rationale for Dismissal from Detailed Analysis or Issue(s) Requiring Detailed Analysis
Lands with Wilderness Characteristics	Y	N	BLM LWC inventory units are contiguous with USFS Wilderness. The LWC units that have wilderness characteristics per BLM managed lands within the horse gather are noted in the Wilderness section. Per the Tonopah RMP, LWC's are managed for multiple use. Impacts to Wilderness Character are the same as those analyzed under Wilderness and WSA.
Human Health and Safety	N	N	Risks have been assessed to mitigate any safety hazards in the form of safety plans and risk management worksheets.
Special Status Plant and Animal Species	Y	Y	Effects to resource are analyzed in this EA.
Wildlife	Y	Y	Effects to resource are analyzed in this EA.
Paleontology	N	N	There is a minimal likelihood that resources would be present. Any surface disturbance resulting from the proposed gather would not be sufficient to cause impacts.
Wild Horses	Y	Y	Effects to resource are analyzed in this EA.
Grazing/Livestock Management	Y	Y	Effects to resource are analyzed in this EA
Soils Resources	Y	Y	Effects to resource are analyzed in this EA.
Water Resources (Water Rights)	N	N	The proposed action and alternatives would not affect water resources or water rights. Project design would avoid surface water and riparian systems. Permitted or pending water uses would not be affected.
Mineral Resources	N	N	There would be no modifications to mineral resources through the Proposed Action.
Vegetation Resources	Y	Y	Impacts under each alternative could result in improving or deteriorating native plant communities. Effects to vegetation resources are analyzed in this EA.
Recreation	Y	N	Recreation is considered present; however, the horse gathering activities are only temporary and would not majorly affect recreation resources in the area. Potential recreational opportunities within the horse gather area include dispersed camping, hunting, hiking, wildlife watching, etc. The major affected recreational activity that would be most affected would be the hunting within NDOW units (162, 163, and 251). Per NDOW hunting regulations, hunters should check with their local BLM office to inquire about horse gathering activities within their hunt unit/area.
Visual Resource Management	Y	N	Impacts to visual resources would be present; however, the horse gathering activities are temporary would not majorly affect visual resource management resources in the area. The gathering activities would not put in place permanent structures and would only occur for short time periods. Impacts would be negligible. Horse gathering activities are proposed in areas with VRM Class II and IV, as stated in the Tonopah Resource Management Plan (RMP).

3.2. General Setting

The general area receives 5-8 inches of annual precipitation in the valley bottoms. The mountain tops can receive as much as 16 inches. The average precipitation received in 2 rain gauges in the Stone Cabin HMA since 1985 is 6.1 and 7.9 inches annually. Summers are hot and dry, with high temperatures in the

90's or higher. Winters are cold, with temperatures dropping below freezing and occasionally below zero. The Stone Cabin and Saulsbury HMAs receive snow during the winter which may range from several inches to nearly a foot in depth depending upon the severity of the winter and elevation.

The Stone Cabin and Saulsbury HMAs are located within the Southern Nevada Basin and Range Major Land Resource Area (MLRA). This area is in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. This MLRA supports saltbush-greasewood, big sagebrush, and pinyon-juniper woodland vegetation in the progression from the lowest to the highest elevation and precipitation. Shadscale, in association with bud sagebrush, spiny hopsage, ephedra, winterfat, fourwing saltbush, Indian ricegrass, squirreltail, and galleta, characterize the saltbush-greasewood type. With an increase in moisture, plants associated with shadscale are replaced by needlegrasses, bluegrasses, bluebunch or beardless wheatgrass, basin wildrye, and forbs. Black greasewood and Nuttall saltbush are important on some sites. Big sagebrush and black sagebrush, which grows on soils that are shallow to an indurated pan or to bedrock, become dominant. In the pinyon-juniper woodland, bitterbrush, serviceberry, and snowberry grow in association with Utah juniper and singleleaf pinyon. The highest elevations support thickets of curl-leaf mountain mahogany and small amounts of mixed conifer forest with limber, bristlecone, or ponderosa pine, Douglas-fir, or white fir. On bottom lands, basin wildrye, creeping wildrye, alkali sacaton, wheatgrasses, bluegrasses, sedges, and rushes are typical. Black greasewood, rubber rabbitbrush, and big sagebrush grow on the drier sites. Inland saltgrass, alkali sacaton, black greasewood, rubber rabbitbrush, and big saltbush typify the vegetation on strongly saline-alkali soils (NRCS, 2006).

3.3. Wild Horses

Affected Environment

Stone Cabin HMA
The Stone Cabin HMA has 403,736 acres of public lands. The Stone Cabin HMA is split by the Highway 6 right of way fence constructed in 2009. The Hot Creek HMA borders the northeastern side of the HMA, and the Nevada Wild Horse Range (NWHR) is located to the south within the Nevada Test and Training Range (NTTR). The Reveille HMA forms the southeastern boundary of the Stone Cabin HMA (Map 4, Appendix I).

Saulsbury HMA
The Saulsbury HMA has 81,152 public land acres and is divided into 2 parcels. The southern unit of the HMA is located immediately west of the Stone Cabin HMA and south of Nevada State Highway 6. This southern portion is bordered to the east by the Stone Cabin HMA and to the south by the NTTR. The northern parcel of the Saulsbury HMA includes the majority of the Hunts Canyon allotment, north of Nevada State Highway 6. It is bordered to the east by U.S. Forest Service Administered lands. These USFS administered lands include the Monitor WHT and the southern portion of the Monitor Range which separates the northern portions of the Saulsbury and Stone Cabin HMAs.

The proposed gather area includes areas within and outside of the HMA boundaries throughout the Stone Cabin, Ralston, Hunts Canyon, and Reveille Allotments, and a portion of the Monitor Allotment. These areas fall under the jurisdictional boundaries of the BLM TFO. The total proposed gather area representing the associated allotments and HMAs includes 885,000 acres.

The AML for the Stone Cabin HMA was established through the Consent Decision signed by Administrative Law Judge David Torbet on May 11, 1992, through the Department of Interior Office of Hearings and Appeals, Hearings Division. The Consent Decision established an AML for the Stone Cabin

Allotment (and HMA) of 364 wild horses, and the Ralston allotment portion of the Saulsbury HMA at 10 wild horses. The AML for the portion of the Saulsbury HMA in the Hunts Canyon Allotment was established as 30 wild horses through a Final Multiple Use Decision (FMUD) in 1996.

Water available for use by wild horses within the HMAs is limited to a few perennial sources including Warm Spring, Point of Rock Spring, and Sidehill Spring in the Stone Cabin HMA and Hunts Creek in the Saulsbury HMA, which tend to produce water year-round. Additionally, stocking water for cattle is used by wild horses when it is available. As water supplies become depleted at other smaller water sources, wild horses tend to concentrate around these primary water sources causing negative effects to riparian resources (Appendix II). These water sources are monitored throughout the summer to make sure water is available for wild horses. During the summer or when drought conditions exist in the complex, wild horses will seek out water sources located on private property, often damaging fencing, wells, and troughs.

Drought is a common occurrence throughout Nevada and the Great Basin. Drought conditions during the period of March through June can substantially reduce annual production of forage, as well as have detrimental effects on vegetative health, especially under heavy or repeated grazing. According to the U.S. Drought Monitor (droughtmonitor.unl.edu), current drought conditions as of March 1, 2022, for Nye County range from severe to exceptional. The portions of the county where the complex is located primarily fall under extreme (category D3) to exceptional (category D4) (Rippey 2022). Possible impacts due to these categories of drought could include: major crop/ pasture losses; widespread water shortages or restrictions; and shortages of water in reservoirs, streams, and wells creating water emergencies. As water becomes scarcer in the summer months, even less forage would be available as wild horses will travel shorter distances from the available water. With the current excess population of wild horses, severe range degradation may occur. Overall wild horse herd and individual health may also be at risk if AML is not achieved and maintained.

Rangeland resources have been and are currently being impacted within the Stone Cabin and Saulsbury HMAs due to the over-population of wild horses. Key area utilization monitoring was conducted at 22 plots in Stone Cabin HMA, 3 plots in the north portion of Saulsbury HMA and 3 plots outside the north portion of the Saulsbury HMA in March 2022 by Tonopah BLM staff and Intermountain Range Consultants, Inc., retained by Stone Cabin Ranch, LLC. Further key area utilization monitoring was conducted by Tonopah BLM staff in April 2022 at one plot in the south portion of Saulsbury HMA and one plot in the Ralston allotment that is outside of the Complex but within the gather area. The Ralston Allotment is currently closed to livestock grazing.

Key species use ranged from negligible to severe use at key areas, with some key areas lacking key species entirely. The key forage species monitored at that time include herbaceous species Indian ricegrass (*Achnatherum hymenoides*), bottlebrush squirreltail (*Elymus elymoides*) James' galleta (*Pleuraphis jamesii*), and Needleandthread grass (*Hesperostipa comata*) and shrub species winterfat (*Krascheninnikovia lanata*) and fourwing saltbush (*Atriplex canescens*). Monitoring data was collected using the Range Utilization Height-Weight Method for grasses and Landscape Appearance Method for shrubs.

At each plot, BLM personnel made a judgment as to whether utilization was attributable to wild horses, domestic cattle, or wildlife. This judgment was based on the relative abundance and recency of sign observed on the plot, including animal feces, trailing and hoof prints, and known 2021-2022 grazing management actions. Where evidence of utilization by multiple kinds of animals was noted, a proportion of utilization attributable to each was estimated. Table 2 summarizes utilization data for each plot, with utilization broken into categories as follows: negligible (0-5%), slight (6-20%), light (21-40%), moderate

(41-60%), and heavy (61-80%).

Many sites lacked key species in the interspaces and the reproductive capability of many species has been limited by a combination of utilization and drought. Numerous sites and many roads throughout the complex showed extensive wild horse trailing and stud piles. While some new growth of both grasses and shrubs was observed at most KAs, plant vigor for those individuals exhibiting heavy utilization was lower than would otherwise be expected.

For the 3 plots in the north portion of the Saulsbury HMA, Indian ricegrass has been utilized so heavily that seed stalk heights could not be obtained, and thus a percent utilization figure could not be determined using the Height-Weight method. For each of the 3 plots, 20 samples of this species were measured, with a remaining average stubble height of 1.0, 1.1, and 1.3 inches, respectively. This corresponds to a heavy degree of utilization, which would be unsustainable for the species' continued presence on the site.

Table 2. 2022 % Utilization by animal, Stone Cabin and Saulsbury HMAs

HMA	Key Area	Easting	Northing	Total Utilization		% Horses (estimated)	% Cattle (estimated)
Stone Cabin	SC 13	537792	4241604	64	Heavy	100	0
Stone Cabin	SC 26	536875	4235930	72	Heavy	100	0
Stone Cabin	SC 29	538625	4226422	59	Moderate	100	0
Stone Cabin	SC 1.2	524286	4195619	61	Heavy	0	100
Stone Cabin	SC 25	530228	4247729	46	Moderate	100	0
Stone Cabin	SC 28	536620	4198277	21	Light	40	60
Stone Cabin	SC 10	542155	4223878	46	Moderate	100	0
Stone Cabin	SC 11	534767	4229816	39	Light	100	0
Stone Cabin	SC 19	529586	4229542	49	Moderate	100	0
Stone Cabin	SC 21	538956	4195453	43	Moderate	90	10
Stone Cabin	SC 22	536081	4207605	63	Heavy	60	40
Stone Cabin	SC 23.1	538073	4210326	54	Moderate	100	0
Stone Cabin	SC 24	533940	4216114	41	Moderate	75	25
Stone Cabin	SC 30	532336	4253788	39	Light	100	0
Stone Cabin	SC 33	527023	4195040	43	Moderate	0	100
Stone Cabin	SC 6	526511	4208413	49	Moderate	0	100
Stone Cabin	SC 9	541230	4222735	37	Light	75	25

Stone Cabin	SC 15	539948	4248380	71	Heavy	100	0
Stone Cabin	SC 8.1	537675	4218765	54	Moderate	100	0
Stone Cabin	WC 1	529549	4257586	0	Negligible	0	0
Stone Cabin	WC 2	533206	4260453	42	Moderate	10	90
Stone Cabin	WC 3	534939	4263658	10	Slight	0	100
Saulsbury	HC 0	499545	4242044	66	Heavy	50	50
Saulsbury	HC 4	504451	4245319	69	Heavy	100	0
Saulsbury	HC 8	500016	4236697	62	Heavy	100	0
Saulsbury	Ra 14	515831	4214610	7	Slight	100	0
None	HC 12	507455	4263636	41	Moderate	75	25
None	HC 17	516106	4264267	50	Moderate	100	0
None	HC 22	516718	4265772	46	Moderate	100	0
None	Ra 5	497088	4217456	24	Light	100	0

Population inventory flights have been conducted in the Stone Cabin and Saulsbury HMAs every two to three years. These population inventory flights have provided information pertaining to population numbers, foaling rates, distribution, and herd health. An emergency resource flight was conducted in July 2021 on north Stone Cabin and Saulsbury HMAs and 665 wild horses were observed throughout the project area. 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 Score. The conduct of the resource flight did not allow for statistical analysis of the observed data, so the resulting 'direct count' is an underestimate of the number of animals present in the surveyed areas.

Genetic monitoring and analysis of the Stone Cabin HMA was most recently completed after the most recent gather conducted in 2017 (Cothran 2017a, 2017b), and were analyzed for the Northern and Southern portions of the HMA; Stone Cabin HMA was also sampled for genetic diversity in 2012 (Cothran 2012a). As reported for the 2017 samples, highest mean genetic similarity of the South Stone Cabin HMA was with Oriental and Arabian breeds, followed closely by the Old World Iberian and the North American Gaited breeds; highest mean genetic similarity of the North Stone Cabin HMA was with Light Racing and Riding breeds, followed closely by the Oriental and Arabian breeds and the Old World Iberian breeds with the same average value. Observed heterozygosity (Ho) for the 2017 samples was 0.781 for North Stone Cabin (Cothran 2017a) and 0.744 for South Stone Cabin (Cothran 2017b), which is higher than the mean for other measured feral horse herds; the reported mean value is 0.716. These results (Cothran 2012a, 2017a, 2017b) indicate a herd with mixed origins with relatively high genetic diversity, no unique genetic markers, and no clear indication of primary breed type. Genetic variability of this herd in general is on the high side with only a moderate percentage of variation that is at risk, however data indicated that the herd is fairly stable genetically (Cothran 2017a, 2017b). In comparison to other feral herds from Nevada, both north and south Stone Cabin cluster most closely with horses from Nellis AFB (the Nevada Wild Horse Range).

Genetic monitoring and analysis of the Saulsbury HMA was completed after the most recent gather conducted in 2010 (Cothran 2012b). As reported by Texas A&M, highest mean genetic similarity of the Saulsbury HMA herd was with Oriental breeds followed by the Old World Spanish. Observed heterozygosity (Ho) was 0.731, which is higher than the mean for other measured feral horse herds. The results (Cothran 2012b) indicate a herd with mixed origins with relatively high genetic diversity, no unique genetic markers, and no clear indication of primary breed type. Genetic variability of this herd is high and likely due to mixing with nearby herds. The values related to allelic diversity are especially high as is heterozygosity (Cothran 2012b). In comparison to other feral herds from Nevada, Saulsbury clusters closely with New Pass Ravenswood and Hall Creek.

Because of history, context, and periodic introductions, wild horses that inhabit the Stone Cabin complex should not be considered an isolated population (NRC 2013). Rather, managed herds of wild horses 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 part of a larger metapopulation (NRC 2013) that has demographic and genetic connections with other BLM-managed herds in Nevada, Utah, and beyond. 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 Cothran's laboratory. Low values of Fst indicate that a given pair of sampled herds has a shared genetic background; values of Fst under approximately 0.05 indicate virtually no differentiation (Frankham et al. 2010). Pairwise Fst values for the 2012 Stone Cabin HMA samples and 130 other horse sample sets were less than 0.05 (NRC 2013), which implies that there was virtually no differentiation between Stone Cabin HMA and a large number of other BLM-managed herds. Similarly, pairwise Fst values were less than 0.05 between Saulsbury HMA and 126 other horse sample sets (NRC 2013). This evidence supports the conclusion that wild horses in the Stone Cabin and Saulsbury HMAs are highly genetically similar (i.e., Fst <0.05; Frankham et al. 2010) to an extremely large number of other wild horse herds (NRC, 2013). Wild horse herds in the larger metapopulation have a background of diverse domestic breed heritage, probably caused by natural and intentional movements of animals between herds.

The Stone Cabin and Saulsbury HMAs are located within Central Nevada in the middle of a large number of contiguous or adjacent wild horse management areas that span from U.S. Highway 50 in the north to State Highway 6 in the south. All total, 13 HMAs and eight WHTs exist and are contiguous or adjacent, spanning over three million acres. Approximately 5,000 wild horses inhabit this large set of herd management areas within Central Nevada. With just the known and suspected movement through the Monitor WHT, Reveille, and the Nevada Wild Horse Range (NWHR), there is currently no concern for the genetic diversity of the horses of the Stone Cabin Complex. Continued future monitoring of this complex and the surrounding management areas will ensure adequate assessment of genetic diversity for all of the wild horse management areas in the region.

Genetic baseline data would be collected at regular periods to monitor the genetic diversity of the wild horses within the project area. Samples may also be taken for ancestral analysis. Analysis would determine whether management is maintaining acceptable genetic diversity (and avoiding excessive risk of inbreeding depression).

Under all action alternatives, wild horse introductions from other HMAs could be used if needed, to augment observed heterozygosity (Ho), 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). However, with the suspected movement of wild horses throughout the region and the historically high levels of Ho in these herds (Cothran 2012a, 2012b, 2017), it is doubtful that such action would be necessary for the Stone Cabin complex.

The most recent gather conducted in the Stone cabin complex was on the north portion of the Stone Cabin HMA in August 2021 as a result of emergency conditions. A total of 322 wild horses were gathered via bait and water trapping, with 314 removed and 8 deaths/euthanasias. Prior to this emergency gather, the

Stone Cabin HMA only was gathered in 2017, the Stone Cabin complex was gathered in 2012, and the Saulsbury HMA only was gathered in 2010.

Environmental Effects

Proposed Action

The Proposed Action would eliminate the existing overpopulation of wild horses and maintain the population at AML through helicopter gathers, and bait and water trapping operations as needed over a period of ten years. Any captured mares returned to the range would be treated with fertility control (PZP vaccines, GonaCon-Equine, IUDs). The objectives of this alternative include managing the stone cabin complex within a range between high and low AML. If the targeted population level cannot be reached initially, individuals in the herd would still be subject to increased stress and possible death as a result of continued overpopulation and competition for water and forage until the project area's population can be reduced to AML. The areas experiencing heavy utilization levels by wild horses 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 low AML range and impacts from concentrations of horses can be reduced.

Removal of excess wild horses and achievement of AML would be expected to improve health for the animals that remain within the Complex. Decreased competition for forage and water resources would reduce stress and promote healthier animals, as measurable by Henneke body condition score (BCS). 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. Fertility control vaccine treatment may increase mare survival rates, leading to longer potential lifespan (Turner and Kirkpatrick 2002, Ransom et al. 2014a). Additionally, reduced population growth rates would be expected to extend the time interval between required gathers and reduce disturbance to individual animals as well as to the herd social structure over the foreseeable future.

Bringing the wild horse population size to low AML and slowing its growth rate once that level has been achieved would reduce damage to the range from the current overpopulation of wild horses and allow vegetation resources to start recovering. Maintaining the wild horse population at AML over a 10-year period is particularly important here because recovery of vegetation resources from repeated overuse will require multiple years of rest.

Impacts to individual animals may occur as a result of handling stress associated with the gathering, processing, and transportation of animals. 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 2019). Other impacts to individual wild horses include separation of members of individual bands of wild horses and removal of animals from the population.

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 wild horse gather operations. Traumatic injuries may occur; however, typical injuries involve bruises from biting and/or kicking, which do not break the skin.

BLMs Use of Contraception and Sex Ratio Skewing 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, as amended, specifically provides for contraception and sterilization (section 3.b.1) in management approaches. No finding of excess animals is required for BLM to pursue contraception in wild horses or wild burros. Contraception has been shown to be a cost effective and humane treatment to slow increases in wild horse populations or, when used with other techniques, to reduce horse 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 horses from an HMA's population, so if a wild horse population is in excess of AML, then contraception alone would result in some continuing environmental effects of horse overpopulation. Successful contraception reduces future reproduction. Limiting future population increases of horses could limit increases in environmental damage from higher densities of horses than currently exist. Horses are long-lived, potentially reaching 20 years of age or more in the wild and, if the population is above AML, treated horses returned to an HMA may continue exerting negative environmental effects, as described in the sections below, throughout their life span. In contrast, if horses above AML are removed when horses are gathered, that leads to an immediate decrease in the severity of ongoing detrimental environmental effects throughout their lifespan, as described above. See Appendix IV for a more detailed analysis on fertility control, including effects of fertility control vaccines, flexible IUDs, gelding, and sex ratio skewing.

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 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, McCann et al. 2017) 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 meters (BLM 2010). Booster doses can be safely administered by hand or by dart. Because it is possible that mares may go years between vaccine treatments, especially if gathers are required to provide that treatment, it is expected that most mares would eventually return to fertility, though some individual mares treated repeatedly may remain infertile. However, many mares treated repeatedly (i.e., 4 or more times) with PZP ZonaStat-H vaccine become infertile for life (Nuñez et al. 2017) – that is to say, effectively sterile. Similarly, depending on their age of first treatment and the age when they die, some mares treated repeatedly with GonaCon-Equine vaccine may remain infertile for 4 or more years, which could mean they are infertile until they die. As noted in the BLM wild horse and burro program 2021 strategic research plan (BLM 2021): "Sterile animals do need not to be recaptured so, where practical, permanent humane sterilization options could be a fiscally responsible part of local herd management, leading to a large decrease in herd growth rates. At the same time, the BLM recognizes the if sterilization is used in management, it will be important to ensure that overall populations are self-sustaining, including with adequate genetic diversity at the herd and metapopulation levels." The population modeling in Appendix II identifies that the Stone Cabin complex herds would still be expected to grow, even with application of fertility control vaccines and sex ratio skewing. Genetically, the herd does not contain unique markers, and is well connected with other herds (see section 3.3, above). In this context, it can be consistent with the purpose and need if some number of the treated mares do remain infertile. Records of each released mare's vaccine treatment history, along with herd size and foal to adult ratio monitoring results, will allow the BLM to ensure that the complex contains an appropriate number of fertile mares for the herd to continue to be stable or grow over time.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 followed SOPs for fertility control vaccine application (Appendix V). 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 (BLM 2010). The BLM requires that treated mares be identifiable via a visible freeze brand or individual color markings so that their vaccination history can be known (BLM 2010). The IM calls for follow-up population surveys to determine the realized annual growth rate in herds treated with fertility control vaccines.

Porcine Zona Pellucida (PZP) Vaccine
For additional detail about the use of PZP vaccine as a fertility control agent, please refer to Appendices V and IV. PZP vaccine may be applied to mares prior to their release back into the HMA. 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. PZP vaccine is relatively inexpensive, meets BLM requirements for safety to mares and the environment, and is produced as the liquid PZP vaccine ZonaStat-H, an EPA-registered commercial product (EPA 2012, SCC 2015), or as PZP-22, which is a formulation of PZP vaccine in polymer pellets that may lead to a longer immune response (Turner et al. 2002, Rutberg et al. 2017). Currently, ZonStat_H can also be applied via remote darting in the field.

For the PZP-22 vaccine pellet formulation administered during gathers, each released mare would receive a single dose of the PZP contraceptive vaccine pellets at the same time as a dose of the liquid PZP vaccine with modified Freund's Complete Adjuvant. Most mares recover from the stress of capture and handling quickly once released back into the HMA and none are expected to suffer serious long-term effects from the injections, other than the direct consequence of becoming temporarily infertile. Depending on their age and the specific timing of when an immune response to the vaccine wears off, mares that are treated multiple times with ZonaStat-H can become infertile until they die – that is, the vaccine use effectively sterilizes the mares (Nuñez et al. 2017). Injection site reactions associated with fertility control treatments are possible in treated mares (Roelle and Ransom 2009, Bechert et al. 2013, French et al. 2017), but swelling or local reactions at the injection site are expected to be minor in nature. In subsequent years, Native PZP vaccine (I.e. ZonaStat-H) or the currently most effective formulation could be administered as a booster dose using the one-year liquid PZP vaccine by field or remote darting. The dart-delivered formulation produced injection-site reactions of varying intensity, though none of the observed reactions appeared debilitating to the animals (Roelle and Ransom 2009). Joonè et al. (2017a) found that injection site reactions had healed in most mares within three months after the booster dose, and that they did not affect movement or cause fever.

Darting can be implemented opportunistically by applicators near water sources or along main trails out on the range. Blinds may be used to camouflage applicators to allow efficient treatment of as many mares as possible. Applicators would be trained and certified in darting techniques and recordkeeping protocols. A tracking database would be utilized to document treated mares, and the history of treatment and foal production. This would include a list of marked horses and/or a photo catalog with descriptions of the animals to assist in identifying which ones have been treated and which ones still need to be treated.

Application of fertility control treatment would be conducted in accordance with the approved standard operating and post-treatment monitoring procedures (SOPs, appendix V).

The historically accepted hypothesis explaining PZP vaccine effectiveness assumes that when injected as an antigen in vaccines, PZP vaccine 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 vaccine can cause a mare to continue having regular estrus cycles throughout the breeding season. Other research has shown, though, that there may be changes in ovarian structure and function due to PZP vaccine treatments (e.g., Joonè et al. 2017b, 2017c). Research has demonstrated that contraceptive efficacy of an injected liquid PZP vaccine, such as ZonaStat-H, is approximately 90% or more for mares treated twice in one year (Turner and Kirkpatrick 2002, Turner et al. 2008). 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 boostered annually with liquid PZP vaccine (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). Application of PZP for fertility control would reduce fertility in a large percentage of mares for at least one year (Ransom et al. 2011). Detailed analysis of the effects of PZP vaccine is provided in Appendix IV.

Gonadotropin Releasing Hormone (GnRH) Vaccine (GonaCon-Equine)
GonaCon-Equine vaccine may be applied to mares prior to their release back into the HMA. 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 methods available for contraception in wild horses and burros (NRC 2013), 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, 2015). Additional detail about the use of GonaCon is available in Appendix IV.

GonaCon is an immunocontraceptive vaccine which has been shown to provide multiple years of infertility in several wild ungulate species, including horses (Killian et al., 2008; Gray et al., 2010). GonaCon uses the gonadotropin-releasing hormone (GnRH), a small neuropeptide that performs an obligatory role in mammalian reproduction, as the vaccine antigen. When combined with an adjuvant, the 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. The lack of estrus cycling that results from successful GonaCon vaccination has been compared to typical winter period of anestrus 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).

Changes in hormones associated with anti-GnRH vaccination led 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.

BLM may apply GonaCon-Equine to captured mares and could return to the HMA as needed to reapply GonaCon-Equine by field or remote darting. 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, although the average duration of effect after booster doses has not yet been quantified. However, as is true for mares treated multiple times with the PZP vaccine ZonaStat-H (Nuñez et al. 2017), lifetime infertility (i.e., sterility) may result for some mares treated multiple times with GonaCon-Equine. Although it is unknown what would be the expected rate for the return to fertility rate in mares boosted more than once with GonaCon-Equine, a prolonged return to fertility would be consistent with the desired effect of using GonaCon (e.g., effective contraception). Once the herd size in the project area is at AML and population growth seems to be stabilized, BLM could make a determination as to the required frequency of new mare treatments and mare re-treatments with GonaCon to maintain the number of horses within AML.

Injection site reactions associated with immunocontraceptive treatments are possible in treated mares (Roelle and Ransom 2009). 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. 2018). Swelling or local reactions at the injection site are generally expected to be minor in nature, but some may develop into draining abscesses. Detailed analysis of the effects of GonaCon are located in Appendix IV.

PZP and GonaCon Indirect Effects
One expected long-term, indirect effect on wild horses treated with fertility control such as PZP or GonaCon 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, her 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. Fertility control vaccine treatment may increase mare survival rates, leading to longer potential lifespan (Turner and Kirkpatrick 2002, Ransom et al. 2014a). 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). Observations of mares treated in past gathers showed that many of the treated mares were larger than, maintained higher body condition than, and had larger healthy foals than untreated mares. For additional information, refer to Appendix IV.

IUD Effects
Flexible IUDs are considered a temporary fertility control method that does not generally cause future sterility (Daels and Hughes 1995). Flexible IUDs would only be inserted in non-pregnant (open) mares, and only by a veterinarian. Wild mares receiving IUDs would be checked for pregnancy by a veterinarian prior to insertion of an IUD. For horse and veterinarian safety, any candidate mares would need to be transported from the capture site to a wild horse handling facility with a hydraulic padded squeeze chute and a split rear door, such as at the BLM-contracted corrals at the Northern Nevada Correctional Center (Carson City, Nevada). The procedure for IUD insertion is described in Appendix V; it includes safe restraint, application of a temporary progesterone injection to improve IUD retention, and analgesia and sedation at the veterinarian's discretion. Appendix IV details expected effects of IUD use and supports the apparent safety and efficacy of some types of flexible IUDs for use in wild horses. Soft and flexible IUDs may cause relatively less discomfort than hard IUDs (Daels and Hughes 1995). The 2013 National Academies of Sciences (NAS) 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, 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, Lyman et al. 2021).

Gelding Effects
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. Appendix IV details expected effects of gelding. The procedure is relatively straight forward, rarely leads to serious complications and seldom requires postoperative veterinary care. 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 V). Minor complications after gelding surgery are not uncommon after surgery, 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; possible complications are detailed in Appendix IV.

Gelding adult male horses results in reduced production of testosterone which eventually 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. The USGS studied wild horse demography, habitat use, and behavior in a herd at Conger HMA, where 42% of adult males were gelded (King et al. 2022). Alternative A would allow for up to 25% of the total population to be geldings – that could be 41% of all males if the herd is 60% male. 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).

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. WinEquus (Appendix II) cannot represent the effects of gelding on female fertility rates but having about 40% or less of the herd as geldings is not expected to substantially change female fertility rates in the long term; King et al. (2022) recorded a slight decrease in female fertility rates for only one year. Even in concert with application of fertility control vaccines and IUDs, the overall level of population growth suppression is still expected to lead to a stable or increasing herd size over time (Appendix III).

Alternative B
Under this alternative the BLM would gather and remove excess animals to low AML without mare fertility control. Environmental effects from this alternative would be similar to the gathering and handling impacts under the Proposed Action. Gathers conducted under Alternative B could be completed as gate-cut gathers where only enough horses are gathered and removed to achieve the AML goal, or as selective removal where removal criteria such as age and conformation could be utilized to choose which horses are to be released in order to improve wild horse health and characteristics and remove only adoptable horses while releasing the older horses back to the range. Mares would not have the additional stress of being vaccinated or microchipped while restrained in the working chute. A gate cut scenario could reduce the opportunity for selection of quality horses for release back to the range and selection of desired ages to ship to adoption which could result in additional older or unadoptable horses being sent to

ORPs rather than being released to the range.

Effects Common to the Proposed Action and Alternative B

Over the past 35 years, various impacts to wild horses as a result of gather activities have been observed. Under the Proposed Action, potential impacts to wild horses would be both direct and indirect, occurring to both individual horses and the population as a whole. Effects common to both the Proposed Action and Alternative B (Gather and Removal only) have been identified as the following:

Helicopter Drive Trapping

The BLM has been conducting wild horse 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 wild horses 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. 2013, Scasta 2019). Refer to Appendix V for information on the methods that are utilized to reduce injury or stress to wild horses and burros during gathers. The Comprehensive Animal Welfare Program (CAWP), PIM 2021-002 would be implemented to ensure a safe and humane gather occurs and would minimize potential stress and injury to wild horses.

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 2019). Pre-existing conditions include such things as club feet, teeth worn to the gums of older horses, poor body condition and old breaks to limbs that healed poorly. 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 wild horses (and burros) from the public lands. The BLM also avoids gathering wild horses 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 wild horses 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 wild horses may include bruises, scrapes, or cuts to feet, legs, face, or body from rocks, brush or tree limbs. Rarely, wild horses will encounter barbed wire fences and will 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, horses 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 wild horses 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 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 and far between with direct gather related mortality averaging less than 1%. Most injuries are a result of the horse's temperament, meaning they do not remain calm and lash out more frequently.

Gathering wild horses during the summer months can potentially cause heat stress. Gathering wild horses 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, CAWP, and techniques used by the gather contractor or BLM staff will 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 horses' exposure to dust.

Indirect individual impacts are those which occur to individual wild horses after the initial event. These may include miscarriages in mares, increased social displacement, and conflict in studs. These impacts, like direct individual impacts, are known to occur intermittently during wild horse gather operations. An example of an indirect individual impact would be the brief 1–2-minute skirmish between older studs which ends when one stud 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. Gather staff 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, wild horses 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 PIM 2021-007 is used as a guide to determine if animals meet the criteria and should be euthanized. 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.

Wild horses 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 (Cothran 2021a, 2012b, 2017). The AML of 404 wild horses in the Stone Cabin complex in relation to the number of HMAs and WHTs within the region, with the expectation that there will continue to be genetic interchange with nearby herds, should provide for acceptable genetic diversity. If at any time in the future the genetic diversity in the Stone Cabin complex is determined to be relatively low, then a number of other HMAs in the region could be used as sources for fertile wild horses that could be transported into the area of concern.

By maintaining wild horse population size within AML, there would be a lower density of wild horses across the Stone Cabin complex, reducing competition for resources and allowing the wild horses that remain to use their preferred habitat. Maintaining population size at the established AML would be expected to improve forage quantity and quality and promote healthy, self-sustaining populations of wild horses in a TNEB and multiple use relationship on the public lands in the area. Deterioration of the range associated with wild horse overpopulation would be reduced. Managing wild horse 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 wild horses 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. The Comprehensive Animal Welfare Program (CAWP), PIM 2021-002 would be implemented to ensure a safe and humane gather occurs and would minimize potential stress and injury to wild horses.

Trapping involves setting up portable panels around an existing water source or in an active wild horse 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 wild horses creates a low stress trap. During this acclimation period the horses would experience some stress due to the panels being setup and perceived access restriction to the water/bait source.

When actively trapping wild horses, the trap would be checked on a daily basis. Wild horses 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 wild horses 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 wild horses 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 wild horses at a given location, which can also relieve the resource pressure caused by too many horses. As the proposed bait and/or water trapping in this area is a low stress approach to gathering of wild horses, 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 horses from these activities is rare but can occur. Other impacts to individual wild horses include separation of members of individual bands and removal of animals from the population.

Indirect impacts can occur to horses after the initial stress event and could include increased social displacement or increased conflict between studs. These impacts are known to occur intermittently during wild horse gather operations. Traumatic injuries could occur and typically involve bruises caused by biting and/or kicking. Horses 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 wild horse gather operations. Since handling, sorting and transportation of horses 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.

Temporary Holding Facilities During Gathers

Wild horses gathered would be transported from the trap sites to a temporary holding corral within the gather area in stock trailers or straight-deck semi-tractor trailers. At the temporary holding corral, the wild horses would be aged and sorted into different pens based on sex. The horses would be provided ample supply of good quality hay and water. Mares and their un-weaned foals would be kept in pens together. All horses identified for retention in the HMA would be penned separately from those animals identified for removal as excess. All mares identified for release would be treated with fertility control vaccine in accordance with the SOPs for Fertility Control Implementation in Appendix V.

At the temporary holding facility, a veterinarian, would provide 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.

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

During transport, potential impacts to individual horses 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 wild horses, 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 wild horses are similar to those that can occur during transport. Injury or mortality during the preparation process is low but can occur.

Mortality at off-range corrals (ORCs, formerly short-term holding) 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.

Off-Range Pastures (ORPs formerly known as long-term 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. About 39,000 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 Oklahoma, Kansas, Iowa, Missouri, Montana, Nebraska, Utah, Wyoming, Washington, and South Dakota. 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, 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 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 Remaining or Released Back into the Stone Cabin Complex following Gather Under the Proposed Action and Alternative B

The wild horses 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 wild horses 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 horses that have been desensitized to vehicles and human activities to return to areas where they were gathered if released back into HMAs. The wild horses that remain in the Stone Cabin 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.

Effects of the No Action Alternative

Under the No Action Alternative, no population growth suppression action or wild horse removals (gathers) would take place. The population of the wild horses within the Stone Cabin complex would continue to grow at the national average rate of increase seen in the majority of HMAs of 20 to 25% per year.

Neither AML or a TNEB would be achieved, and excess concentrations of wild horses would continue to impact site specific areas throughout the complex into the future. The animals would not be subject to the individual direct or indirect impacts of a trapping operation. However, 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 wild horses’ habitat needs. The areas currently experiencing heavy utilization by wild horses would increase over time and degradation could become irreversible in areas where ecological thresholds are passed.

Wild horses are a long-lived species with survival rates estimated between 80 and 97% and may be the determinant of wild horse population increases (Garrott and Taylor 1990, Ransom et al. 2016). Predation and disease have not substantially regulated wild horse population levels within or outside the project area. Throughout the HMAs few predators exist to control wild horse populations. Some mountain lion predation occurs 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 wild horses unless the horses 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 horse growth rates. Being a non-self-regulating species (NRC 2013), there would be a steady increase in wild horse numbers for the foreseeable future, which would continue to exceed the carrying capacity of the range. Individual wild horses would be at risk of death by starvation and lack of water as the population continues to grow annually. The wild horses would compete for the available water and forage resources, affecting mares and foals most severely. Social stress would increase. Fighting among stud horses would increase as well as injuries and death to all age classes of animals as the studs protect their position at scarce water sources. Significant loss of the wild horses in the complex due to starvation or lack of water would have obvious consequences to the long-term viability of the herd. Allowing wild horses to die of dehydration and starvation would be inhumane treatment and would be contrary to the WFRHBA, which mandates removal of excess wild horses.

The damage to rangeland resources that results from excess numbers of wild horses 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 wild horses, 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 Stone Cabin 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 wild horses. As a result, the No Action Alternative, by delaying the removal of excess horses from specific areas that are most impacted at this time, would not ensure healthy rangelands that would allow for the management of a healthy wild horse population, and would not promote a TNEB.

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

Cumulative Effects

Cumulative Effects of the Proposed Action and Alternative B:

Cumulative effects expected when incrementally adding the Proposed Action or Alternative B would include continued improvement in riparian vegetation conditions, which would in turn benefit current livestock management, native wildlife, water resources and wild horse populations as forage (habitat) quantity and quality improves. Benefits from reduced wild horse populations would include fewer animals competing for limited water quantity and at limited perennial water sources. Cumulatively there should be more stable wild horse populations, healthier rangelands, healthier horses, and fewer multiple-use conflicts within the gather area over the short and long term. Gathering and removing excess wild horses from the Stone Cabin Complex and treating gathered horses that are released back into the Complex, would also likely benefit resources in the adjoining areas. As the population returns to AML, wild horses would not need to travel outside of the HMA in search of additional forage, water, and space due to overpopulation.

Cumulatively over the next 10–15-year period, continuing to manage wild horses within the established AML range would result in improved vegetation condition (i.e. forage availability and quantity), which in turn would result in improved vegetation density, cover, vigor, seed production, seedling establishment, and forage production over current conditions. Managing wild horses within the established AML would allow the primary forage plant species to return more rapidly and allow for improvements to riparian habitat, even though some vegetation conditions may never be able to return to their potential.

Cumulatively over the next 10-15 years, fewer gathers should result in less frequent disturbance to individual wild horses and the herd's social structure. Individual and herd health would be maintained. There is no expectation that genetic diversity would be compromised due to a high level of expected diversity at this time, and the expectation of continued movement and genetic exchange between the HMAs within the complex and adjacent HMAs and WHTs.

Cumulative Effects of the No Action Alternative:
Under the No Action Alternative, the wild horse population within the Stone Cabin Complex combined could exceed 1200 in four years, almost three times high AML. Continued and expanded movement outside the HMAs would be expected as greater numbers of horses search for food and water for survival, thus impacting larger areas of public and private lands. Heavy to Severe utilization of the available forage would 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 wild horse population would be expected to crash; this result would be expedited under drought conditions. As wild horse populations continue to increase within and outside the Complex, rangeland degradation intensifies on public lands. Also as wild horse populations increase, concerns regarding public safety along highways increase as well as conflicts with private land.

Emergency removals could be expected in order to prevent individual animals from suffering or death as a result of insufficient forage and water. 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 effects of the no action alternative would result in foregoing the opportunity to improve rangeland health and to properly manage wild horses in balance with the available forage and water and other multiple uses. Attainment of site-specific vegetation management objectives and Standards for Rangeland Health would not be achieved. AML would not be achieved.

3.4. Riparian/Wetland Areas and Surface Water Quality

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 complex near seeps, springs, and along perennial drainages. Many of these areas support limited riparian habitat (forage) and water flows.

At the present time, wild horse use at the majority of these areas is readily evident, including trampling and trailing and excessive utilization. A decline in the quantity and diversity of stabilizing vegetation along lotic riparian areas indicates these perennial waterways are at risk of increased bank erosion and sedimentation. The current over population of wild horses is contributing to resource damage and decline in functionality of both lotic and lentic riparian areas (See Appendix II).

Environmental Effects

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 wild horses 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. There would also be reduced competition among wildlife, wild horses, and domestic livestock for the available water.

Alternative B – Environmental effects from this alternative would be similar to the Proposed Action. Over the long-term alternative B would be less effective at improving Riparian/Wetland Areas and Surface Water Quality and would require more frequent gathers to maintain AML

No Action Alternative – With the No Action Alternative, wild horse populations would continue to increase within the Stone Cabin complex and to expand beyond the complex boundaries. Increased horse use within and outside the complex would present additional adverse impacts to riparian resources and their associated surface waters. 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.

Cumulative Effects

Cumulative Effects of the Proposed Action and Alternative B

The long-term incremental impact to these resources under these alternatives would be positive as the number of horses are decreased with this gather and over time with subsequent gathers, thus reducing pressure from wild horses on riparian and wetland areas. This would result in improved surface water quality and reestablishment of riparian areas exhibiting increased stability and vigor.

Cumulative Effects of the No Action Alternative

Under the No Action Alternative, no beneficial incremental gather-associated impacts would occur to riparian/wetland areas and surface water quality, thus declining conditions would continue as horse populations increase.

3.5. Wildlife, Including Migratory Birds

Affected Environment

The Stone Cabin complex provides habitat for many species of wildlife, including large mammals like mule deer, pronghorn antelope, bighorn sheep and Rocky Mountain elk. Habitat for mule deer occurs throughout the complex. The majority of the complex is yearlong pronghorn antelope habitat. The Monitor and Hot Creek Ranges are Rocky Mountain elk habitat. Bighorn sheep can also be found on the Hot Creek Range.

Predominant habitat types within the complex which are likely to support migratory birds include:

riparian, mountain shrub, sagebrush, pinyon/juniper, salt desert scrub, playa and cliffs/talus habitat types. There are small inclusions of coniferous forest and mountain mahogany habitat types included in the upper elevations of the Hot Creek and Monitor Ranges.

The migratory bird nesting season is from March 1 through July 31 (including raptors). No surface disturbing activity (staging, trapping, or corrals) can be conducted during this time period without a nesting bird survey of the proposed project area.

Environmental Effects

Proposed Action – Individual animals of all species may be disturbed or displaced during gather operations. Large mammals and some birds may run or fly (flush from the nest) during helicopter operations, but animals should return to normal activities post disturbance. Small mammals, birds, and reptiles would be displaced at staging areas. Overall, there would be no impact to wildlife and migratory bird populations as a result of gather operations.

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.

Foreseeable trends from removing wild horses would bring decreased competition between wild horses, wildlife and migratory birds for available forage and water resources as soon as the gather is completed. Over the long-term, both riparian and upland habitat conditions (forage quantity and quality) for wildlife and migratory birds would improve. Soil compaction, spring degradation and stream bank deterioration would be reduced as horse numbers decreased as a result of gather operations.

Alternative B – Environmental effects from this alternative would be similar to the Proposed Action. Over the long-term alternative B would be less effective at improving wildlife and migratory bird habitat and would require more frequent gathers to maintain AML

No Action Alternative – Wildlife would not be disturbed or displaced by gather operations under the no action alternative. However, competition between wildlife and wild horses for forage and water resources would continue and may worsen as wild horse numbers continue to further increase above AML. As competition increases, some wildlife species may not be able to compete successfully, potentially leading to increased stress and possible dislocation or death of native wildlife species over the long-term.

Cumulative Effects

Cumulative Effects of the Proposed Action and Alternative B

Impacts to wildlife and migratory bird habitat within the complex have resulted from past and present actions such as livestock grazing, road construction and maintenance, agriculture, OHV use and recreation, and wild horses. The cumulative effects from the Proposed Action, in addition to past, present and reasonably foreseeable future actions would be beneficial for wildlife, migratory birds and their habitat. With a reduction of horse numbers, habitat within the HA and surrounding area 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 overall habitat quality for all species would improve over time.

Cumulative Effects of the No Action Alternative

The cumulative effects from the No Action Alternative, in addition to past, present and reasonably foreseeable future actions would result in continual degradation of habitat for all wildlife and migratory bird species. Horses would continue to be above AML and compete for resources with other wildlife and livestock. Breeding, foraging, nesting and overall habitat quality for all species would continue to degrade.

3.6. Special Status Plant and Animal Species

Affected Environment

Several Special Status Species may potentially occur within the Stone Cabin complex, including several bat, reptile, avian and other special status species.

According to both the 2015 and 2019 Greater sage-grouse Land Use Plan Amendments (LUPA), portions of the Stone Cabin complex contain Other Habitat (OHMA), General Habitat (GHMA), and Priority Habitat Management Areas (PHMA); (Map 5, Appendix I). Greater sage-grouse require a herbaceous understory of forbs and grass to provide nest concealment, as well as to provide a diet of forbs and insects for the adults and their chicks. Riparian areas are frequently used by greater sage-grouse for late brood-rearing habitat. There are approximately 6 active leks, 9 inactive and 4 pending, historic or unknown leks within or near the Stone Cabin complex. Lek counts throughout the Tonopah Field Office in 2021 and 2022 showed a significant decrease in lek attendance. 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 2020). All required design features found in the Nevada and Northeastern California Greater Sage-Grouse Approved Resource Management Plan Amendment will be adhered to.

Private lands within the complex provide aquatic and riparian habitat for one aquatic BLM Sensitive Species, the Hot Creek Valley tui chub (*Gila bicolor* ssp. 6).

There is potential pygmy rabbit habitat within the complex. Pygmy rabbits predominately inhabit tall sagebrush with deep friable soils for burrowing. Known occurrences of Pale Kangaroo Mouse can also be found throughout the complex.

Occupied year-round bighorn sheep can be found in the southern portion of the complex in the Hot Creek range.

Common special status avian species potentially found within the Complex include Golden eagle (*Aquila chrysaetos*), Ferruginous hawk (*Buteo regalis*), Burrowing owl (*Athene cunicularia*) and Pinyon jay (*Gymnorhinus cyanocephalus*).

There are four BLM sensitive plant species that have been found within or adjacent to the complex. These are the Candelaria blazingstar (*Mentzelia candelaria*), Nevada Dune beardtongue (*Penstemon arenarius*), squalid milkvetch (*Astragalus serenoi*) and Beatley buckwheat (*Eriogunum beatleyae*).

Environmental Effects

Proposed Action – Individual raptors and birds may be disturbed during helicopter gather operations; however, birds should return to normal activities once operations have ceased. Staging, corral and trapping locations would be surveyed for nests if operations take place during the breeding season, minimizing impacts to avian species. Because gather sites and holding corrals would not be located where sensitive animal and plant species are known to occur, there would be no impact from the placement of facilities. Staging, holding and trap locations would not be placed near any known occurrences of special status plant species.

Important habitat used for Greater sage-grouse strutting grounds and pygmy rabbit habitat would not be used for trap sites or staging areas. Additionally, greater sage-grouse timing restrictions identified in the

Proposed Action would be applied to minimize impacts to breeding, nesting and brood-rearing birds. Water bait trapping sites that occurred on natural water sources during the late brood-rearing season would be reviewed for use by Greater sage-grouse prior to use as a trapping location to minimize impacts. BLM would coordinate with NDOW if the gather could not meet any of these stipulations. Greater sage-grouse may be disturbed during the winter if gather operations were to occur during that timeframe.

Foreseeable trends from removing wild horses would be decreased competition between wild horses and special status species for available forage and water resources as soon as the gather is completed. Over the long-term, both riparian and upland habitat conditions (forage quantity and quality) for special status species would improve. Impacts from soil compaction spring degradation and stream bank deterioration would decrease as the number of horses decreased under the proposed action.

Alternative B – Environmental effects and reasonably foreseeable trends from this alternative would be similar to the Proposed Action. Over the long-term alternative B would be less effective at improving special status species habitat than the proposed action and would require more frequent gathers to maintain AML.

No Action Alternative – Individual animals would not be disturbed or displaced because gather operations would not occur under the No Action Alternative. However, habitat conditions for all special status animal species would continue to deteriorate as wild horse numbers above the established AML further reduce herbaceous vegetative cover and trample riparian areas, springs, and stream banks. Sensitive plant species would be more likely to be grazed and trampled under the no action alternative because there would be more wild horses in the complex.

Cumulative Effects

Cumulative Effects of the Proposed Action and Alternative B

Impacts to special status plant and animals within the complex have resulted from past and present actions such as livestock grazing, road construction and maintenance, agriculture, OHV use and recreation, and wild horses. The cumulative effects from the Proposed Action, in addition to past, present and reasonably foreseeable future actions would be beneficial for special status species and their habitat. With a reduction of horse numbers, habitat within the Complex and surrounding area 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 overall habitat quality for all special status species would improve over time.

Cumulative Effects of the No Action Alternative

The cumulative effects from the No Action Alternative, in addition to past, present and reasonably foreseeable future actions would result in continual degradation of habitat for all wildlife and migratory bird species. Horses would continue to be above AML and compete for resources with other wildlife and livestock. Breeding, foraging, nesting and overall habitat quality for all species would continue to degrade.

3.7. Livestock Grazing

Affected Environment

The Stone Cabin complex includes the entirety of the Stone Cabin and Willow Creek Allotments within the Stone Cabin HMA, a portion of the Hunts Canyon Allotment in the north portion of the Saulsbury HMA, and a portion of the Ralston Allotment in the south portion of the Saulsbury HMA. Permitted livestock grazing use in the complex is limited to cattle. Livestock grazing is authorized year round in the Stone Cabin Allotment, though livestock are rotated around stocking water sources throughout the year, and seasonally in the Willow Creek and Hunts Canyon Allotments. Livestock grazing also occurs in areas immediately adjacent to the complex.

Table 3: Grazing Summary for Stone Cabin Complex

Allotment	Permittee	Season of Use	% of Allotment in HMA	Permitted Use (AUM)	Ten Year Average Billed AUM	Percent Actual Use of Permit
Stone Cabin	Stone Cabin Ranch	Cattle year round	100%	1,990	1,461	73%
Stone Cabin	Colvin & Son	Cattle 10/16 to 5/15	100%	11,973	7,980	67%
Willow Creek	Stone Cabin Ranch	Cattle 6/11 to 10/10	100%	338	261	77%
Hunts Canyon	Stone Cabin Ranch	Cattle 9/15 to 6/1	72%	1,611**	1,174**	73%
Ralston	None	Not authorized	16%	N/A	N/A	N/A

*Billed AUM may not represent actual use by cattle, but is reflective of grazing strategy in response to available forage
** Permitted AUMs and Billed AUMs expressed as a percentage of the allotment in HMA

Over the past ten years permitted use has decreased from historical levels, and actual livestock use has generally been less than permitted use for each of the grazing allotments (Table 1). In particular, during the current drought cycle, livestock AUMs were reduced by 20% in 2020 (12,810 of 15,912 AUMs billed) and 50% in 2021 (8,048 of 15,912 AUMs billed). So far in 2022, AUMs have been reduced by 68% (Colvin & Son has been billed for 3,856 out of 11,973 AUMs; Stone Cabin Ranch is not billed until the end of the grazing season). Over the past ten years, reductions have been in part due to persistent drought, competition with wild horses for forage, and the needs of the livestock operations.

The Stone Cabin, Willow Creek, and Hunts Canyon Allotments continue to be evaluated for achievement of land health standards, as described in the Mojave and Southern Great Basin Resource Advisory Council Standards and Guidelines (BLM, 2006). Adjustments to livestock grazing are implemented as appropriate, as grazing term permits are renewed or through annual coordination between the land management agencies and the grazing permit holder. Adjustments can include livestock stocking levels, seasons of use, grazing rotations, utilization standards, and other management practices to better control livestock distribution.

Environmental Effects

Proposed Action – Wild horse gather operations have few direct impacts to cattle 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 operations cease. Under the Proposed Action, competition between livestock and wild horses for water and forage resources would be reduced over time. Forage availability and quality would improve over time as the wild horse population is brought to AML. These effects would be extended by population growth control measures. Over the long-term these alternatives would result in decreased competition for water and forage, improving the long-term health of the range resource.

Alternative B – Environmental effects from this alternative would be similar to the Proposed Action. Over the long-term, alternative B would require more frequent gathers to maintain AML, thus increasing the potential impacts to livestock.

No Action Alternative – Livestock would not be displaced or disturbed as a result of gather operations under the No Action Alternative. However, there would be continued competition with excess numbers of wild horses for limited water and forage resources. As wild horse numbers continue to increase, livestock grazing within the complex may be further reduced in an effort to slow the deterioration of the range to the greatest extent possible.

Cumulative Effects

Cumulative Effects of the Proposed Action and Alternative B

Under the Proposed Action, wild horse populations would be maintained at or near AML for the longest amount of time, compared to the alternatives. This would reduce excess pressure from wild horses on the overutilized and shared resources of forage and water. Over time this would likely aid in the achieving of the Standards of Rangeland Health and allow for continued livestock grazing. The cumulative effects of Alternative B would be similar to the Proposed Action, but they would not be as long lasting because the reproductive rates of the wild horse would not be reduced or controlled indefinitely. If bait and/or water traps are to be used, short term effects to livestock may include accidental trapping; if livestock are trapped, they would be released immediately, and the bait/water trapping operation would consider moving trap locations as necessary. Site conditions should experience a short-term period of improvement and a long-term attainment of achieving the Standards for Rangeland Health.

Cumulative Effects of the No Action Alternative

Under the no action alternative, wild horse populations would continue to increase. This continually increasing competition between livestock and wild horses for available forage and water resources would lead to increased resource utilization. Where site-specific vegetation management objectives and Standards for Rangeland Health are not being achieved, they would likely continue to not achieve the standard. Where standards are being achieved, it is possible they would change to not achieving the standard. Opportunities to improve rangeland health, by bringing the wild horse population to AML and reducing resource competition and utilization, would be lost.

3.8. Wilderness

Affected Environment

The Stone Cabin Complex contains a portion of the Rawhide Mountain and Kawich Wilderness Study Areas (WSA's). The Rawhide Mountain Wilderness Study Area encompasses over 69,000 acres of wild and remote country. Diverse topography, vegetation, and wildlife characterize this extensive area. Important archaeological sites can be found within the WSA. The Kawich WSA encompasses over 64,000 acres of wild and remote country. Diverse topography, vegetation, and wildlife also characterize this extensive area.

LWC Information

LWC Units with Wilderness Characteristics		
NV-060-055	NV-060-079	NV-060-029
NV-060-044	NV-060-058	NV-060-009
NV-060-027A	NV-060-059C	NV-060-019B
NV-060-015	NV-060-069B	
NV-060-0017A	NV-060-027A	
NV-060-078	NV-060-130A	

LWC Units without Wilderness Characteristics		
NV-060-065A	NV-060-017C	NV-060-039
NV-060-065B	NV-060-018A	NV-060-038
NV-060-054	NV-060-017B	NV-060-008A
NV-060-053C	NV-060-309A	NV-060-028
NV-060-025	NV-060-077	NV-060-007
NV-060-027B	NV-060-059D	NV-060-008B
NV-060-036	NV-060-047	NV-060-019H
NV-060-037	NV-060-048	
NV-060-026	NV-060-049	

LWC's are managed for multiple use. Impacts to Wilderness Characteristics are the same as those analyzed under the Wilderness section.

Environmental Effects

Proposed Action – Per BLM Manual 6330—Management of BLM Wilderness Study Areas, "Helicopters and fixed wing aircraft may be used for aerial surveys and for the gathering of wild horses and burros". Impacts to opportunities for solitude could occur during gather operations due to the possible noise of the helicopter and increased vehicle traffic around the WSA. It is reasonably foreseeable that those impacts would cease when the gather was completed. No surface impacts within the WSA's are anticipated to occur during the gather since all gather sites and holding facilities would be placed outside wilderness. However, wilderness values of naturalness would remain at or near the current condition. Under the Proposed Action wilderness values would likely see more improvement over time since excess wild horse population would be gathered and removed and application of population control measures means growth rates would be less under this alternative. Any impacts to resources within the WSA's as a result of concentrated use by wild horses would be reduced or eliminated over time as the AML and TNEB is achieved and maintained, further enhancing opportunities for enjoyment of the area by the public.

Alternative B – Environmental effects would be similar to the Proposed Action but may be less effective at increasing wilderness values over the long-term due to the foreseen need to conduct more frequent gathers as the population continues to increase at a normal rate. Wilderness values of naturalness after gathers are conducted would be enhanced by an improved ecological condition of the plant communities and other natural resources occurring as a result of a reduction in wild horse numbers.

No Action Alternative – No direct impacts to wilderness values would occur. However, impacts to wilderness values of naturalness could be threatened through the continued population growth of wild horses and concentrated use of resources within the WSAs by wild horses. The WSA's currently receive slight to moderate use by wild horses during certain times of the year. Increasing wild horse populations would be expected to further degrade the condition of vegetation and soil resources. The sight of heavy horse trails, trampled vegetation and areas of high erosion would continue to detract from the wilderness experience within the WSA's. WSA values would decrease over time under this alternative.

Cumulative Effects

Cumulative Effects of the Proposed Action and Alternative B

The cumulative impacts from the Proposed Action and Alternative B would include temporary negative impacts to solitude during operations but would have beneficial impacts to naturalness. These impacts to opportunities for solitude could occur during gather operations due to the possible noise of the helicopter and increased vehicle traffic around the Wilderness/WSA. Those impacts would cease when the gather was completed. No surface impacts within the Wilderness/WSA are anticipated to occur during the gather since all gather sites and holding facilities would be placed outside wilderness. Wilderness values of naturalness after gathers are conducted would be enhanced by a reduction in wild horse numbers as a result of an improved ecological condition of the plant communities and other natural resources. Under the Proposed Action, wilderness values would likely see more improvement over time since growth rates would be reduced under this alternative, thus extending time between gathers. In contrast, enhancement of wilderness values under Alternative B would be shorter-lived, with gathers required more frequently to maintain the wild horse population within AML.

Cumulative Effects of the No Action Alternative
The cumulative impacts from the No Action Alternative, in addition to past, present and reasonably foreseeable future actions would have no temporary negative impacts to solitude during operations but would have negative impacts to naturalness.

3.9. Noxious Weeds and Invasive Non-Native Species

Affected Environment
Noxious and invasive weeds are known to exist on public lands within the administrative boundaries of the complex. Noxious and invasive weed species are aggressive, typically non-native, ecologically damaging, undesirable plants, which severely threaten native rangeland biodiversity, decrease forage quality, wildlife habitat, and ecosystems. Because of their aggressive nature, noxious and invasive weeds can readily spread into established plant communities primarily through ground disturbing activities. In addition, new populations can become established when seeds are transported to new locations via equipment, vehicles, animals, and people. The only Nevada listed noxious weed known to occur within the complex is saltcedar (*Tamarix ramosissima*), which occurs along Hunts Creek in the north portion of the Saulsbury HMA. Other problematic nonnative species found in the complex include cheatgrass (*Bromus tectorum*), Russian thistle (*Salsola tragus*), saltlover (*Halogeton glomeratus*) and annual mustards (*Brassica spp*.).

These species occur in a variety of habitats including roadside areas, rights-of-way, along waterways, wetland meadows, and undisturbed upland rangelands.

Environmental Effects
Proposed Action The proposed gather may spread existing noxious and/or invasive species. This could occur if vehicles drive through infestations and spread seed into previously weed-free areas or arrive already carrying seeds attached to the vehicle or equipment. It is reasonably foreseeable gather activities could introduce new noxious weed infestations, though the risk can largely be mitigated by following weed best management practices (BMPs). The contractor, together with the contracting officer's representative or project inspector (COR/PI), shall examine proposed gather sites and holding corrals for noxious and invasive weed populations prior to construction. If state-listed noxious weeds are found, the location of the facilities would be moved. Any equipment or vehicles exposed to weed infestations or arriving on site carrying dirt, mud, or plant debris would be cleaned before moving into or within the project area. All gather sites and holding facilities on public lands would be monitored for weeds during the next several years. Despite short-term risks, achieving the established AML and removing excess wild horses offers the best opportunity for improvements in resource health over the long term and the subsequent recovery of the native vegetation resulting in fewer disturbed sites that would be susceptible to invasion by non-native plant species.

Alternative B – Environmental effects from this alternative would be similar to the Proposed Action. Over the long-term alternative B would require more frequent gathers to maintain AML, thus increasing the longer-term potential of spread or introduction of noxious weeds and non-native plant species.

No Action Alternative – No impacts from the gather would occur. However, wild horse populations would remain over AML and the impacts to native vegetation from wild horse over-grazing and/or trampling, especially around water sources, would increase dramatically and impacts to the present plant communities could lead to an expansion of noxious weeds and non-native plant species.

Cumulative Effects

Cumulative Effects of the Proposed Action and Alternative B

The cumulative effects of the proposed gather could increase the existing noxious and invasive weed populations through vehicle traffic, foot traffic, gather sites, camp sites, and temporary holding and processing sites, however through awareness and location scouting the risks of spreading the populations can be reduced. New weed species could be introduced without proper inspection and washing, if necessary, of equipment and vehicles. Best Management Practices should be followed to reduce the risks.

Cumulative Effects of the No Action Alternative

Under the No Action Alternative, the cumulative effects are reduced but still exist. By not gathering to AML the overall rangeland health would decrease thus allowing the opportunity for established noxious and invasive weed populations to expand and establish. Seeds can be carried on the horse's lower legs among their hair and fall off in other locations and establish as seedlings. There is a direct correlation to rangeland health and noxious and invasive weed population percentage.

3.10. Vegetation

Affected Environment

The Stone Cabin and Saulsbury HMAs are located within the Southern Nevada Basin and Range Major Land Resource Area (MLRA). This area is in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. This MLRA supports saltbush-greasewood, big sagebrush, and pinyon-juniper woodland vegetation in the progression from the lowest to the highest elevation and precipitation. Shadscale, in association with bud sagebrush, spiny hopsage, ephedra, winterfat, fourwing saltbush, Indian ricegrass, squirreltail, and galleta, characterize the saltbush-greasewood type. With an increase in moisture, plants associated with shadscale are replaced by needlegrasses, bluegrasses, bluebunch or beardless wheatgrass, basin wildrye, and forbs. Black greasewood and Nuttall saltbush are important on some sites. Big sagebrush and black sagebrush, which grows on soils that are shallow to an indurated pan or to bedrock, become dominant. In the pinyon-juniper woodland, bitterbrush, serviceberry, and snowberry grow in association with Utah juniper and singleleaf pinyon. The highest elevations support thickets of curl-leaf mountain mahogany and small amounts of mixed conifer forest with limber, bristlecone, or ponderosa pine, Douglas-fir, or white fir. On bottom lands, basin wildrye, creeping wildrye, alkali sacaton, wheatgrasses, bluegrasses, sedges, and rushes are typical. Black greasewood, rubber rabbitbrush, and big sagebrush grow on the drier sites. Inland saltgrass, alkali sacaton, black greasewood, rubber rabbitbrush, and big saltbush typify the vegetation on strongly saline-alkali soils (NRCS, 2006).

The Stone Cabin and Saulsbury HMAs are dominated by three naturally occurring ecological systems, as defined by the Southwest Regional Gap Analysis Project (SWREGap). Together, the Intermontane mixed salt desert scrub, sagebrush shrubland/steppe systems, and Great Basin pinyon-juniper woodland comprise greater than 90% of the total area.

Inter-Mountain Basins Mixed Salt Desert Scrub includes open-canopied shrublands of typically saline basins, alluvial slopes and plains across the Intermountain western U.S. This type also extends in limited distribution into the southern Great Plains. This system dominates the analysis area, comprising approximately 46% of the Stone Cabin and Saulsbury HMAs. Substrates are often saline and calcareous, medium- to fine-textured, alkaline soils, but include some coarser-textured soils. The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more Atriplex species such as shadscale saltbush or fourwing saltbush. Other shrubs present to co-dominate may include Wyoming big sagebrush, yellow rabbitbrush, rubber rabbitbrush, Nevada ephedra, spiny hopsage, winterfat, bud sagebrush, Bailey's greasewood, and littleleaf horsebrush. Black greasewood is generally absent, but if present does not co-dominate. The herbaceous layer varies from sparse to moderately dense and is dominated by perennial graminoids such as Indian ricegrass, blue grama, bottlebrush squirreltail, western wheatgrass, James' galleta, Sandberg bluegrass, or alkali sacaton. Various forbes are also present (Lowry, et al., 2005).

Great Basin xeric mixed sagebrush shrublands and Intermountain basin big sagebrush shrublands together comprise approximately 30% of the total area. Great Basin xeric mixed sagebrush shrublands occur on dry flats and plains, alluvial fans, rolling hills, rocky hillslopes, saddles and ridges at elevations between approximately 3,200 and 8,500 feet. Sites are dry, often exposed to desiccating winds, with typically shallow, rocky, non-saline soils. Within the Complex, these shrublands are dominated by black sage (mid and low elevations), low sage (higher elevation) and may be co-dominated by Wyoming big sagebrush or yellow rabbitbrush. Other shrubs that may be present include shadscale saltbush, Nevada ephedra, rubber rabbitbrush, spiny hopsage, Shockley's desert-thorn, budsage, greasewood, and horsebrush. The herbaceous layer is likely sparse and composed of perennial bunch grasses such as Indian ricegrass, squirreltail, or Sandberg bluegrass. Intermountain basin big sagebrush shrublands comprise approximately 32% of the area on the broad basin between the mountain ranges, plains, and foothills between approximately 4,900- and 7,500-feet elevation. Soils are typically deep, well-drained and non-saline. These shrublands are dominated by basin big sagebrush and/or Wyoming big sagebrush. Scattered juniper, greasewood, and saltbushes may be present in some stands. Rabbitbrush co-dominates some disturbed stands. Perennial herbaceous components typically contribute less than 25% vegetative cover. Common graminoid species include Indian ricegrass, needle and thread grass, basin wildrye, galleta, or Sandberg bluegrass (Lowry, et al., 2005).

Great Basin pinyon-juniper woodlands comprise approximately 16% of the Complex. This ecological system occurs on the dry mountain ranges and foothills, at elevations ranging from 5,250 to 8,500 feet. These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Woodlands dominated by a mix of pinyon and juniper, pure or nearly pure occurrences of pinyon, or woodlands dominated solely by juniper comprise this system. Curl-leaf mountain mahogany is a common associate. Understory layers are variable. Associated species include shrubs such as Greenleaf manzanita, low sage, black sage, big sagebrush, or little leaf mountain mahogany. Common herbaceous component includes bunch grasses needle and thread and basin wildrye (Lowry, et al., 2005).

Environmental Effects

Proposed Action:

The Proposed Action is expected to influence small areas of vegetative resources through trampling by wild horses at gather sites and holding locations and crushing of vegetation by vehicles, at temporary corrals and holding facilities. These disturbed areas would be less than one acre in size. Gather corrals and holding facility locations are usually placed in areas easily accessible to livestock trailers and standard equipment, utilizing roads, gravel pits or other previously disturbed sites and accessible by existing roads. No new roads would be created. These impacts are temporary, and vegetation likely would recover within the next growing season.

Achieving and maintaining the established AML would benefit the vegetation by reducing the grazing pressure on the forage resources. Defoliation that occurs more than once in a growing season reduces a plant's ability to maintain plant health and reproduce (Herbel, 2004). The impacts to vegetation by reducing grazing or trampling associated with bringing wild horse numbers to AML would result in maintaining or improving plant health, reproduction, diversity, and composition by allowing the plants to maintain and continue photosynthetic processes to initiate regrowth for recovery and grow adequately for reproduction. Achieving and maintaining the established AML throughout the Complex would be expected to result in upward trends in vegetation health, increased vigor, production and frequency of key forage species, and attainment of Rangeland Health Standards.

Alternative B- Environmental effects from this alternative would be similar to the Proposed Action. Over the long-term alternative B would be less effective at improving special status species habitat than the proposed action and would require more frequent gathers to maintain AML, thus increasing the frequency of potential plant disturbance associated with gather activities.

No Action Alternative – No impacts from the gather would occur. Wild horse populations would continue to exceed AMLs. The impacts to vegetation by grazing or trampling would increase and would result in deterioration in plant health, reproduction, diversity, and composition. By reducing opportunities for photosynthetic processes, the vegetation, particularly desirable forage species, would be susceptible to over-grazing and other stressors, such as drought. This disturbance would ultimately lead to a decrease in desirable forage species and an increase in less desirable species, and an alteration of the overall species composition for the area. It is reasonably foreseeable the decreased availability and quality of forage resources would negatively impact wild horse body condition scores and health.

Cumulative Effects
Cumulative Effects of the Proposed Action and Alternative B
The incremental cumulative effects of different population levels and different reproductive rates of wild horse populations over time would have varying effects on the vegetative communities they rely on for forage, the vegetative communities they travel through and seasonally occupy, and the vegetative communities around areas of water. Under the Proposed Action, wild horse populations would be maintained at or near AML for the longest amount of time, compared to the alternatives. This would reduce excess pressure on the over utilized vegetative resources. Over time this would likely improve plant health, reproduction, diversity, and composition. The cumulative effects of Alternative B would be similar to the Proposed Action, but they would not be as long lasting because the growth rate of the remaining wild horse population within the Complex would not be reduced or controlled to the same extent.

Cumulative Effects of the No Action Alternative
Under the no action alternative, wild horse populations would continue to increase leading to greater resource use and consumption. Where site-specific vegetation management objectives and Standards for Rangeland Health are not being achieved, they would likely continue not being achieved. Where standards are being achieved, it is possible they would transition to not being achieved. Opportunities to improve rangeland health and that of the vegetation, by bringing the wild horse population to AML and reducing vegetation utilization and trampling, would be lost.

3.11. Soils/Watersheds

Affected Environment
Soils within the complex are typical of the Great Basin and vary with elevation. Soils range in depth from very shallow (below 20 inches to bedrock) to deep (greater than 60 inches to bedrock) and are typically gravelly, sandy and/or silt loams. Soils that are located on low hill slopes, upland terraces, and fan piedmont remnants are typically shallow to deep over bedrock or indurated lime hardpan and derived from parent material of volcanic origin. They are highly calcareous and medium textured with gravel. Soils on mountain slopes are also calcareous and range from shallow to deep over limestone. Some of the

mountain soils have high rock fragment content, and support pinyon and juniper trees. Mountain soils typically have gravelly to very gravelly loam textures. Soils on floodplains and fan skirts are deep, have silt textures, and are highly calcareous.

Environmental Effects

Proposed Action- Project implementation would involve use of existing roads, washes and horse trail areas, and would disturb relatively small areas used for gathering and holding operations. Horses may be concentrated for a limited period of time in traps and at holding corrals. Potential for soil compaction exists but would be minimal and temporary and is not expected to adversely impact soil or hydrologic function. It is reasonably foreseeable soils and watersheds would remain at or near the current condition. However, soils and watersheds would likely see more improvement over time with the achievement of AML and reduction of concentrated use of resources by wild horses including trailing and trampling, as well as reduced utilization levels and healthier plant communities. since wild horse population would be gathered in increments and growth rates would be less under this alternative.

Alternative B- The environmental effect of Alternative B will be similar to those of the Proposed Action except that it is reasonably foreseeable that gathers would be required more frequently to maintain AML, thus increasing the frequency of plant and soil disturbance associated with gather activities.

No Action Alternative- Soils and watersheds would continue to experience concentrated use by wild horses. As horse populations continue to increase heavy trailing and trampling around water sources and to foraging areas would further increase beyond current levels. Watershed objectives would not be met due to increased horse populations over time.

Cumulative Effects

Cumulative Effects of the Proposed Action and Alternative B

Direct cumulative effects from the Proposed Action would include the short-term incremental impact of disturbance and compaction from hoof action around horse corrals. However, the long-term incremental impact to soil resources/watersheds would be positive as the number of horses are decreased with this gather and over time with subsequent gathers. This would result in restored soil structure, increased stability, and improved biological function of soils resulting in increased water-holding capacity, reduced erosion and enhanced vegetation community support.

Cumulative Effects of the No Action Alternative

Under the No Action Alternative, no incremental gather-associated impacts would occur to soils/watersheds, thus the declining conditions from compaction, erosion, and consequent poor vegetation support would continue to increase as horse populations increase.

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 reasonably foreseeable future actions 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 Stone Cabin Complex and portions of the Ralston and Monitor allotments where wild horses have been consistently documented outside of HMAs; this CESA is identified in Map 1.

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
The past, present, and reasonably foreseeable future actions 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
Wild horse and burro gathers	x	x	x
Mineral exploration / 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

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

4.1 Past Actions
In 1971 Congress passed the WFRHBA which placed wild and free-roaming horses and burros, that were not claimed for individual ownership, under the protection of the Secretaries of Interior and Agriculture. In 1976 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, 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 wild horse HMAs and WHTs, establishment of AML for wild horses, wild horse 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.

Stone Cabin HMA
The Stone Cabin HMA was designated for the long-term management of wild horses in the Tonopah 1981 Management Framework Plan (MFP); management of this HMA is guided by the 1997 Tonopah ROD and RMP. AML for the Stone Cabin HMA is 218-364 as established through the 1981 MFP and subsequently confirmed by the Tonopah Resource Management Plan (RMP) approved October 6, 1997. Since 1984, the Stone Cabin HMA has been gathered 8 times with a total of 1,456 wild horses being gathered and removed.

Saulsbury HMA
The Saulsbury HMA was designated for the long-term management of wild horses in the Tonopah 1981 Management Framework Plan (MFP); management of this HMA is guided by the 1997 Tonopah ROD and RMP. AML for the Stone Cabin HMA is 24-40 as established through the 1981 MFP and

subsequently confirmed by the Tonopah Resource Management Plan (RMP) approved October 6, 1997. The Saulsbury HMA has only been gathered twice during the same temporal span with a total of 414 wild horses being captured and removed. An emergency wild horse gather was conducted in 1997 due to the severe drought and degraded condition of the range.

The Land Use Plan analyzed impacts of management's direction for grazing and wild horses, as updated through Bureau policies, Rangeland Program direction, and Wild Horse Program direction. Forage was allocated within the allotments for livestock, wild horse, and wildlife use and range monitoring studies were initiated to determine if allotment objectives were being achieved, or that progress toward the allotment objectives was being made.

Adjustments in livestock season of use, livestock numbers, and grazing systems were made through the allotment evaluation/multiple use decision process. In addition, temporary closures to livestock grazing in areas burned by wildfires, or due to extreme drought conditions, were implemented to improve range condition. Some changes were made to the livestock management within the Stone Cabin and Hunts Canyon Allotments through a Multiple Use Decision issued September 9, 1996. A Notice of Closure of livestock grazing was issued December 6, 1996 due to severe drought, limited forage, and heavy to severe use levels. Grazing resumed in grazing year 1997 once drought conditions subsided and perennial vegetation was reestablished.

The Mojave and Northeastern Great Basin RAC developed standards and guidelines for rangeland health that have been the basis for assessing rangeland health in relation to management of wild horse and livestock grazing within the Battle Mountain Districts. Adjustments in numbers, season of use, grazing season, and allowable use have been based on the evaluation of progress made toward reaching the standards.

Historical mining activities have occurred throughout the area.

4.2 Present Actions

In fall of 2022, the Stone Cabin complex had an estimated population of at least 930 wild horses (Table 1); 651 on the Stone Cabin HMA and 280 on the Saulsbury HMA. Resource damage is occurring in portions of the complex due to excess animals. Current BLM policy is to conduct removals targeting portions of the wild horse population based upon age. 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 (BLM 2010). 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 complex. 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 complex.

The focus of wild horse management has also expanded to place more emphasis on achieving rangeland health as measured against the RAC Standards. The Mojave-Southern Great Basin and Northeastern Great Basin 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 Battle Mountain 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.

4.3 Reasonably Foreseeable Future Actions

All past and present actions discussed in sections 4.1 and 4.2 are expected to continue into the foreseeable future. Reasonably Foreseeable Future Actions applicable to this assessment are identified as the following: wild horse gathers and population growth suppression, livestock grazing, mineral exploration and extraction, oil and gas exploration, recreation including dispersed camping and hunting, land use authorizations and wildfire suppression.

In the future, the BLM would manage wild horses within the complex for a population range, while monitoring and maintaining genetic diversity, age structure, and sex ratios. The BLM would continue to conduct monitoring to assess progress toward meeting rangeland health standards. Wild horses would continue to be a component of the public lands, managed within a multiple-use concept. As the BLM achieves AML on public lands through removal of excess wild horses and application of population growth suppression, gathers should become more predictable due to facility space and needed funding allocations. This should increase stability of gather schedules. 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 wild horses and possibly extending the time between gathers.

The public lands within the HMA contain a variety of resources and support a variety of uses. Any alternative course of wild horse 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 effects of implementing the Proposed Action include: future wild horse gathers, continuing livestock grazing in the surrounding Stone Cabin, Hunts Canyon, and adjacent allotments, development of range improvements, continued development of mineral extraction, oil and gas 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.

4.4 Cumulative Effects Conclusion

The combination of the past, present, and reasonably foreseeable future actions, along with the Proposed Action, should result in more stable and healthier wild horse populations, healthier rangelands (vegetation, riparian areas and wildlife habitat), and fewer multiple-use conflicts within the Stone Cabin Complex and adjacent HMAs and WHTs. While a few of the resources analyzed will experience short term effects of disturbance from gather related activities (such as vegetation trampling and soil compaction) under the Proposed Action and Alternative B, the long-term benefits from these management actions outweigh the negative effects across all resources.

If no action is taken, cumulative effects will be negative across all resources. This action would result in foregoing the opportunity to improve rangeland health and to properly manage wild horses in balance with the available forage and water and other multiple uses. Attainment of site-specific vegetation management objectives and Standards for Rangeland Health would not be achieved. AML would not be achieved. Horses would continue to be above AML and compete for resources with other wildlife and livestock and there would be continual degradation of habitat for all wildlife and migratory bird species.

Breeding, foraging, nesting and overall habitat quality for all species would continue to degrade. Declining conditions from overutilization would continue for riparian/wetland areas, vegetation, wildlife habitat, as the wild horse population continued to increase. An increase in multiple-use conflicts within and around the gather area would be expected as more wild horses would be forced to seek forage and water sources outside of the Complex.

5.0 Mitigation Measures and Suggested Monitoring

Proven mitigation and monitoring are incorporated into the Proposed Action through SOPs, which have been developed over time. These SOPs (Appendix V) 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 to monitor genetic diversity of the wild horses from the Stone Cabin Complex; additional samples would be collected during future gathers (in 10-15 years) to determine trend. If monitoring indicates that genetic diversity (as measured in terms of observed heterozygosity) is not being adequately maintained, 5-10 young mares from HMAs in similar environments may be added every generation (every 8-10 years) to avoid negative effects of inbreeding depression and to maintain acceptable genetic diversity. Samples may also be collected for genetic ancestry analysis. Ongoing resource monitoring, including climate (weather), and forage utilization, population inventory, and distribution data would continue to be collected.

6.0 Consultation and Coordination

Public hearings are held annually on a state-wide or national basis regarding the use of motorized vehicles, including helicopters and fixed-wing aircraft, in the management of wild horses and burros. 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 HQ WHB Program hosted an annual virtual public hearing on the use of motorized vehicles in the management of wild horses and burros on April 26, 2022. The lead or back-up for the lead of each BLM state office was in attendance. After a brief presentation covering the use of motorized vehicles and BLM's Comprehensive Animal Welfare Program, 18 verbal comments were made by members of the public. The BLM also received 79 additional written comments, including letters from Wyoming Governor and Wyoming state agencies. The consensus of the comments was opposition to the use of helicopters for gathers. There were 456 views of the live hearing.

The use of helicopters and motorized vehicles has proven to be a safe, effective and practical means for the gather and removal of excess wild horses and burros from the range. Since 2012, 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. In accordance with policy outlined in Handbook H-4700-1 and IM 2015-152, BLM does not conduct helicopter removals of wild horses during the peak of foaling, March 1 through June 30, absent emergency conditions.

The Battle Mountain District BLM coordinated with the NDOW on 12/16/2021. The NDOW was supportive of gather operations within the Stone Cabin complex.

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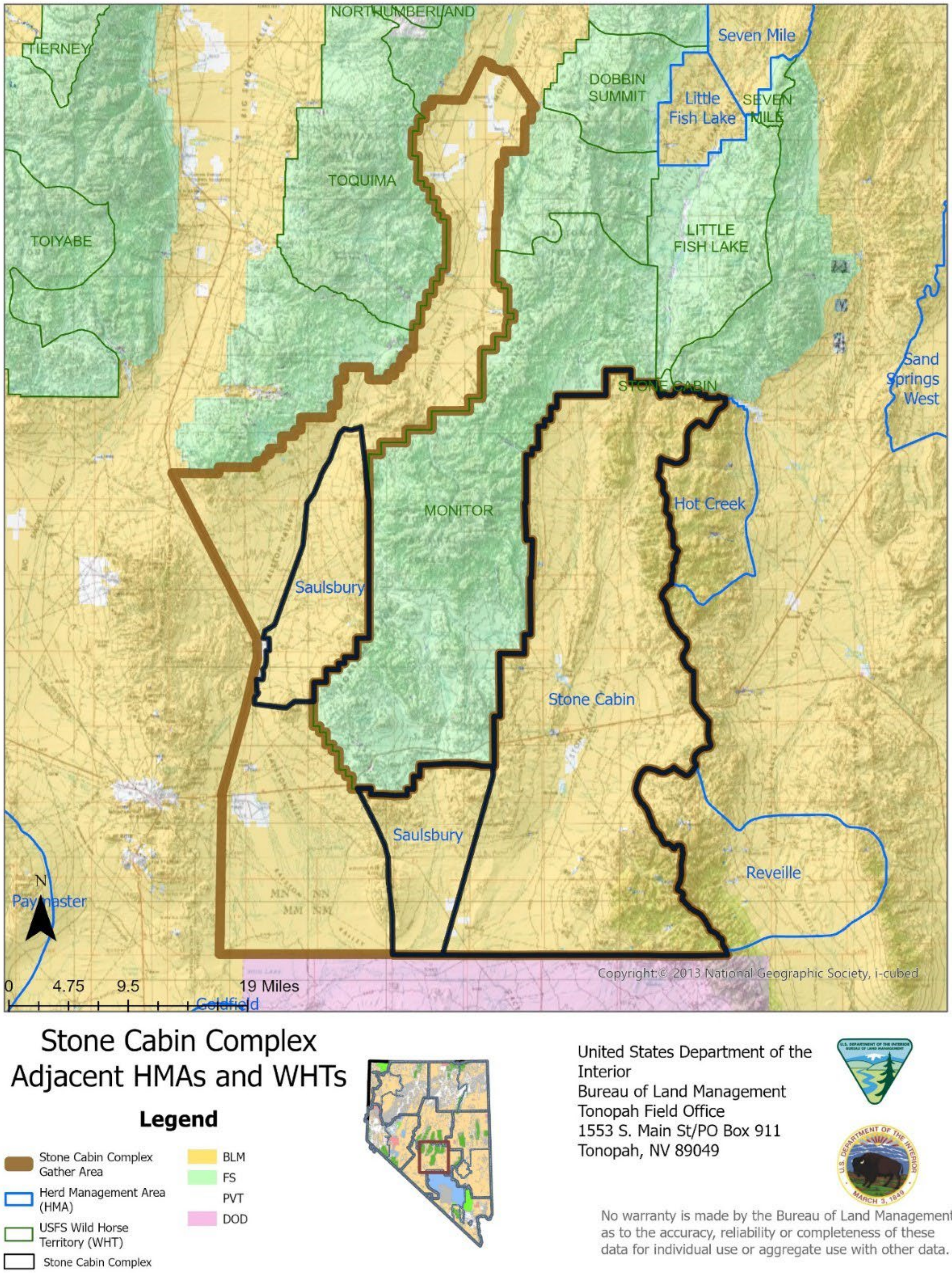
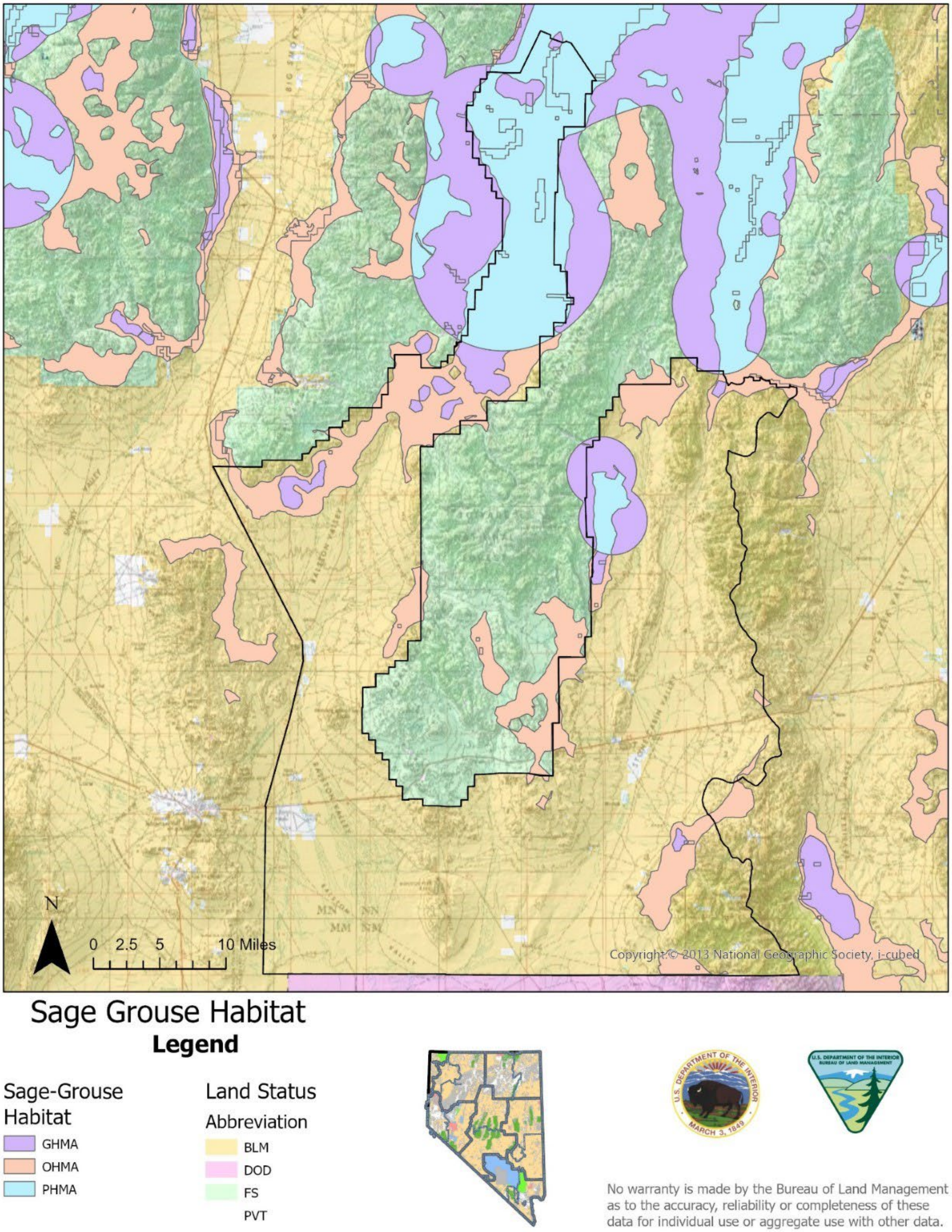
8.2 Acronyms

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
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
WHT- Wild Horse Territory

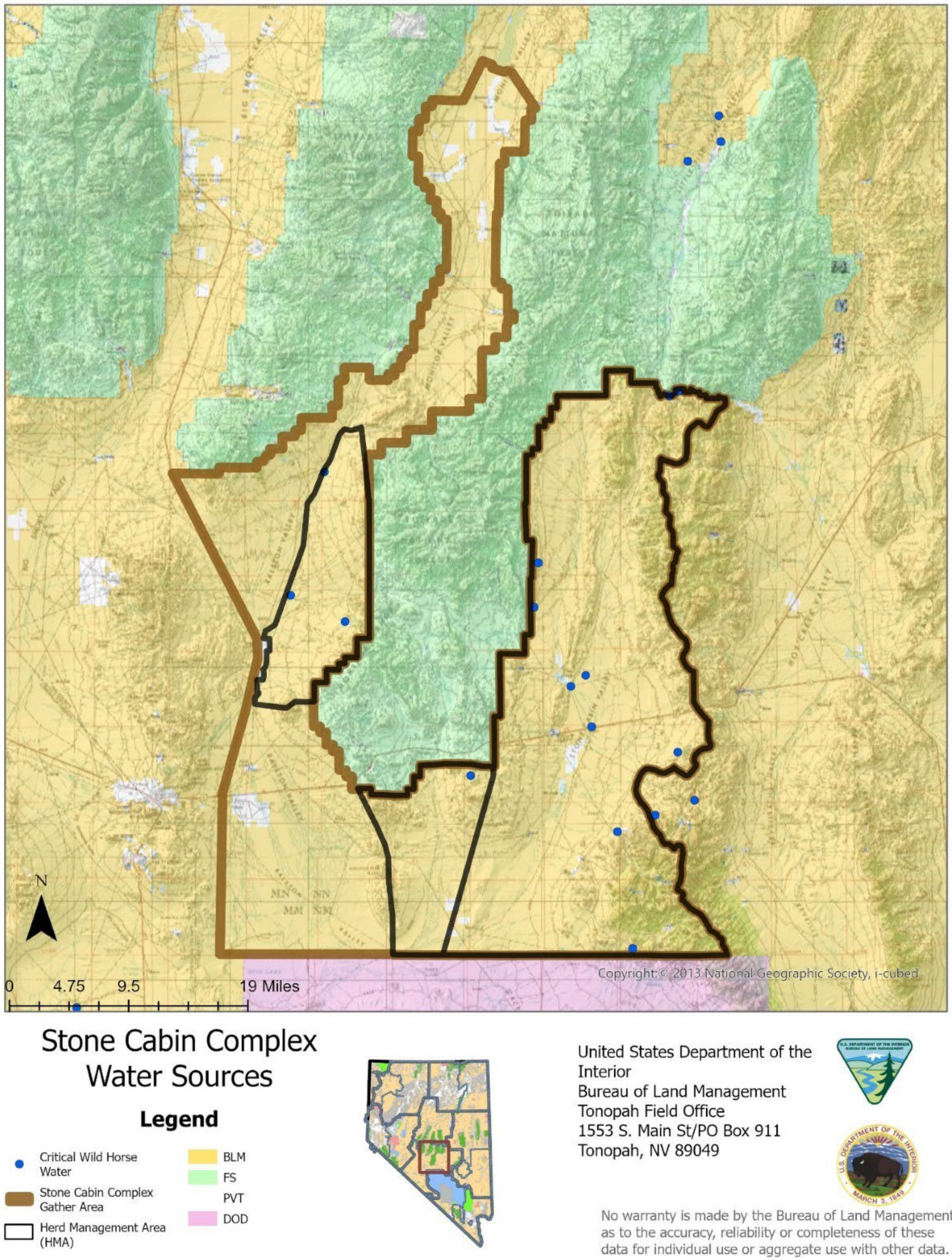
Appendix I. Maps



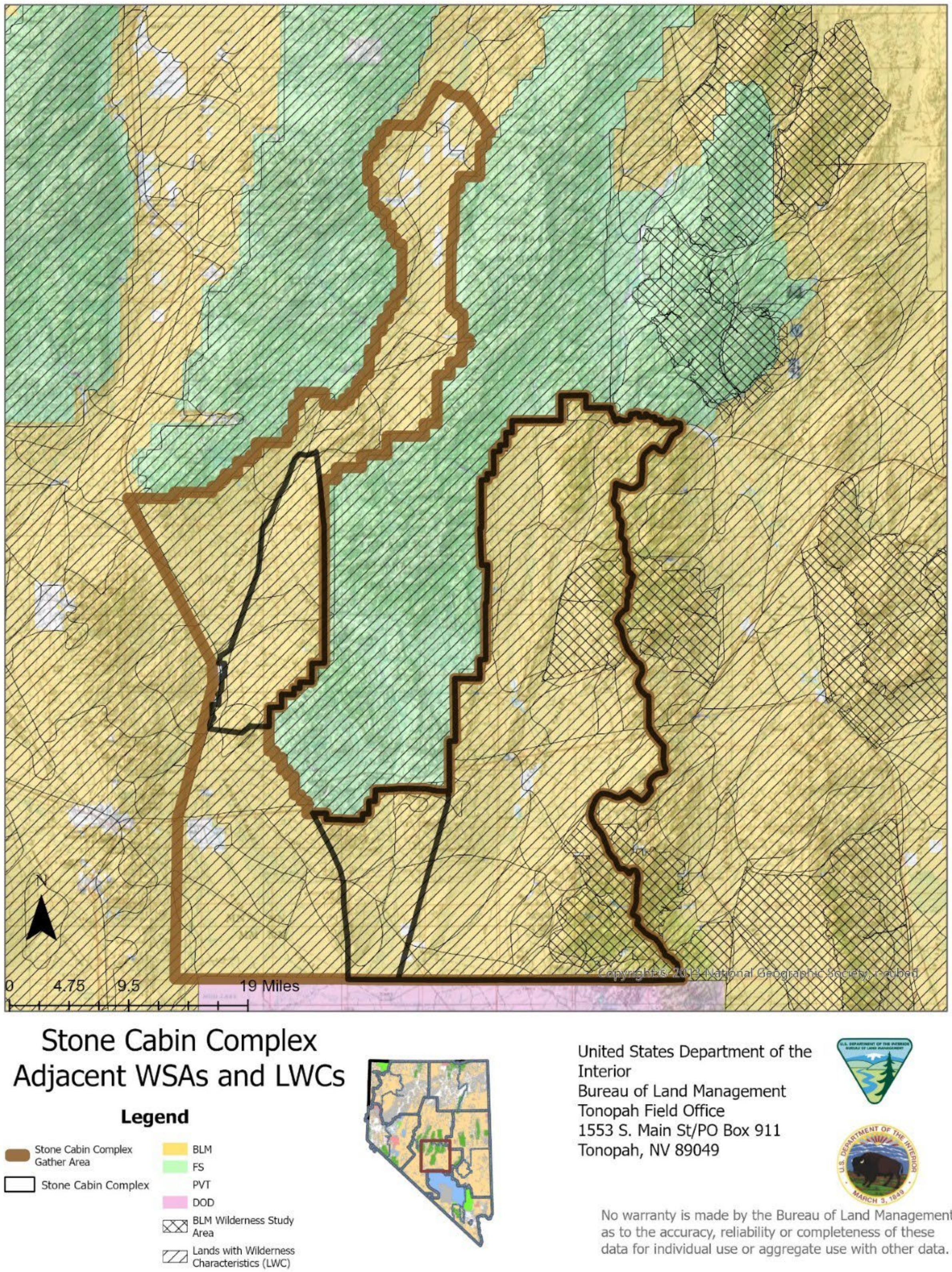
Map 2. Stone Cabin Complex and adjacent HMAs and WHTs



Map 3. Greater Sage-Grouse Habitat within and around the Stone Cabin Complex



Map 4. Stone Cabin Complex Water Resources



Map 5. Stone Cabin Complex adjacent wilderness areas and wilderness study areas

Appendix II. Vegetation, Climate, and Monitoring Data

Vegetation

The Stone Cabin and Saulsbury HMAs are located within the Southern Nevada Basin and Range Major Land Resource Area (MLRA). This area is in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. This MLRA supports saltbush-greasewood, big sagebrush, and pinyon-juniper woodland vegetation in the progression from the lowest to the highest elevation and precipitation. Shadscale, in association with bud sagebrush, spiny hopsage, ephedra, winterfat, fourwing saltbush, Indian ricegrass, squirreltail, and galleta, characterize the saltbush-greasewood type. With an increase in moisture, plants associated with shadscale are replaced by needlegrasses, bluegrasses, bluebunch or beardless wheatgrass, basin wildrye, and forbs. Black greasewood and Nuttall saltbush are important on some sites. Big sagebrush and black sagebrush, which grows on soils that are shallow to an indurated pan or to bedrock, become dominant. In the pinyon-juniper woodland, bitterbrush, serviceberry, and snowberry grow in association with Utah juniper and singleleaf pinyon. The highest elevations support thickets of curl-leaf mountain mahogany and small amounts of mixed conifer forest with limber, bristlecone, or ponderosa pine, Douglas-fir, or white fir. On bottom lands, basin wildrye, creeping wildrye, alkali sacaton, wheatgrasses, bluegrasses, sedges, and rushes are typical. Black greasewood, rubber rabbitbrush, and big sagebrush grow on the drier sites. Inland saltgrass, alkali sacaton, black greasewood, rubber rabbitbrush, and big saltbush typify the vegetation on strongly saline-alkali soils (NRCS, 2006).

The Stone Cabin and Saulsbury HMAs are dominated by three naturally occurring ecological systems, as defined by the Southwest Regional Gap Analysis Project (SWREGap). Together, the Intermontane mixed salt desert scrub, sagebrush shrubland/steppe systems, and Great Basin pinyon-juniper woodland comprise greater than 90% of the total area.

Inter-Mountain Basins Mixed Salt Desert Scrub includes open-canopied shrublands of typically saline basins, alluvial slopes and plains across the Intermountain western U.S. This type also extends in limited distribution into the southern Great Plains. This system dominates the analysis area, comprising approximately 46% of the Stone Cabin and Saulsbury HMAs. Substrates are often saline and calcareous, medium- to fine-textured, alkaline soils, but include some coarser-textured soils. The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more Atriplex species such as shadscale saltbush or fourwing saltbush. Other shrubs present to co-dominate may include Wyoming big sagebrush, yellow rabbitbrush, rubber rabbitbrush, Nevada ephedra, spiny hopsage, winterfat, bud sagebrush, Bailey's greasewood, and littlehair horsebrush. Black greasewood is generally absent, but if present does not co-dominate. The herbaceous layer varies from sparse to moderately dense and is dominated by perennial graminoids such as Indian ricegrass, blue grama, bottlebrush squirreltail, western wheatgrass, James' galleta, Sandberg bluegrass, or alkali sacaton. Various forbs are also present (Lowry, et al., 2005).

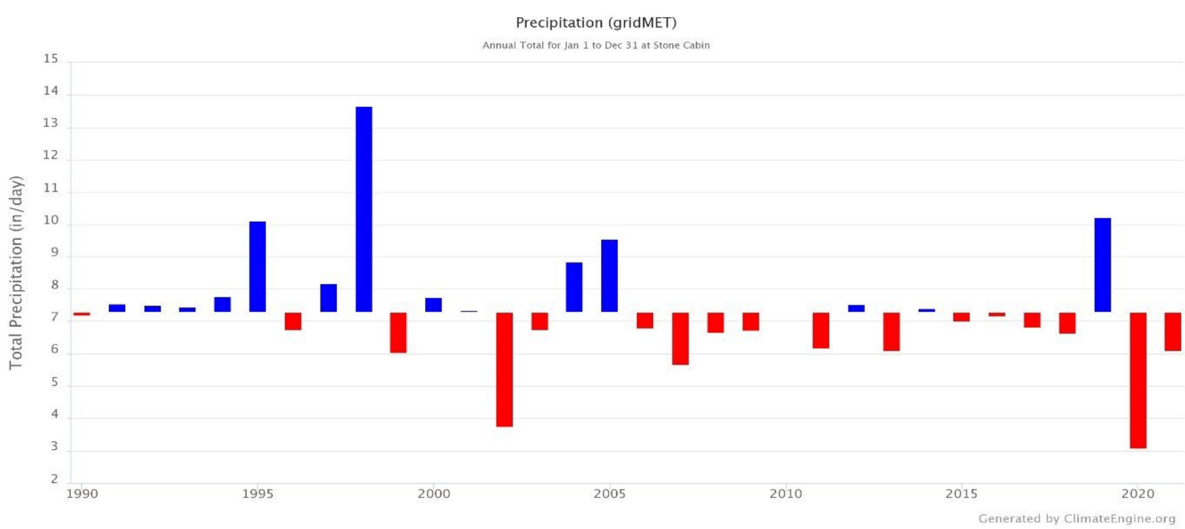
Great Basin xeric mixed sagebrush shrublands and Intermountain basin big sagebrush shrublands together comprise approximately 30% of the total area. Great Basin xeric mixed sagebrush shrublands occur on dry flats and plains, alluvial fans, rolling hills, rocky hillslopes, saddles and ridges at elevations between approximately 3,200 and 8,500 feet. Sites are dry, often exposed to desiccating winds, with typically shallow, rocky, non-saline soils. Within the Complex, these shrublands are dominated by black sage (mid and low elevations), low sage (higher elevation) and may be co-dominated by Wyoming big sagebrush or yellow rabbitbrush. Other shrubs that may be present include shadscale saltbush, Nevada ephedra, rubber rabbitbrush, spiny hopsage, Shockley's desert-thorn, budsage, greasewood, and horsebrush. The herbaceous layer is likely sparse and composed of perennial bunch grasses such as Indian ricegrass, squirreltail, or Sandberg bluegrass. Intermountain basin big sagebrush shrublands comprise approximately 32% of the area on the broad basin between the mountain ranges, plains, and foothills between approximately 4,900 and 7,500 feet elevation. Soils are typically deep, well-drained and non-saline. These shrublands are dominated by basin big sagebrush and/or Wyoming big sagebrush. Scattered juniper, greasewood, and saltbushes may be present in some stands. Rabbitbrush co-dominates some disturbed stands. Perennial herbaceous components typically contribute less than 25% vegetative cover. Common graminoid species include Indian ricegrass, needleandthread grass, basin wildrye, galleta, or Sandberg bluegrass (Lowry, et al., 2005).

Great Basin pinyon-juniper woodlands comprise approximately 16% of the Complex. This ecological system occurs on the dry mountain ranges and foothills, at elevations ranging from 5,250 to 8,500 feet. These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Woodlands dominated by a mix of pinyon and juniper, pure or nearly pure occurrences of pinyon, or woodlands dominated solely by juniper comprise this system. Curl-leaf mountain mahogany is a common associate. Understory layers are variable. Associated species include shrubs such as Greenleaf manzanita, low sage, black sage, big sagebrush, or littleleaf mountain mahogany. Common herbaceous component includes bunch grasses needleandthread and basin wildrye (Lowry, et al., 2005).

Climate

The climate associated with the Stone Cabin Complex is typical of the Basin and Range Ecological Region and characterized as having generally hot/dry summers and cold/wet winters. However, the past 10 years have frequently seen warmer than average summers and drier than average winters. Annual total precipitation can be highly variable with a few years receiving above average precipitation while most year receiving below average precipitation. The 30-year average annual precipitation for the Stone Cabin HMA is 7.29 inches, with 1998 being the wettest and 2020 being the driest. The Saulsbury HMA has comparable precipitation data.

Figure 1: 30-year average precipitation deviation from mean for the Stone Cabin BLM grazing allotment (Climate Engine)



Monitoring Data

Utilization

Key area utilization was conducted at 22 plots in Stone Cabin HMA, 3 plots in the north portion of Saulsbury HMA and 3 plots outside the north portion of the Saulsbury HMA in March 2022 by Tonopah BLM staff and Intermountain Range Consultants, Inc., retained by Stone Cabin Ranch, LLC. An additional 2 plots were monitored by BLM personnel in April 2022, one in the south portion of the Saulsbury HMA and one plot outside Saulsbury HMA. Key species use ranged from negligible to severe use at key areas, with some key areas lacking key species entirely (see maps below). Utilization on winterfat and perennial grasses, particularly Indian ricegrass, is severe and repeated. Both species show signs of reduced vigor and reproductive capability are severely reduced. Continued use by wild horses may impact the species' continued occurrence on the landscape.

For the 3 plots in the north portion of the Saulsbury HMA, Indian ricegrass has been utilized so heavily that seed stalk heights could not be obtained, and thus a percent utilization figure could not be determined using the Height-Weight method. For each of the 3 plots, 20 samples of this species were measured, with a remaining average stubble height of 1.0, 1.1, and 1.3 inches, respectively. This corresponds to a heavy degree of utilization, which would be unsustainable for the species' continued presence on the site.

At each plot, BLM personnel made a judgment as to whether utilization was attributable to wild horses, domestic cattle, or wildlife. This judgment was based on the relative abundance and recency of sign observed on the plot, including animal feces, trailing and hoof prints, and known 2021-2022 grazing management actions. Where evidence of utilization by multiple kinds of animals was noted, a proportion of utilization attributable to each was estimated. Table 1 summarizes utilization data for each plot and Figures 2 and 3 spatially depict the relative utilization by wild horses and cattle, respectively.

Based on available monitoring data, an excess number of wild horses in the Stone Cabin and Saulsbury HMAs are contributing to the over utilization of key species such as Indian ricegrass, winterfat, and crested wheatgrass.

Table 1: 2022 % Utilization by animal, Stone Cabin and Saulsbury HMAs

HMA	Key Area	Easting	Northing	Wild Horse % Utilization	Cattle % Uti-lization
Stone Cabin	SC 13	537792	4241604	64	0
Stone Cabin	SC 26	536875	4235930	72	0
Stone Cabin	SC 29	538625	4226422	59	0
Stone Cabin	SC 1.2	524286	4195619	0	61
Stone Cabin	SC 25	530228	4247729	46	0
Stone Cabin	SC 28	536620	4198277	8	13
Stone Cabin	SC 10	542155	4223878	46	0
Stone Cabin	SC 11	534767	4229816	39	0
Stone Cabin	SC 19	529586	4229542	49	0
Stone Cabin	SC 21	538956	4195453	39	4
Stone Cabin	SC 22	536081	4207605	38	25
Stone Cabin	SC 23.1	538073	4210326	54	0
Stone Cabin	SC 24	533940	4216114	31	10
Stone Cabin	SC 30	532336	4253788	39	0
Stone Cabin	SC 33	527023	4195040	0	43
Stone Cabin	SC 6	526511	4208413	0	49
Stone Cabin	SC 9	541230	4222735	28	9
Stone Cabin	SC 15	539948	4248380	71	0
Stone Cabin	SC 8.1	537675	4218765	54	0
Stone Cabin	WC 1	529549	4257586	0	0
Stone Cabin	WC 2	533206	4260453	4	38
Stone Cabin	WC 3	534939	4263658	0	10
Saulsbury	HC 0	499545	4242044	33	33
Saulsbury	HC 4	504451	4245319	69	0
Saulsbury	HC 8	500016	4236697	62	0
Saulsbury	Ra 14	515831	4214610	7	0
None	HC 12	507455	4263636	31	10
None	HC 17	516106	4264267	50	0
None	HC 22	516718	4265772	46	0
None	Ra 5	497088	4217456	24	0

Appendix III. WinEquus Population Modeling

Overview
To complete the population modeling for the Stone Cabin Complex, version 3.2 of the WinEquus program, created April 2, 2002, was utilized. The WinEquus program, developed by Dr. Steven Jenkins at the University of Nevada at Reno, was designed to assist Wild Horse and Burro Specialists evaluate various management plans and possible outcomes for management of wild horses that might be considered for a particular area.

The model was run for 10 years to show potential effects over time. However, prior to future gathers, the data from this proposed gather along with future inventory data would be analyzed to determine the appropriate course of action. Appropriate NEPA would also be completed, if necessary, prior to a future gather being conducted.

The current WinEquus Population Model includes options for management by Fertility Control Only, Removals only or Removals and Fertility Control. The model was created to show implementation of all of the management through actual gathers, removals and treatment of horses. Currently, within WinEquus, there are no options to implement booster treatment of fertility control via darting, initial or repeat treatment of PZP-22 via bait and water trapping, or gelding. Because of these limitations, the results for the modeling provide a general idea of the range of potential outcomes.

Because of the way the population model reflects the first foaling season at the beginning of the trial, the initial gather year was set to 2022.

The Proposed Action involves the use of fertility control. Alternative 1 was shown to manage through removals only, with no fertility control. The No Action alternative includes no management, removals or fertility control to simulate continued growth of the population. The fertility control only alternative includes management solely through the use of fertility control; ***this alternative was considered but eliminated from further consideration and is included in this section for comparison purposes only.***

Objectives of Population Modeling
The purpose of the modeling was to compare the potential results of the Proposed Action and Alternatives including the No Action to include population size over time, growth rates, and the number of animals that could be gathered, removed and treated for fertility control over the next 10 years. Review of the data output for each of the simulations provided many useful comparisons of the possible outcomes for each alternative. Some of the questions that need to be answered through the modeling include:

- Do any of the Alternatives "crash" the population?
- What effect does fertility control have on population growth rate?
- What effects do the different alternatives have on the average population size?
-

Population Data, Criteria, and Parameters Used for Population Modeling
All simulations used the survival probabilities, foaling rates, and sex ratio at birth that was supplied with the WinEquus population for the Garfield HMA 1997. Sex ratio at Birth: 43% Females 57% Males.

- Initial age-sex distribution was scaled to 776 horses, the estimated population for the complex **before** the addition of a 20% growth rate for 2022, as the model adds a foal crop to the initial gather year.
- Fertility control parameters: Year 1—94%, Year 2—82%, Year 3—68%

- Initial Gather Year: 2022
- Gather interval: minimum interval of three years
- Gather for fertility treatment regardless of population size: No
- Continue to gather after reduction to treat females: Yes
- Percent of the population that can be gathered: 80%
- Minimum age for sanctuary horses: Not Applicable
- Foals are not included in the AML

Simulations were run for 10 years with 100 trials each. Modeling Parameter	Proposed Action: selective removal down to low AML with application of fertility control to mares	Alternative 2: Removal only	No Action: no removal or fertility control
Threshold population for gathers	404	404	N/A
Target post-gather population size	242	242	N/A
Gather for fertility control regardless of population size	No	No	No
Continue gathering after removals to treat additional females	Yes	No	No
Year 1 effectiveness of fertility control	94%	N/A	N/A
Year 2 effectiveness of fertility control	82%	N/A	N/A
Year 3 effectiveness of fertility control	68%	N/A	N/A

Population Modeling Results

Table 1: Population Sized in 11 years – Proposed Action

Trial	Population Sizes in 11 Years – Proposed Action		
	Minimum	Average	Maximum
Lowest Trial	252	414	777
Median Trial	328	467	840
Highest Trial	374	519	1162

Table 2: Population Sized in 11 years – Alternative 1

Trial	Population Sizes in 11 Years – Alternative 1		
	Minimum	Average	Maximum
Lowest Trial	217	439	780
Median Trial	334	487	837
Highest Trial	376	542	1133

Table 3: Population Sized in 11 years – No Action

Trial	Population Sizes in 11 Years – No Action		
	Minimum	Average	Maximum
Lowest Trial	778	1524	3044
Median Trial	838	2434	5214
Highest Trial	1144	3602	7643

Table 4: Population Sized in 11 years – Fertility control only

Trial	Population Sizes in 11 Years – No Action		
	Minimum	Average	Maximum
Lowest Trial	753	1086	1309
Median Trial	846	1660	2642
Highest Trial	1084	2312	3783

Table 4: Average Population Growth Rates in 11 Years

Trial	Proposed Action	Alternative 1	No Action	Fertility Control only
Lowest Trial	9.5	12.9	14	4.8
Median Trial	14.5	17.7	19.8	11.7
Highest Trial	18.8	21.5	22.7	15.7

Table 5: Gather Results in 11 Years – Proposed Action

Trial	Totals in 11 Years – Proposed Action		
	Gathered	Removed	Treated
Lowest	1034	692	40
Median	1496	972	114
Highest	1693	1166	165

Table 6: Gather Results in 11 Years – Alternative 1

Trial	Totals in 11 Years –Alternative 1		
	Gathered	Removed	Treated
Lowest	961	869	N/A
Median	1162	1054	N/A
Highest	1398	1267	N/A

Table 7: Gather Results in 11 Years – No Action

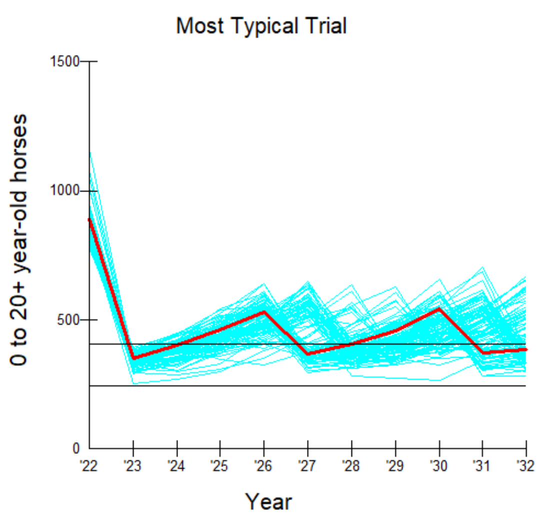
Trial	Totals in 11 Years –No Action		
	Gathered	Removed	Treated
Lowest	N/A	N/A	NA
Median	N/A	N/A	NA
Highest	N/A	N/A	NA

Table 8: Gather Results in 11 Years – Fertility Control Only

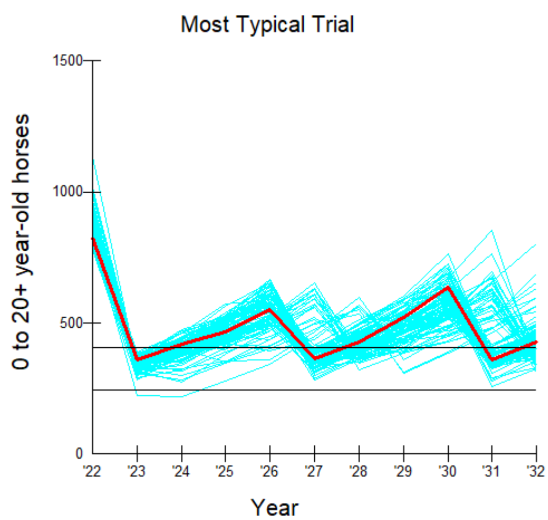
Trial	Totals in 11 Years –No Action		
	Gathered	Removed	Treated
Lowest	2342	0	760
Median	3390	0	1012
Highest	4664	0	1384

Table 9: Most Typical Trial Population by Year

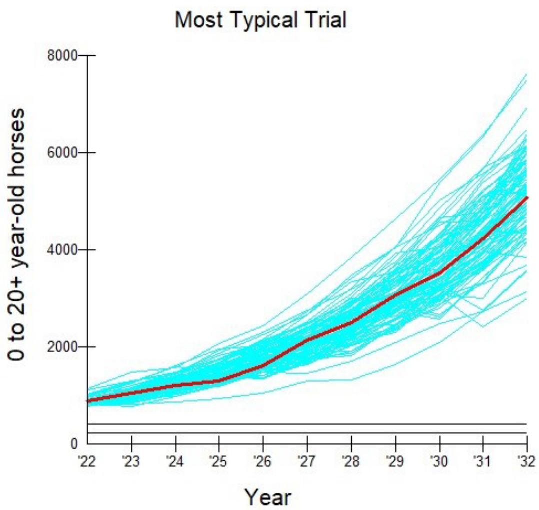
Year	Proposed Action	Alternative 1	No Action	Fertility Control Only
Year 1 – 2022	891	825	887	844
Year 2 – 2023	349	385	1047	968
Year 3 – 2024	401	420	1198	1083
Year 4 – 2025	459	463	1302	1203
Year 5 – 2026	531	549	1615	1336
Year 6 – 2027	366	363	2137	1613
Year 7 – 2028	406	428	2511	1654
Year 8 – 2029	455	521	3076	1791
Year 9 – 2030	541	635	3533	2186
Year 10 – 2031	373	358	4239	2561
Year 11 -- 2032	384	429	5062	2777
Average	469	486	2419	1638



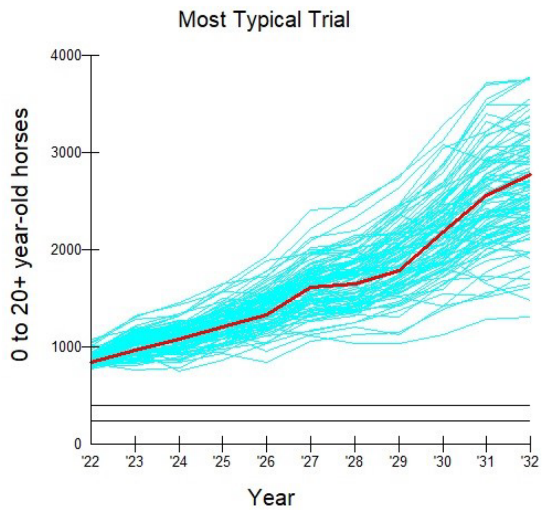
Proposed Action Most Typical Trial



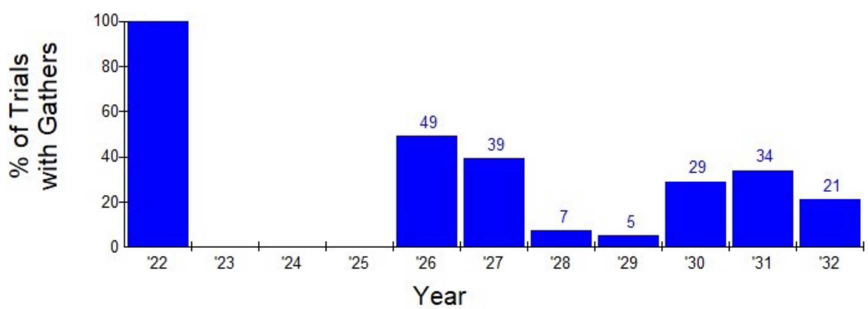
Alternative B Most Typical Trial



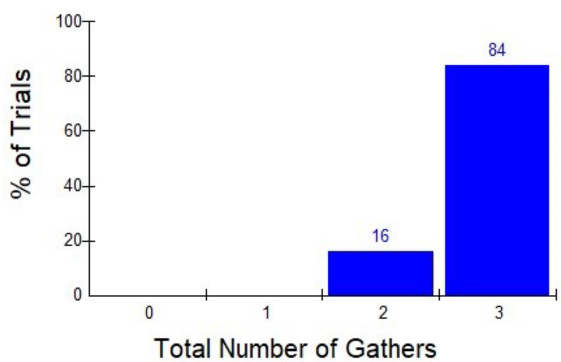
No Action Alternative Most Typical Trial



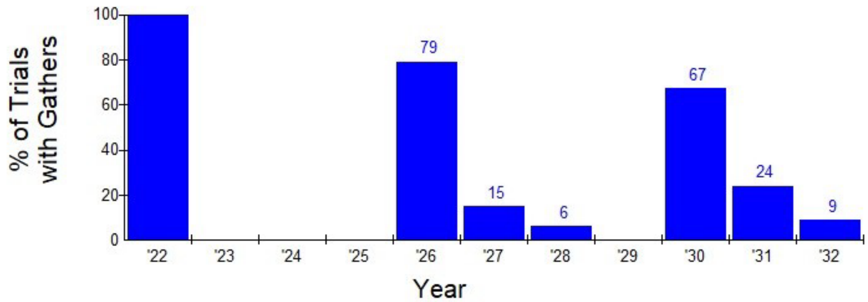
Fertility control only



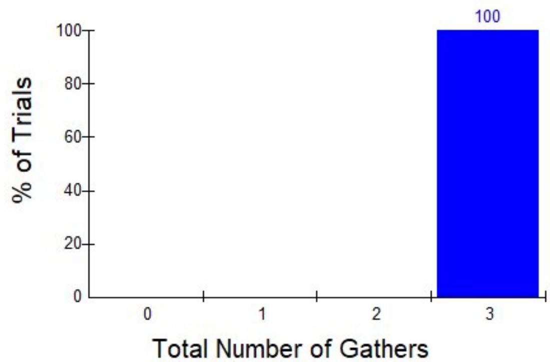
Proposed Action Gather schedule



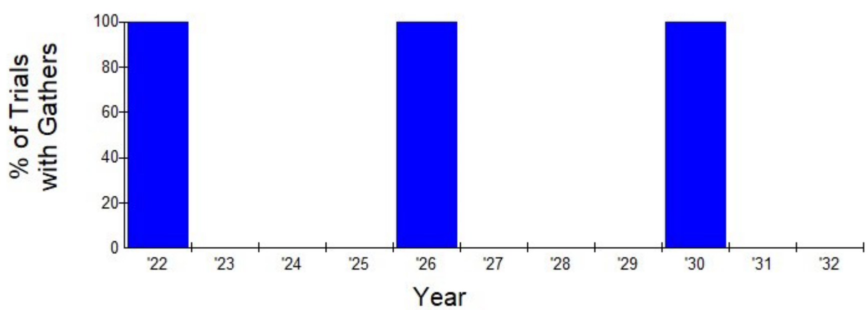
Proposed Action Gather total



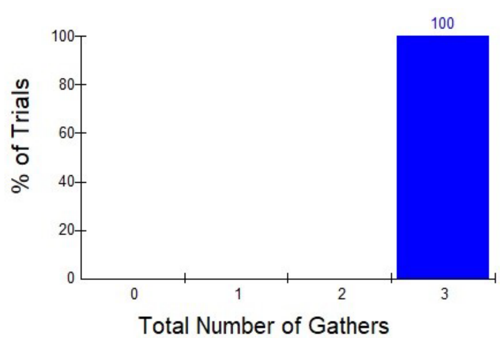
Alternative B Schedule of Gathers



Alternative B Gather total



Fertility Control Only schedule of gathers



Fertility control only gather total

Appendix IV. Literature Reviews

Dietary Overlap with other species
Wild horse populations above AML compete for forage, water, and cover allocated to wildlife and livestock. Over populations of wild horses impact riparian areas with increased trailing, vegetative use, and trampling. Wild horses in such situations will drive away livestock and native ungulates from watering and feeding areas (Miller 1981).

Numerous studies identify dietary overlap of preferred forage species and habitat preference between horses, cattle, and wildlife species in the Great Basin ecosystems for all season (Ganskopp 1983; Gandskopp et al. 1986, 1987; McInnis 1984; McInnis 1987; Smith et al 1982; Vavra and Sneva 1987). A strong potential exists for exploitative competition between horses and cattle under conditions of limited forage (water and space) availability (McInnis et al. 1987).

Although horses and cattle are often compared as grazers, horses can be more destructive to the range than cattle due to their differing digestive systems and grazing habits. The dietary overlap between wild horses and cattle is much higher than with wildlife, and averages between 60 and 80% (Hubbard and Hansen 1976, Hansen et al. 1977, Hanley 1982, Krysl et al. 1984, McInnis and Vavra 1987). Horses are cecal digesters while most other ungulates including cattle, pronghorn, and others are ruminants (Hanley and Hanley 1982, Beever 2003). Cecal digesters do not ruminate, or have to regurgitate and repeat the cycle of chewing until edible particles of plant fiber are small enough for their digestive system. Ruminants, especially cattle, must graze selectively, searching out digestible tissue (Olsen and Hansen 1977). Horses, however, are one of the least selective grazers in the West because they can consume high fiber foods and digest larger food fragments (Hanley and Hanley 1982, Beever 2003). Because horses have a cecal digestive system and can cover longer distances than domestic ruminants, wild horses can remain in good health under forage conditions fatal to domestic ruminants (Holechek 1989).

Wild horses can exploit the high cellulose of graminoids, or grasses, which have been observed to make up over 88% of their diet (McInnis and Vavra 1987, Hanley 1982). However, this lower quality diet requires that horses consume 20-65% more forage than a cow of equal body mass (Hanley 1982, Menard et al. 2002). With more flexible lips and upper front incisors, both features that cattle do not have, wild horses trim vegetation more closely to the ground (Symanski 1994, Menard et al. 2002, Beever 2003). As a result, areas grazed by horses may retain fewer plant species and may be subject to higher utilization levels than areas grazed by cattle or other ungulates. A potential benefit of a horse's digestive system may come from seeds passing through system without being digested but the benefit is likely minimal when compared to the overall impact wild horse grazing has on vegetation in general.

Competition from a large dominant species may drive niche partitioning of other species (Carothers and Jaksi, 1984; Ziv et al., 1993; Schuette et al., 2013). The study found that during times of greatest physiological stress (increased temperature, decreased precipitation), horses monopolized access to water sources where they were present up to 73% of the day, leaving limited time for other species. The potential for an exotic species, such as the wild horses, to outcompete native species for a limited communal resourced during peak need raises concern for native communities in water-limited environments (Hall et al. 2016).

Effects of Wild Horses and Burros on Rangeland Ecosystems
The presence of wild horses and wild 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. Horses went extinct in the Americas by the end of the Pleistocene, about 10,000 years ago (Webb 1984; MacFadden 2005). Burros evolved in Eurasia (Geigl et al. 2016). 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 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. The following literature review draws 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 95,000 BLM-administered wild horses and burros as of March 1, 2020, which does not include foals born in 2020. Lands with wild horses and burros are managed for multiple uses, so it can be difficult to parse out their ecological effects. Despite this, scientific studies designed to separate out those effects, 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), horses tend to favor use of more open habitats (Schoenecker 2016) that are dominated by grasses and shrubs and where ambush is less likely. Horses can compete with managed livestock in forage selected (Scasta et al. 2016).

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 (NAS 2013), although wild horse herd growth rates may be somewhat reduced by predation in some localized areas, particularly where individual cougars specialize on horse predation (Turner and Morrison 2001, Roelle et al. 2010). Andreasen et al. (2021) recently found that some mountain lions (*Puma concolor*) prey on young horses, particularly where horses are at very high densities and native ungulates are at very low densities. The greatest rate of predation on horses was in the Virginia Range, 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. BLM does not have the legal authority to regulate or manage mountain lion populations, and it is not clear whether there are any mountain lions in the Stone Cabin Complex that specialize on horse predation. Andreasen et al. (2021) concluded that “At landscape scales, cougar predation is unlikely to limit the growth of feral horse populations.” Given the recent history of consistent growth in the Stone Cabin Complex wild horse herd, as documented by repeated aerial survey, the inference that predation does not limit local wild horse 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 1986; 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). 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). 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). Wild 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, wild 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. 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, 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). However, when grazer density is high relative to available forage resources, 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. 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, 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).
Wild 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 wild 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).

Literature Reviews of PZP, GonaCon, and Intrauterine Devices (IUDs)

Porcine Zona Pellucida (PZP) and GonaCon Vaccines
Various forms of fertility control can be used in wild horses and wild 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). 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).

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 wild burros, but NEPA analysis has been required. 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 review does not examine effects of spaying and neutering. 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. While most studies reviewed here refer to horses, burros are extremely similar in terms of physiology, such that expected effects are comparable, except where differences between the species are noted.

On the whole, the identified impacts are generally transient 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 (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&B 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 (NAS 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. 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. Because applying contraception to horses 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. 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 (NAS 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.

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, McCann et al. 2017) 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. Because it is possible that mares may go years between vaccine treatments, especially if gathers are required to provide that treatment, it is expected that most mares would eventually return to fertility, though some individual mares treated repeatedly may remain infertile. However, many mares treated repeatedly (i.e., 4 or more times) with PZP ZonaStat-H vaccine become infertile for life (Nuñez et al. 2017) – that is to say, effectively sterile. Similarly, depending on their age of first treatment and the age when they die, some mares treated repeatedly with GonaCon-Equine vaccine may remain infertile for 4 or more years, which could mean they are infertile until they die. As noted in the BLM wild horse and burro program 2021 strategic research plan (BLM 2021): "Sterile animals do need not to be recaptured so, where practical, permanent humane sterilization options could be a fiscally responsible part of local herd management, leading to a large decrease in herd growth rates. At the same time, the BLM recognizes the if sterilization is used in management, it will be important to ensure that overall populations are self-sustaining, including with adequate genetic diversity at the herd and metapopulation levels." The population modeling in Appendix II identifies that the Stone Cabin complex herds would still be expected to grow, even with application of fertility control vaccines and sex ratio skewing. Genetically, the herd does not contain unique markers, and is well connected with other herds (see section 3.3, above). In this context, it can be consistent with the purpose and need if some number of the treated mares do remain infertile. Records of each released mare's vaccine treatment history, along with herd size and foal to adult ratio monitoring results, will allow the BLM to ensure that the complex contains an appropriate number of fertile mares for the herd to continue to be stable or grow over time. 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 followed SOPs for fertility control vaccine application (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. The IM requires that treated mares be identifiable via a visible freeze brand or individual color markings, so that their vaccination history can be known. The IM calls for follow-up population surveys to determine the realized annual growth rate in herds treated with fertility control vaccines.

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 (NAS 2013), and in feral burros on Caribbean islands (Turner et al. 1996, French et al. 2017). 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), and as Spayvac, where the PZP protein is enveloped in liposomes (Killian et al. 2008, Roelle et al. 2017, Bechert and Fraker 2018). '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 2015) 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 the hip. Although PZP-22 pellets have been delivered via darting in trial studies (Rutberg et al 2017, Carey et al. 2019), BLM does not plan to use darting for PZP-22 delivery until there is more demonstration that PZP-22 can be reliably delivered via dart.

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 2013, 2015). GonaCon has been used on feral horses in Theodore Roosevelt National Park and on wild horses administered by BLM (BLM 2015). 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 (NAS 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 2015) 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., *in press*).

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). 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 treated twice in the first year (Turner and Kirkpatrick 2002, Turner et al. 2008). 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). 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 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)	~30-75%	~20-50%

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 efficacy following a booster dose can be expected to be in the following ranges (based on figure 3 in Rutberg et al. 2017).

Year 1	Year 2	Year 3	Year 4
0 (developing fetuses come to term)	~50-90%	~55-75%	~40-75%

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). Gather efficiency does not usually exceed 85% 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, some mares may not respond to the fertility control vaccine, but instead will continue to foal normally.

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. 2009a, Janett et al. 2009b, 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. 2011); 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).

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, NAS 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. 2011, 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 2007, Botha et al. 2008, Killian et al. 2008, Miller et al. 2008, Janett et al. 2009, 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 (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. 2001, 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 which individuals of a given age class will have long-lasting immune responses to the GonaCon vaccine. Gray (2010) 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 most important factors affecting efficacy are.

Several studies have monitored animal health after immunization against GnRH. GonaCon treated mares did not have any measurable difference in uterine edema (Killian 2006, 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. 2011), 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 (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.

Reversibility and Effects on Ovaries: PZP Vaccines
In most cases, PZP contraception appears to be temporary and reversible, with most treated mares returning to fertility over time (Kirkpatrick and Turner 2002). 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 (J. Turner, University of Toledo, Personal Communication to BLM).

The purpose of applying PZP vaccine treatment is to prevent mares from conceiving foals, but BLM acknowledges that long-term infertility, or permanent sterility, could be a result for some number of individual wild horses receiving PZP vaccinations. 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). Permanent 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 to 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.

In some number of individual mares, 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). Joonè et al. (2017a) noted reversible effects on ovaries in mares treated with one primer dose and booster dose. 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. 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). Bagavant et al. (2003) demonstrated T-cell clusters on ovaries, but no loss of ovarian function after ZP protein immunization in macaques.

Reversibility and Effects on Ovaries: GnRH Vaccines
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. However, preliminary results on the effects of boostered doses of GonaCon-Equine indicate that it can have high efficacy and longer-lasting effects in free-roaming horses (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 fertility outcome (McCann et al. 2017).

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) and other species (Curtis et al. 2001) 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).

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.

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. 2001, Powers et al. 2011). 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. 2001, Stout et al. 2003, Schulman et al. 2013). It is plausible that giving ConaGon-Equine to prepubertal mares will lead to long-lasting infertility, but that has not yet been tested.

To date, short term evaluation of anti-GnRH vaccines, show contraception appears to be temporary and reversible. 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 reversible infertility. If long-term treatment resulted in permanent infertility for some treated mares, such permanent infertility fertility would be consistent with the desired effect of using GonaCon (e.g., effective contraception).

Other anti-GnRH vaccines also have had reversible effects in mares. Elhay (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 reversible. 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).

Permanent sterility as a result of single-dose or boostered GonaCon-Equine vaccine, or other anti-GnRH vaccines, has not been recorded, but that may be because no long-term studies have tested for that effect. It is conceivable that some fraction of mares could become sterile after receiving one or more booster doses of GonaCon-Equine. If some fraction of mares treated with GonaCon-Equine were to become sterile, though, that result would be consistent with text of the WFRHBA of 1971, as amended, which allows for sterilization to achieve population goals.

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). There is no data to support speculation regarding efficacy of multiple boosters of GonaCon-Equine; however, given it 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 might not exceed 85% 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, Janett et al. 2009a, 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 spayed 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). Nuñez's (2010) research 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 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. 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. If there are shifts in birth phenology, though, it is reasonable to assume that some negative effects on foal survival for a small number of foals might result from particularly severe weather events (Nuñez et al. 2018).

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 (NAS 2013). Curtis et al. (2011) 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 she did not assess other possible explanatory factors such as mare social status, age, body condition, or habitat in her analysis (NAS 2013). Gray et al. (2010) found no difference in foal survival in foals born to free-roaming mares treated with GonaCon.

There is little empirical information available to evaluate the effects of GnRH vaccination on foaling phenology, but those effects are likely to be similar to those for PZP vaccine treated mares in which the effects of the vaccine wear off. 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). Curtis et al. (2001) did observe 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 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). Unpublished results from an ongoing study of GonaCon treated free-roaming mares indicate that some degree of seasonal foaling is possible (D. Baker, Colorado State University, personal communication to Paul Griffin, BLM WH&B Research Coordinator). 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 (NAS 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. If there were to be a shift in foaling date for some treated mares, the effect on foal survival may depend on weather severity and local conditions; for example, Ransom et al. (2013) did not find consistent effects across study sites.

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, for the purpose of identifying that mare and identifying her 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 2015).

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 (Roelle and Ransom 2009, Bechert et al. 2013, French et al. 2017, Baker et al. 2018), 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. 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). In an examination of the GnRH vaccine Equity™, IM injections in the neck 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, her 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 in past gathers showed that many of the treated mares were larger than, maintained higher body condition than, and had larger healthy foals than untreated mares (BLM, anecdotal observations).

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. 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 (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. 2001, 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). Nuñez's later analysis (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, 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 (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. 2001, 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. 2001). 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 et al. (2009a) and Baker et al. (2018) found no difference in sexual behaviors in mares treated with GonaCon and untreated mares. 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 et al. (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 et al. (2009) and Ransom et al. (2014b) monitored non-reproductive behaviors in GonaCon treated populations of free-roaming horses. Gray et al. (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 her 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 (NAS 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). 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* NAS 2013). 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 she is treated with contraceptives.

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).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. 2013). This premise is based on an assumption that lack of response to any given fertility control vaccine is a heritable trait, and that the frequency of that trait will increase 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 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. 2001, Herbert and Trigg 2005). However, Magiafolou et al. (2013) 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 (NAS 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). Unfortunately, predictions about the long-term, population-level evolutionary response to immunocontraceptive treatments are speculative at this point, with results 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.

BLM is not aware of any studies that have quantified the heritability of a lack of response to immunocontraception such as PZP vaccine or GonaCon-Equine in horses or burros. At this point, there are no studies available from which one could make conclusions about the long-term effects of sustained and widespread immunocontraception treatments on population-wide immune function. 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), no studies have tested for changes in immune competence in those areas. Relative to the large number of free-roaming feral horses in the western United States, immunocontraception has not been, and is not expected to be used in the type of widespread or prolonged manner that might be required to cause a detectable evolutionary response.

The Stone Cabin Complex would have only a low risk of loss of genetic diversity if logistically realistic rates of PZP vaccine contraception are applied to mares. After the initial gather, subsequent PZP vaccine and/or would take place only after gathers, but also could take place through remote field darting. Wild horses in most HMAs are descendants of a diverse range of ancestors coming from many breeds of domestic horses, and this is apparently true in the Stone Cabin Complex as well. The genetic diversity of the Stone cabin herd was most recently sampled in 2017 and Saulsbury in 2010; results from the analysis of both HMAs indicated herds with mixed origins.

Genetic diversity of the Stone Cabin HMA was analyzed for the northern and southern portions, as the HMA is divided by the right of way fence along state HWY 6. As reported by Texas A&M, highest mean genetic similarity of the South Stone Cabin HMA was with Oriental and Arabian breeds, followed closely by the Old World Iberian and the North American Gaited breeds; highest mean genetic similarity of the North Stone Cabin HMA was with Light Racing and Riding breeds, followed closely by the Oriental and Arabian breeds and the Old World Iberian breeds with the same average value. Genetic variability of this herd in general is on the high side with only a moderate percentage of variation that is at risk, however data indicated that the herd is fairly stable genetically (Cothran 2017). In comparison to other feral herds from Nevada, both north and south Stone Cabin cluster closely with the Nevada Wild Horse Range (referenced as “Nellis” in the analysis report).

Genetic monitoring and analysis of the Saulsbury HMA was completed in 2010. As reported by Texas A&M, highest mean genetic similarity of the Saulsbury HMA herd was with Oriental breeds followed by the Old World Spanish. The results indicate a herd with mixed origins with no clear indication of primary breed type. Genetic variability of this herd is high and likely due to mixing with nearby herds. The values related to allelic diversity are especially high as is heterozygosity (Cothran 2010). In comparison to other feral herds from Nevada, Saulsbury clusters closely with New Pass Ravenswood and Hall Creek.

The Stone Cabin Complex is contiguous with the USFS Monitor Wild Horse Territory (WHT), which is west of the Stone Cabin HMA and north and west of the Saulsbury HMA. It is also contiguous with the Nevada Wild Horse Range to the south, the Little Fish Lake WHT to the north, the Reveille HMA to the southeast, and the Hot Creek HMA to the northeast. Though the degree of movement is unknown, adequate interchange between HMAs within this “metapopulation” likely occurs to maintain the genetic diversity of the Stone Cabin Complex, which is supported by the results of past genetic analysis. This historic, and probably ongoing, interchange would be expected to have the effect of maintaining relatively high levels of genetic diversity. Refer to Appendix I for an overview map of nearby HMAs.

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.

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 at the Swasey HMA, in Utah, and in several HMAs in Wyoming. 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 (NAS) 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, NAS 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). 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., unpublished results), 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 (Gradil 2019, Joonè et al. 2021, Gradil et al. 2021, Hoopes et al. 2021).

Sex Ratio Adjustment
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 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 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 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 (NAS 2013), and it is common for female foals to reproduce by their second year (NAS 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 fertile females. Wild mares may be distributed in a larger number of smaller harems. 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 in 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.

Infanticide is a natural behavior that has been observed in wild equids (Feh and Munktuya 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.

Effects of Male Neutering

Population growth suppression becomes less expensive if fertility control is long-lasting (Hobbs et al. 2000), such as with sterilization methods. 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. 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 wild burros, but NEPA analysis has been required. This review focuses on peer-reviewed scientific literature. 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 most studies reviewed here refer to horses, burros are extremely similar in terms of physiology, such that expected effects are comparable, except where differences between the species are noted.

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 (2013) encouraged the 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 NAS 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 roamed BLM lands as of March 1, 2022, and those numbers do not include at least 9,000 WHB 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 (NAS 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), fertility control alone is 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 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. 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 2015, 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. A study on the effects of having some gelded wild horses in a herd with fertile wild horses demonstrates this (King et al. 2022), in that non-reproductive changes in behavior were minimal. 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.

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, King et al. 2022). 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&B fertility control (NAS 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 gelding in this 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 (NAS 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). 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&B 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 (NAS 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 (NAS 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 is relatively little published research on castrates' behaviors (Hart and Jones 1975). 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 must be surmised from the existing literature. There is an ongoing BLM study in Utah focused on the individual and population-level effects of including some geldings in a free-roaming horse population (BLM 2016), but results from that study are not yet available. However, 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 and llamas continuing to respond to females even a year later in the case of goats, although mating time and the ejaculatory response was reduced (Hart and Jones 1975, Nickolmann et al. 2008).

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 Van Dierendonck et al. (2004) concluded that the presence of geldings did not appear to affect the social behavior of mares or negatively influence parturition, mare-foal bonding, or subsequent maternal activities. 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).

Appendix V. Standard Operating Procedures (SOPs)

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:

- Helicopter Drive Trapping. This gather method involves utilizing a helicopter to herd wild horses into a temporary trap.
- Helicopter Assisted Roping. This gather method involves utilizing a helicopter to herd wild horses or burros to ropers.
- Bait Trapping. This gather method involves utilizing bait (e.g., water or feed) to lure wild horses 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

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.

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.

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:

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.

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”.

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.

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

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

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.

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.

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.

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.

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.

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

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.

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

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:

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

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

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

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 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.

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

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:

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

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

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

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.

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.

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.

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.

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.

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).

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.

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

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.

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.

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

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

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

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.

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 wild horses or burros 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
Shawna Richardson, WH&B Specialist, Battle Mountain District
Brianna Brodowski, WH&B Specialist, Battle Mountain District, Tonopah Field Office
Ruth Thompson, NV WH&B 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 Tonopah Assistant Field Manager – Renewables and the Tonopah Field Manager 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 Assistant Field Manager – Renewables 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.

Fertility Control Treatment SOPs common to all 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 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 (Reno, Nevada). A copy of the form and data sheets and any photos taken should be maintained at the field office.

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.

PZP Vaccine SOPs

1. PZP vaccine would be administered by trained BLM personnel.

2. The fertility control drug is administered with two separate injections: (1) a liquid dose of PZP is administered using an 18-gauge needle primarily by hand injection; (2) the pellets are preloaded

into a 14-gauge needle. These are loaded on the end of a trocar (dry syringe with a metal rod) which is loaded into the jab-stick which then pushes the pellets into the breeding mares being returned to the range. The pellets and liquid are designed to release the PZP over time similar to a time-release cold capsule.

3. Delivery of the vaccine would be as an intramuscular injection while the mares are restrained in a working chute. Half a cubic centimeter (cc) of the PZP vaccine would be emulsified with half a cc of adjuvant (a compound that stimulates antibody production) and loaded into the delivery system. The pellets would be loaded into the jab-stick for the second injection. With each injection, the liquid and pellets would be propelled into the left hindquarters of the mare, just below the imaginary line that connects the point of the hip and the point of the buttocks.

4. All treated mares would be freezemarked on the hip and / or chipped to enable researchers to positively identify the animals during the research project as part of the data collection phase.

5. At a minimum, monitoring of reproductive rates using helicopter flyovers will be conducted in years two through four by checking for the presence or absence of foals. The flight scheduled for year four will also assist in determining the percentage of mares that have returned to fertility. In addition, field monitoring will be routinely conducted as part of other regular ground-based monitoring activities.

6. A field data sheet will be used by the field applicators to record all the pertinent data relating to identification of the mare including a photograph when possible, date of treatment, type of treatment (1 or 2 year vaccine, adjuvant used) and HMA. The original form with the data sheets will be forwarded to the Authorized Officer at the National Program Office (NPO) in Reno, Nevada. A copy of the form and data sheets and any photos taken will be maintained at the district office.

7. A tracking system will be maintained by NPO detailing the quantity of PZP issued, the quantity used, and disposition of any unused PZP, the number of treated mares by HMA, district office, and state along with the freeze-mark and / or chip applied by HMA.

8. The field office will assure that treated mares do not enter the adoption market for 3 years following treatment. In the rare instance, due to unforeseen circumstances, that treated mare(s) are removed from an HMA before 3 years have lapsed, they will be maintained in either a BLM facility or BLM-contracted Long-Term Pastures (LTPs) until expiration of the 3-year holding period. In the event it is necessary to remove treated mares, their removal and disposition will be coordinated through NPO. After expiration of the 3-year holding period, the animal may be placed in the adoption program or sent to long-term pastures.

PZP Remote Darting SOPs

1. PZP vaccine would be administered through 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.

2. All mares targeted for treatment will be clearly identifiable through photographs to enable darters and HMA managers to positively identify the animals during the project and at the time of removal during subsequent gathers.
3. Mares that have never been treated would receive 0.5 cc of PZP vaccine emulsified with 0.5 cc of Freund's Modified Adjuvant (FMA) and loaded into darts at the time a decision has been made to dart a specific mare. Mares identified for re-treatment receive 0.5 cc of the PZP vaccine emulsified with 0.5 cc of Freund's Incomplete Adjuvant (FIA).
4. The liquid dose of PZP vaccine is administered using 1.0 cc Pneu-Darts with 1.25" or 1.5" barbless needles fired from either Dan Inject®, Pneu-Dart® X-Caliber or Palmer® Cap-Chur rifle.
5. Only designated darters would mix the vaccine/adjuvant and prepare the emulsion. Vaccine-adjuvant emulsion would be loaded into darts at the darting site and delivered by means of an appropriate CO_2 powered or cartridge darting delivery system.
6. Delivery of the vaccine would be by intramuscular injection into the left or right hip/gluteal muscles while the mare is standing still.
7. Safety for both humans and the horse is the foremost consideration in deciding to dart a mare. Safe darting distances would depend on the skill and ability of the darter, and the particular model of dart gun being utilized. No attempt would be taken when other persons are within a 30-m radius of the target animal.
8. No attempts would be taken in high wind or when the horse is standing at an angle where the dart could miss the hip/gluteal region and hit the rib cage. The ideal is when the dart would strike the skin of the horse at a perfect 90° angle.
9. 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 horse. 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. Refrigerated darts would not be used in the field.
10. No more than two people should be present at the time of a darting. The second person is responsible for locating fired darts. The second person should also be responsible for identifying the horse and keeping onlookers at a safe distance.
11. 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.
12. Attempts will be made to recover all darts. To the extent possible, all darts which are discharged and drop from the horse 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 the 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.
13. In the event that a dart strikes a bone or imbeds in soft tissue and does not dislodge, the darter would follow the affected horse until the dart falls out or the horse can no longer be found. The darter would be responsible for daily observation of the horse until the situation is resolved.

GonaCon SOPs

GonaCon-Equine vaccine (USDA Pocatello Storage Depot, Pocatello, ID; Spay First!, Inc., Oklahoma City, OK) is distributed as preloaded doses (2 mL) in labeled syringes.

Delivering GonaCon by Hand-Injection of GonaCon

1. GonaCon-Equine vaccine is administered by hand-injection to mares that are appropriately immobilized or restrained. Important: label instructions must be followed for this product. Females identified for treatment application are hand-injected with an intramuscular injection of Gona-Equine vaccine (2 ml) in the lower gluteal musculature using a hand-held, luer-lock syringe (18-gauge, 3.8 cm needle). The syringe is made of transparent plastic with the barrel showing graduated marks indicating the volume of the vaccine in the syringe. This facilitates the visual assessment of the quantity of vaccine injected into the animal without the need to weigh the syringes. Pre-loaded syringes should be kept refrigerated overnight and then set out the morning of application at room temperature. They should not be allowed to get too warm or cold during the day.

2. The vaccine is distributed as preloaded doses (2 mL) in labeled syringes. Upon receipt, the vaccine should be kept refrigerated (4° C) until use. Do not freeze. 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.

3. Although infrequent, hand-injections to immobilized or restrained horses can result in partial delivery of the vaccine due to inexperienced personnel and/or unexpected movement of the horse. As a precaution, order extra doses of the vaccine. For hand-injection application, assume a 10% failure rate and increase the original quantity accordingly.

4. Examine each syringe before and after injection and visually determine approximately how much vaccine was injected. A full dose is considered 90% (1.8 ml) or greater of the original 2 ml dose. Ensure a full dose is administered.

5. It is recommended that all treated mares be photographed to facilitate identification by individual markings, RFID chip, and/or freeze-marked on the hip or neck to positively identify the animals as a GonaCon-Equine vaccinated mare during field observations or subsequent gathers.

Preparation of Darts for GonaCon Remote Delivery:

General practice guidelines for darting operations, as noted above for dart-delivery of ZonaStat-H, should be followed for dart-delivery of GonaCon-Equine.

1. The vaccine is distributed as preloaded doses (2 mL) in labeled syringes. Upon receipt, the vaccine should be kept refrigerated (4° C) until use. Do not freeze. 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. Important: label instructions must be followed for this product.

2. 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 (~15 %). To determine the amount of vaccine delivered, the dart must be weighed before loading, and before and after delivery in the field.

3. For best results, darts with a gel barb should be used. (i.e. 2 cc Pneu-Dart brand darts configured with Slow-inject technology, 3.81 cm long 14 ga.tri-port needles, and gel collars positioned 1.27 cm ahead of the ferrule).

4. Wearing latex gloves, darts are numbered and filled with vaccine by attaching a loading needle (7.62 cm; provided by dart manufacturer) to the syringe containing vaccine and placing the needle into the cannula of the dart to the fullest depth possible. Slowly depress the syringe plunger and begin filling the dart. Periodically, tap the dart on a hard surface to dislodge air bubbles trapped within the vaccine. Due to the viscous nature of the fluid, air entrapment typically results in a maximum of approximately 1.8 ml of vaccine being loaded in the dart. The dart is filled to max once a small amount of the vaccine can be seen at the tri-ports.

5. 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.

6. 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 a cooler at about 4° C and used the next day, but do not store in a refrigerator or any other container likely to cause condensation.

Administering the GonaCon Vaccine Remotely (via Darting):

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

2- With each injection, the vaccine should be injected into the left or right hind quarters of the mare, above the imaginary line that connects the point of the hip (hook bone) and the point of the buttocks (pin bone).

3- 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. 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.

4- A booster vaccine may be administered after the first injection to improve efficacy of the product over subsequent years.

5- Free ranging animals may be photographed using a telephoto lens and high quality digital receiver as a record of treated individuals, and the injection site can be recorded on data sheets to facilitate identification by animal markings and potential injection scars.

SOPs for Insertion of Y-shaped Silicone IUD for Feral Horses

Background: Mares must be open. A veterinarian must determine pregnancy status via palpation or ultrasound. Ultrasound should be used as necessary to confirm open status of mares down to at least 14 days for those that have recently been with stallions. For mares segregated from stallions, this determination may be made at an earlier time when mares are identified as candidates for treatment, or immediately prior to IUD insertion. Pregnant mares should not receive an IUD.

Preparation: IUDs must be clean and sterile. Sterilize IUDs with a low-temperature sterilization system, such as Sterrad.

The Introducer is two PVC pipes. The exterior pipe is a 29” length of ½” diameter pipe, sanded smooth at one end, then heat-treated to smooth its curvature further (Fig. 1). The IUD will be placed into this smoothed end of the exterior pipe. The interior pipe is a 29 ½” long, ¼” riser tube (of the kind used to connect water lines to sinks), with one end slightly flared out to fit more snugly inside the exterior pipe (Fig. 1), and a plastic stopper attached to the other end (Fig. 2).

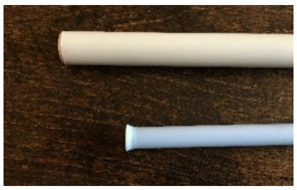


Figure 1. Interior and exterior pipes (unassembled), showing the ends that go into the mare

Figure 2. Interior pipe shown within exterior pipe. After the introducer is 4” beyond the os, the stopper is pushed forward (outside the mare), causing the IUD to be pushed out from the exterior pipe.

Introducers should be sterilized in Benz-all cold steriliant, or similar. Do not use iodine-based sterilant solution. A suitable container for sterilant can be a large diameter (i.e., 2”) PVC pipe with one end sealed and one end removable.

Prepare the IUD: Lubricate with sterile veterinary lube, and insert into the introducer. The central stem of the IUD goes in first (Fig. 3).

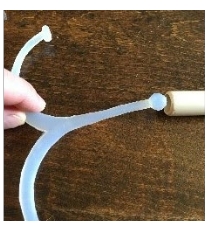


Figure 3. Insert the stem end of the IUD into the exterior pipe.

Fold the two ‘legs’ of the IUD, and push the IUD further into the introducer, until just the bulbous ends are showing (Fig. 4).

Figure 4. Insert the IUD until just the tips of the 'legs' are showing.

Restraint and Medication: The mare should be restrained in a padded squeeze chute to provide access to the rear end of the animal, but with a solid lower back door, or thick wood panel, for veterinarian safety.

Only a veterinarian shall oversee this procedure and insert IUDs. Some veterinary practitioners may choose to provide sedation. If so, when the mare's head starts to droop, it may be advisable to tie the tail up to prevent risk of the animal sitting down on the veterinarian's arm (i.e., double half hitch, then tie tail to the bar above the animal). Some veterinary practitioners may choose to provide a dose of long-acting progesterone to aid in IUD retention. Example dosage: 5mL of BioRelease LA Progesterone 300 mg/mL (BET labs, Lexington KY), *or* long-acting Altrenogest). No other intrauterine treatments of any kind should be administered at the time of IUD insertion.

Insertion Procedure:

- Prep clean the perineal area.
- Lubricate the veterinarian's sleeved arm and the Introducer+IUD.
- Carry the introducer (IUD-end-first) into the vagina.
- Dilate the cervix and gently move the tip of the introducer past the cervix.
- Advance the end of the 1/2" PVC pipe about 4 inches past the internal os of the cervix.
- Hold the exterior pipe in place, but push the stopper of the interior pipe forward, causing the IUD to be pushed out of the exterior pipe, into the uterus.
- Placing a finger into the cervical lumen just as the introducer tube is removed from the external os allows the veterinarian to know that the IUD is left in the uterus, and not dragged back into or past the cervix.
- Remove the introducer from the animal, untie the tail.

Mares that have received an IUD should be observed closely for signs of discharge or discomfort for 24 hours following insertion after which they may be released back to the range.

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 83 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 (IM 2009-041, 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 (IM 2009-041, 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 non-breeding animals.

Appendix VI. Wild Horse 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-Battle Mountain.

- 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