Environmental Assessment

Red Desert Complex Herd Management Area Gather
DOI-BLM-WY-030-EA15-63

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Prepared by:

U.S. Bureau of Land Management
High Desert District
Rawlins Field Office
1300 North Third Street
Rawlins, Wyoming 82301

U.S. Bureau of Land Management
Wind River Big Horn Basin District Office
Lander Field Office
1335 Main Street
Lander, Wyoming 83520

Mission Statement

To sustain the health, diversity, and productivity of the public lands
for the use and enjoyment of present and future generations.

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1.0 INTRODUCTION

This Environmental Assessment (EA) has been prepared to analyze the Bureau of Land Management's (BLM) High Desert District, Rawlins Field Office (RFO), and Wind River – Big Horn Basin District, Lander Field Office (LFO), proposal to conduct a wild horse gather in the Lost Creek, Stewart Creek, Green Mountain, Crooks Mountain and Antelope Hills Herd Management Areas (HMAs) – collectively called Red Desert Complex. The "gather area" includes the five HMAs and areas outside of the HMAs where wild horses reside (See Map 1). These HMAs are analyzed as a Complex since the HMAs are adjacent, but not necessarily contiguous, and have animal interchange. The BLM has determined that excess wild horses are present in the Red Desert Complex. The terms "horse" and "wild horse" are used synonymously throughout this document.

The EA contains a site-specific analysis of potential impacts that could result from implementation of any one of three alternatives. It assists the BLM in project planning and ensuring compliance with the National Environmental Policy Act (NEPA), and in making a determination as to whether any "significant" impacts to the human environment could result from the analyzed actions. "Significance" is defined by NEPA and is found in regulation 40 CFR 1508.27. An EA provides evidence for determining whether to prepare an Environmental Impact Statement (EIS) or a statement of "Finding of No Significant Impact" (FONSI). If the decision maker determines that this project has "significant" impacts following the analysis in the EA, then an EIS would be prepared. If the decision maker determines that this project does not have "significant" impacts following the analysis, then an FONSI would be prepared. A Decision Record would then be signed for the EA approving one or a mixture of the alternatives presented in the EA.

The RFO and LFO are located in south central and central Wyoming, covering the eastern third of Sweetwater County, all of Carbon, Albany, Laramie, and Fremont County and portions of Hot Springs and Natrona Counties. The Complex is located in the Sweetwater, Carbon, Fremont and Natrona Counties west and south of Wyoming Highway 789/287 (See Map 1). The Complex encompasses about 753,000 acres of land. About 49,500 acres (about 6 percent) is privately or state owned. The Complex is characterized by gently rolling hills to steep mountainous terrain around Green Mountain and Crooks Mountain, to greasewood flats and sand dunes in the lower portions of Lost Creek and Stewart Creek. Annual precipitation ranges from 5 to 7 inches per year at the lower elevations and 15-20 inches for the upper elevations on Green Mountain and Crooks Mountain, most of which is received in the form of winter snows. This general discussion tiers to the affected environment that is discussed in the Approved Rawlins Resource Management Plan (RMP) (2008b) and in the Approved Lander RMP (2014a)

The definition of Appropriate Management Level (AML) (BLM 2010b) is the population range within which wild horses and burros (WH&B) can be managed for the long term. The AML upper limit is established as the maximum number of WH&B which results in a thriving natural ecological balance (TNEB) and avoids a deterioration of the range. The AML range for wild horses within the Complex is 480-724. This AML was established in the Approved Rawlins RMP (2008b) and in the Approved Lander RMP (2014a) following an in-depth analysis of habitat suitability, resource monitoring, and population inventory data, with public involvement.

Table 1 lists the AML for wild horses in the Red Desert Complex by HMA and grazing allotment. Establishing the AML as a population range allows for the periodic removal of excess animals (to the low range) and subsequent population growth (to the high range) between removals.

The current estimated population of wild horses in the gather area is 2,620[1]. This estimate is based on the April 2015 aerial population survey flights using the double observer method and includes the addition of the 2015 and 2016 foal crop. For more information on the methods of this population survey and its results, see Appendix 6.

Based upon all information available, the BLM determined that approximately 2,140 excess wild horses exist within the gather area, which would need to be removed to maintain a TNEB, meet local and national wild horse program goals, and other program goals. This assessment is based on the following factors and BLM objectives including, but not limited to:

- Wild horse population double observer population survey estimates and distribution (Appendix 6).
- The Standards and Guidelines Rangeland Health Assessments (BLM 2003 and BLM 2013b).
- Range trend monitoring and results in areas without Rangeland Health Assessment.
- Actual use by livestock has varied from 10%-70% of authorized use, depending on water and available forage conditions.
- Consideration of preserving and maintaining Greater Sage-Grouse habitat, including Sagebrush Focal Areas.
- Slow horse population growth to maximize the time between gathers;
- Reduce the number of wild horses being placed
    - for adoption/sale; or
    - in short-term holding or long-term pastures;
- Maintain wild horse populations within AMLs; and
- Manage the HMAs to achieve and maintain a thriving natural ecological balance, and multiple-use relationship.
- Manage the HMA populations to preserve and enhance the historic physical and biological characteristics of the herd, including noted Iberian characteristics in the Lost Creek HMA.
- Maintain sex ratios and age structures, which would allow for the continued physical, reproductive, and genetic health of horses.
- Preserve and maintain a healthy and viable wild horse population that will survive and be successful during poor years when elements of the habitat are limiting due to severe winter conditions, drought, or other uncontrollable and unforeseeable environmental influences to the herd. Manage the HMA herds as self-sustaining populations of healthy animals in balance with other uses and the productive capacity of their habitat.

[1] All wild horse numbers used in reference to current population, gather number, treatment number, etc., are approximate; based upon the 2015 aerial survey (Appendix 6) and adjusted for herd growth rate. This pertains throughout the document. The AML numbers are not approximate, as discussed in the preceding paragraph of the document.

Table 1. AML by Allotment/HMA and Decision Record Date

HMA	Allotment	AML (low)-(high)	Decision Record Date
Stewart Creek	Stewart Creek (#10102)	125-175	2008
Lost Creek	Cyclone Rim (#10103)	60-82	2008
Antelope Hills	Antelope Hills (#17055), Cyclone Rim (#10103)	60-82	2014
Crooks Mountain	Arapahoe Creek (#17056), Alkali Creek Sheep (#17056)	65-85	2014
Green Mountain	Mountain (#32030), Arapahoe Creek (#17056), Whiskey Peak Common (#12003)	170-300	2014
Complex Total		480-724	

1.1 Purpose and Need

Purpose: The purpose of the Proposed Action is to address an overpopulation of wild horses within the Complex to achieve TNEB, alleviate deterioration of the rangeland, and to respond to requests to remove wild horses located outside the Complex in areas not designated for their long-term use.

Need: The need for the Proposed Action is to achieve and maintain populations within the established AMLs for each HMA (areas designated for their long-term management), to protect rangeland resources from deterioration associated with the current overpopulation, and to restore a TNEB and multiple use relationship on public lands in the Complex consistent with the provisions of Section 1333(b) (2) of the Wild and Free Roaming Horse and Burro Act (WFRHBA, Public Law 92-195), as amended, section 302(b) of the Federal Land Policy and Management Act of 1976 (FLPMA, Public Law 94-579), and Section 2(b)(4) of the Public Rangelands Improvement Act of 1978 (PRIA, Public Law 95-514). The WFRHBA provides that the Department of Interior "manage wild free-roaming horses and burros in a manner that is designed to achieve and maintain a thriving natural ecological balance on the public lands." (Section 1333(a), as amended). The WFRHBA also provides that "If wild free-roaming horses or burros stray from public lands onto privately owned land, the owners of such land may inform the nearest Federal marshal or agent of the Secretary, who shall arrange to have the animals removed." (Section 1334, as amended). BLM's management of WH&B must comply with law and policy.

1.2 Decision to be made

Based on the analysis presented in the EA, the authorized officer will select an alternative that meets the Purpose and Need for the proposed action. The BLM's authorized officer will decide whether or not to gather, remove, treat, and release wild horses in the Red Desert Complex.

The decision to be made would not set or adjust AMLs, which were set through previous planning-level decisions and included public and stakeholder involvement. Future decisions regarding long-term management within the HMAs would continue to be accomplished through a land use planning process. Additionally, the decision would not adjust livestock use, which has

been established through prior planning-level decisions which have complied with NEPA requirements and provided opportunity for public review and input.

1.3 Scoping

Internal scoping by an interdisciplinary team identified issues of concern to be analyzed. Public comments on the various components of wild horse management on public lands in the Complex have been received throughout the last several years. On April 20, 2015, the BLM issued a scoping letter for this proposed wild horse gather. In excess of 6,000 comment letters/emails were received from individuals, organizations, and agencies following the issuance of the Red Desert Complex Wild Horse Gather Plan Scoping Letter. These comments represented a wide range of views. The vast majority of 6,000 letters or emails were submitted as a form letter. All substantive comments were considered in the preparation of this EA (Appendix 8).

Resources considered, but not present or affected in such a manner as requiring site-specific analysis in this EA are identified in the Table below.

Table 2. Resources considered and RMP references

Resource/Resource Use	Approved Rawlins RMP FEIS Reference	Approved Lander RMP FEIS Reference
Air Quality/Greenhouse Gas Emissions	3-3 to 3-9	3.1.1
Environmental Justice	3-77	3.8.4
Fire and Fuels Management	3-18 to 3-20	3.3
Forest Management	3-21 to 3-23	3.4.1
Hazardous Materials	Appendix 32	3.8.3
Health and Safety		3.8.3
Lands and Realty	3-24 to 3-26	3.6-3.6.3
Lands with Wilderness Characteristics	RMP ROD 1-3	3.1.6
Minerals	3-34 to 3-44	3.2
Noise		3.4.9
Off-Highway Vehicles	3-45 to 3-47	3.6.4
Paleontology		3.5.2
Reclamation	3-44; Appendix 36	3.1.3
Socioeconomics	3-59 to 3-76; Appendix 35	3.8.1, 3.8.2
Special Designations and Management Areas	3-86 to 3-98	3.7.1-3.7.3
Transportation	3-100; Appendix 21	
Visual Resource Management	3-120 to 3-122	3.5.3
Water Resources/Quality (drinking/surface/ground)	3-123 to 3-135; Appendix 11	3.1.4

2.0 ALTERNATIVES CONSIDERED

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

- Alternative 1: Remove all wild horses outside of HMA boundaries. Gather horses within the HMA boundaries and utilize fertility control treatments on mares to be released back to the HMA to slow population growth.. Release treated mares and studs that were gathered within the HMA, back within the HMA boundaries.
- Alternative 2: Proposed Action: Remove all excess wild horses inside and outside of the HMA boundaries, remove to low AML, and utilize fertility control treatments on mares to be released back within the HMA boundaries. Utilize selective retention/removal criteria in accordance with WO-IM-2010-135, the Lander RMP (pp. 70-71), and the Rawlins RMP (p. 2-51). Conduct genetic analysis on retained horses in accordance with WO-IM-2009-062.
- Alternative 3: No action--No gather or removal and no fertility control treatments.

2.1 Actions Common to Alternative 1 and Alternative 2: Proposed Action

- Approximately 80% of an estimated population of 2,620 wild horses in the gather area would be gathered (2,096 wild horses) beginning no sooner than fall of 2017.
- All wild horses outside of the HMA boundaries, between HMAs or on the checkerboard south of the Complex, would be removed.
- A helicopter inventory would be completed during the gather and prior to releasing any horses back into the Complex to ensure that all horses are removed from outside the HMA boundaries, and to verify the number of ungathered/untreated horses. Because population numbers are estimates, post gather horse numbers should be based on population surveys rather than the number removed.
- Each HMA would be gathered independently due to limited staff availability, weather, and gather logistics. The entire gather may not be completed in one gather session and may have to be continued in during the following three years.
- All capture and handling activities would be conducted in accordance with the Standard Operating Procedures (SOPs) described in Appendix 1 (SOPs). Multiple capture sites (traps) would be used to capture wild horses. Whenever possible, capture sites would be located in previously disturbed areas and would be analyzed as they are identified, including clearances from archeology, weed, botanical and wildlife specialists prior to use. If new trap sites are needed, they also would be surveyed for cultural, botanical, and wildlife resources prior to use. If sensitive resources are encountered (riparian habitat, tall sagebrush, sensitive species habitat, etc.), these locations would not be utilized unless they could be modified to avoid any impacts. Every effort would be made to return the released horses to the same HMA from which they were gathered.
- Livestock operators within the gather area would be notified prior to the gather, enabling them to take precautions and avoid conflict with gather operations.
- Capture techniques would include the helicopter-drive trapping method and/or helicopter-roping from horseback.

- Mares older than one year that are selected to be returned back into the Complex would be treated with a fertility control vaccine (Porcine Zona Pellucida (PZP)). Horses that are a year old or younger would not be treated. Implementation of fertility control treatment on captured mares would be conducted in accordance with the approved standard operating and post-treatment monitoring procedures (Appendix 4). Data on the captured horses would be collected, including sex and age distribution, and color.
- For monitoring purposes, mares treated with the PZP vaccine would be identified by a freeze mark. All treated mares would receive an "HB" brand on the left hip. In addition, a small number would be applied to the left side of the neck to identify what HMA that horse came from, following past branding practices. Horses from Antelope Hills were marked with a 6, Crooks Mountain received a 5, Green Mountain received a 4, Lost Creek received a 2, and Stewart Creek were marked with a 1.
- Hair samples would be collected for DNA analysis to assess the genetic diversity of the herd, per HMA, in accordance with IM No. 2009-062. This IM can be found at: https://www.blm.gov/media/blm-policy
- Through the capture and sorting process, wild horses are examined for health, injury and any defects using the humane care and treatment methods as described in BLM Instruction Memorandum 2015-070 (BLM 2015a).
- An Animal and Plant Inspection Service (APHIS) veterinarian would be on-site, as needed, to examine animals and make recommendations to the BLM for care and treatment of wild horses in accordance with Instruction Memorandum No. 2015-070, *Animal Health, Maintenance, Evaluation and Response* (BLM 2015a). On-site inspection by an APHIS veterinarian is required for any animals to be transported across State borders without testing for Equine Infectious Anemia (EIA) prior to transport. The IM can be found at: https://www.blm.gov/media/blm-policy
- Selection of animals for removal and/or release would also be guided by Instruction Memorandum No. 2010-135, *Gather Policy, Selective Removal Criteria, and Management Considerations for Reducing Population Growth Rates* (BLM 2010a). The IM can be found at: https://www.blm.gov/media/blm-policy
- The BLM is committed to the humane treatment and care of wild horses and burros through all phases of its program. The gathering of wild horses would be in accordance with Instruction Memorandum No. 2015-151, Comprehensive Animal Welfare Program for Wild Horse and Burro Gathers (BLM 2015b). This IM can be found at: https://www.blm.gov/media/blm-policy
- Advance planning for observation of gather operations can minimize the potential for unanticipated situations to occur and ensure the safety of the animals, staff, and Contractor personnel, as well as the public/media. In response to this, an Incident Command System would be followed during the gather operations as guided by Instruction Memorandum No. 2013-060, *Wild Horse and Burro Gathers: Management of Incident Command System* (BLM 2013c). This IM can be found at: https://www.blm.gov/media/blm-policy
- Public access to the gather sites/traps may be restricted during gather operations to ensure public and horse safety and minimize disruption to the gather process. Any areas closed would be reopened upon completion of the gather operations. Public viewing of the gather would be permissible, but it would be managed through the gather incident commander and public affairs officer assigned to the gather.

- Policy and procedures for safe and transparent visitation by the public and media at wild horse gather operations would be in accordance with Instruction Memorandum No. 2013-058 *Wild Horse and Burro Gathers: Public and Media Management* (BLM 2013a). This IM can be found at: https://www.blm.gov/media/blm-policy
- Certified weed free hay would be used to feed the horses while in trap sites and holding locations throughout the gather time period. Prior to the establishment of the trap sites and holding areas, a weed inventory would be performed by a weed specialist. Mobile equipment being transported from an offsite location to the gather areas, would be cleaned prior to arrival to remove any invasive or noxious weed seed and plant parts.
- Horses that are removed would be shipped to BLM holding facilities where they would be prepared for adoption and/or sale to qualified individuals and/or long-term holding.
- Monitoring and data collection would be continued to assess whether healthy and self-sustaining wild horse herds are being maintained on the HMAs over the long term. Monitoring of the gather area would also continue for vegetation and water resources (rangeland health).
- The BLM intends to return to these HMAs within three years to gather and treat mares to maintain fertility control measures.

2.2 Alternative 1: Remove all wild horses outside of HMA boundaries and utilize fertility control on mares to be released back to the HMA

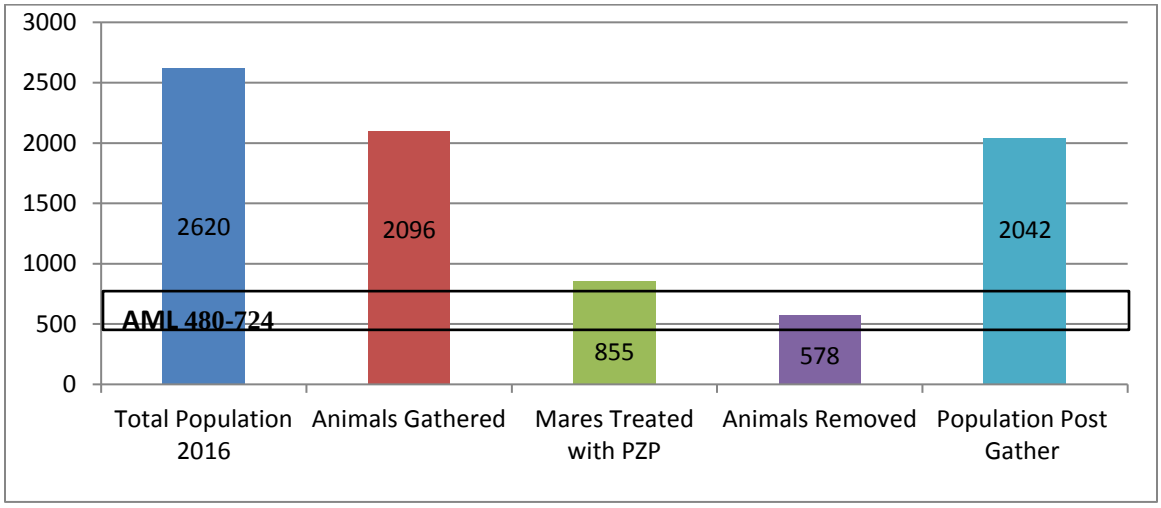
Approximately 80% of an estimated population of 2,620 wild horses in the gather area would be gathered (approximately 2,096 wild horses) and approximately 578 wild horses would be gathered and removed from outside of the HMA boundaries. Approximately 855 mares would be treated with PZP, and approximately 1,518 wild horses would be released back into the HMAs. The population of horses within the boundaries of the Complex would not be reduced and would remain at approximately 2,042 horses.

The primary objective would be to slow the population growth until another gather could be completed. The BLM intends to return to the Complex within 3 years to gather and remove all excess horses both inside and outside of HMA boundaries but within the Complex area and/or gather and re-treat mares to maintain the fertility control measure. The AML ranges established in the approved RMPs for each HMA would continue to be exceeded by over four times until a subsequent gather and removal could take place.

Selective removal criteria would not be conducted because all horses within HMA boundaries would be returned to their respective HMAs. As a result, genetic composition would continue to evolve naturally.

Figure 1 illustrates how many horses would be affected by the components of Alternative 1.

Figure 1. Projection of Wild Horse Population under Alternative 1



2.3 Alternative 2: Proposed Action—Remove to low AML and utilize fertility control

Approximately 80% of an estimated population of 2,620 wild horses in the gather area would be gathered (2,096 horses), including 578 wild horses from outside of the HMA boundaries, and all excess horses would be removed—approximately 2096. That would leave 524 horses in the Complex (slightly exceeding the low AML). Historically, on average, 80% of a given horse population can be gathered, as a result of varying terrain, tree cover, etc. Due to the high numbers of horses, more than 80% of the population may need to be gathered in order to capture enough adoptable horses to remove, since a portion of the animals gathered may be unadoptable (e.g. due to age). If any mares older than 1 year of age are to be released back into the HMAs, they would be treated with PZP. The entire gather may not be able to be accomplished in one year due to budget limitations, housing capacity for horses, weather, etc. The gather would proceed by HMA and close proximity, utilizing multiple traps in each HMA, to reduce stress on the horses and the distance they would have to travel from their home range.

If gather efficiencies utilizing helicopter drive-trapping do not achieve the desired goals of the Proposed Action or if a follow-up helicopter gather cannot be scheduled to remove remaining excess wild horses, water/bait trapping may be utilized as a supplement to a helicopter gather. Water/bait trapping would be used to remove sufficient numbers of horses to achieve the management targets, to relieve resource concerns, to treat/re-treat mares with PZP, and/or to remove concentrated groups of horses both inside and adjacent to the HMAs. This technique would only be utilized if it were appropriate for a particular portion of an HMA. For example, in isolated cases, water/bait trapping could be utilized to gather small numbers of wild horses for fertility control treatment. Any water/bait trapping activities would be scheduled during time periods that would be most effective and in those isolated areas that would be most conducive for the use of this technique.

The primary objective would be to reduce the population to the lower AML and treat mares with PZP to increase the time interval before another gather would need to be completed. The BLM intends to return to the Complex within 3 years to gather and remove excess horses and/or gather

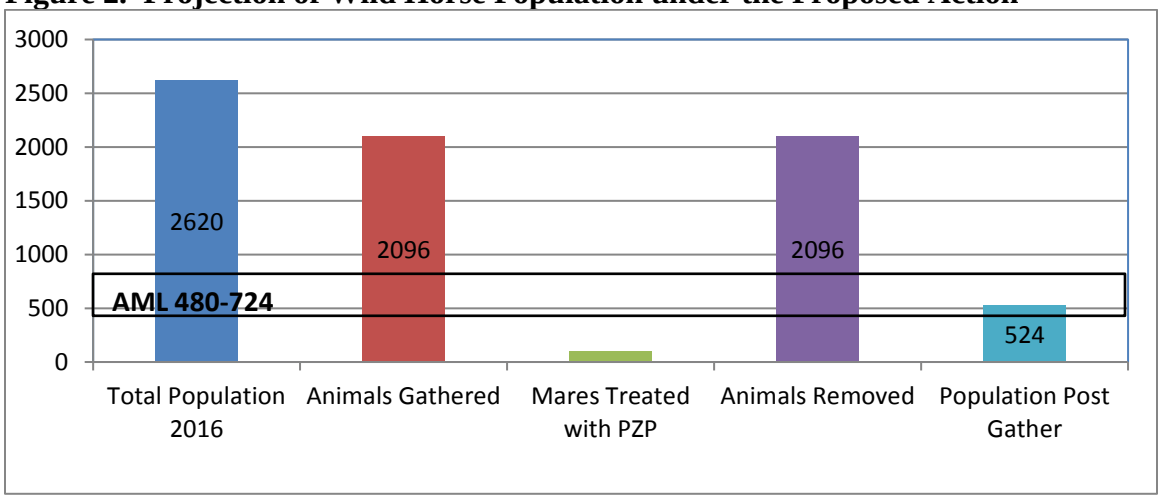
and re-treat mares to maintain AML and the effectiveness of the fertility control measure. AML ranges established for individual HMAs would be achieved and maintained.

Selective removal and retention criteria would be used as described in WO-IM-2010-135, the Lander RMP, and the Rawlins RMP. In respect to the Lander RMP, selective removal/retention would be utilized with the goal of maintaining or enhancing heard viability, genetic diversity, and unique characteristics that distinguish individual herds, if any have been identified to exist. Horses within the Antelope Hills HMA may not be genetically unique nor of New World Iberian ancestry. Selective retention criteria would be based on readily recognized phenotypic traits that may or may not be related to specific genotypes. The Rawlins RMP more specifically seeks to increase the recognized occurrence of the New World Iberian genotype[2] and associated phenotype[3], especially in the Lost Creek HMA (see Appendix 3). In accordance with the RMP, BLM would retain horses from the Lost Creek HMA which display popularly recognized visual characteristics commonly attributed to the New World Iberian phenotype, such as having a dished head profile, small ears with a notch or inward point at the tips, a wide neck, and sharp withers (Sponenberg and Reed, unpublished). DNA samples (a minimum of 25 samples per HMA) would be taken only from retained horses and photographs would be taken to compare visual characteristics with genetic results. This comparison may inform future management actions. DNA sampling and analysis would also be done in the other HMAs in the Complex so that genotypic changes and overall genetic health can be monitored and management practices can be adapted based on the results of this genetic monitoring.

Figure 2 illustrates how many horses would be affected by the components of Alternative 2.

[2] Genotype: The genetic makeup of an organism or group of organisms with reference to a single trait set of traits, or an entire complex of traits and/or the sum total of genes transmitted from parent to offspring.
[3] Phenotype: The composite of an organism's observable characteristics or traits, such as its morphology, development, biochemical or physiological properties, behavior, and products of behavior. A phenotype results from the expression of an organism's genetic code, its genotype, as well as the influence of environmental factors and the interactions between the two.

Figure 2. Projection of Wild Horse Population under the Proposed Action



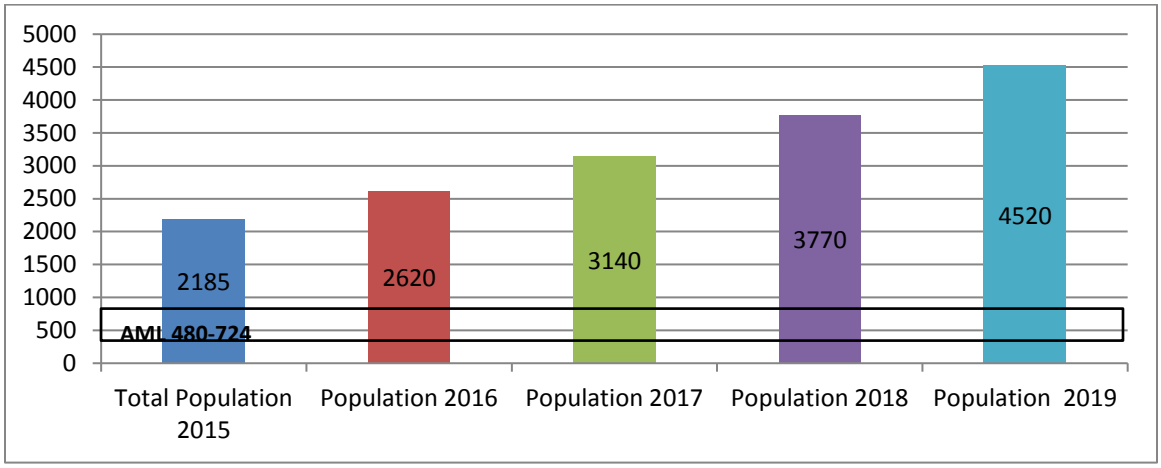
2.4 Alternative 3: No Action--No Gather or Removal and no fertility control

A wild horse gather would not be conducted. Wild horse populations would not be actively managed at this time and excess wild horses would not be removed. The population growth suppression program would not be continued. The current estimated population of 2,620 wild horses would continue to increase at an estimated rate of 20% annually and the established AML range would continue to be exceeded. No selective removal criteria would be implemented and genetic composition would continue to evolve naturally.

This Alternative would not achieve the Purpose and Need identified in Section 1.1. However, it is analyzed to provide a basis for comparison with the action alternatives, and to assess the effects of not gathering. The No Action Alternative would not be consistent with the requirement under the WFRHBA, FLPMA, and PRIA to remove excess wild horses and burros from public lands, to prevent damage to rangeland resources from an overpopulation of wild horses, and is also not in conformance with regulatory provisions for management of wild horses and burros as set forth at 43 CFR § 4700 – Protection, Management, and Control of Wild Free-Roaming Horses and Burros.

Figure 3 illustrates how the No Action Alternative would affect the wild horse population. The population from 2015 to 2019 is shown to illustrate what would happen if no gather occurred over the next 4 years. This estimate used a 20% growth rate. The estimated population would double to approximately 4,520 horses, and a gather would need to remove over 4000 excess wild horses in 2019 from the Complex and surrounding areas in order to achieve low range of AML.

Figure 3. Projection of Wild Horse Population under Alternative 3



2.5 Alternatives Considered But Eliminated From Further Analysis

These alternatives were eliminated from further analysis for many reasons, including: they do not accomplish the management objectives, are not consistent with the RMPs or existing regulations and policy, or pose a health and safety issue for horses and personnel.

2.5.1 Use of Bait and/or Water Trapping

The use of bait and or water trapping, though effective in specific areas and circumstances (for example, see Proposed Action), would not be timely, cost-effective or practical as the primary or sole gather method for this Complex of HMAs. This alternative was dismissed from detailed analysis as a primary or sole gather method for the following reasons:

- The gather area is too large to effectively use this gather method as the primary or sole method;
- The number of water sources on both private and public lands within and outside the Complex would make it difficult to restrict wild horse access to selected water trap sites;
- Road access for vehicles to potential trapping locations necessary to get equipment in/out as well as safely transport gathered wild horses is limited;
- The large numbers of horses proposed to be gathered would render water or bait trapping impossible within a reasonable time frame.

2.5.2 Other Alternative Capture Techniques

Capture methods other than helicopters to gather excess wild horses, were suggested through public comment. As no specific methods were suggested, the BLM identified chemical immobilization, net gunning, and wrangler/horseback (drive trapping) as potential methods for gathering wild horses.

- Chemical immobilization is a very specialized technique and strictly regulated. Currently, the BLM does not have sufficient expertise to implement this method and it would be impractical to use given the size of the HMAs, access limitations, the number of horses involved, and the approachability of the wild horses.
- Net gunning techniques normally used to capture big game also rely on helicopters and are therefore not under consideration as an alternative to the helicopter-capture method.
- Use of wranglers on horseback (drive-trapping) to remove excess wild horses can be fairly effective on a small scale; however, due to the number of excess wild horses to be removed, the large geographic extent of the Complex, and the approachability of the wild horses, this technique would be ineffective and impractical to meet the purpose and need. Horseback drive-trapping is also very labor intensive and can be dangerous for the domestic horses and wranglers.

For these reasons, the alternative capture method alternatives were eliminated from further consideration and are not analyzed in detail.

2.5.3 Remove or Reduce Livestock within the HMAs

Livestock grazing may be reduced or eliminated under 43 CFR 4100 and must be consistent with multiple use allocations set forth in the land-use plan. Such changes to livestock grazing cannot be made through a wild horse gather decision, and are only possible if the BLM first revises the land-use plans to re-allocate livestock forage to wild horses and to reduce or eliminate livestock grazing.

Furthermore, re-allocation of livestock animal unit months (AUMs) to increase the wild horse AMLs would not achieve a TNEB due to differences in how wild horses and livestock graze. Livestock can be managed through seasons of use, numbers, and different pastures to minimize use of vegetation during the critical growing season or of riparian zones during the summer months. However, wild horses are present year-round and their use of rangeland resources cannot be controlled through establishment of a grazing system. Thus, vegetation use from wild horses can only be addressed by limiting their numbers to a level that does not degrade rangeland resources and affect other multiple uses.

While the BLM is authorized to remove livestock from HMAs "if necessary to provide habitat for wild horses or burros, to implement herd management actions, or to protect wild horses or burros from disease, harassment or injury" (43 CFR 4710.5), this authority is applied in cases of emergency and not for general management of wild horses; livestock removal cannot be applied in a manner that would be inconsistent with the existing land-use plans (43 CFR 4710.1).

This action 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, which directs the Secretary to immediately remove excess wild horses. Additionally this would only be effective for the very short term as the horse population would continue to increase. Eventually, the HMAs and adjacent lands would no longer be capable of supporting the

horse populations. Removing approximately 2096 excess wild horses now and treating released mares with a fertility control vaccine would delay the need for future removal of excess horses.

For the reasons stated above, this alternative was dropped from detailed analysis. For modifications in long-term multiple use management, changes in forage allocations between livestock and wild horses would have to be re-evaluated and implemented through the appropriate public decision-making processes.

2.5.4 Change the Current Established AMLs

Changing the established AMLs within the HMAs was not brought forward for detailed analysis. The population range for the Stewart and Lost Creek HMAs is established in the approved Rawlins RMP. To adjust the AML in these HMAs would require an amendment to the RMP. The population range for the Crooks Mountain, Green Mountain and Antelope Hills are established in the approved Lander RMP. To adjust the AML in these HMAs would require an amendment to the Herd Management Area Plan (HMAP), RMP, or both. Current information indicates that the AML ranges for the Red Desert Complex maintains a TNEB. For these reasons and others, this gather document is not the appropriate mechanism for adjusting the AML of an HMA.

2.5.5 The Use of Surgical or Chemical Sterilization to Reduce Population Growth

The use of these methods to reduce population growth has not been implemented successfully in wild horse populations. Research on the use of these techniques on wild horse behavior is still being studied. The impacts of these techniques are well understood in controlled settings, but they have not been extensively researched under field conditions. Due to these uncertainties, this alternative was removed from further analysis.

2.5.6 Control of Wild Horse Numbers by Natural Means

The use of natural control means, such as natural predation, forage availability, and weather, to control the wild horse population was eliminated from further consideration because it would be contrary to current law, regulation, and policy. BLM is required to protect the range resources from deterioration associated with an overpopulation of wild horses. Wild horse populations are not substantially regulated by predators. In addition, wild horses are a long-lived species with documented foal survival rates exceeding approximately 95% and are not a self-regulating species. As a result, an exponential increase in the wild horse population would occur (see Figure 3 above). This would result in a continued exceedance of the carrying capacity of the range and would cause increasing damage to the vegetation and water sources until severe range degradation or natural conditions like blizzards or extreme drought, cause a catastrophic mortality of wild horses. Horses would also continue to expand in numbers outside of the Complex increasing rangeland degradation across the landscape, resulting in a further loss of a TNEB.

2.5.7 Genetic Testing Before Decision about Which Animals to Turn Back

One method that could be used to increase the number of horses with an increased prevalence of genetic markers associated with the New World Iberian breed type would be to capture horses,

obtain genetic (hair and follicle) samples from all individual horses caught, send those samples for analysis in terms of genetic similarity of each individual to the New World Iberian breed type, determine which horses to turn back to the range based on the results, and then release those selected animals. While this method undoubtedly has the potential to increase the relative fraction of individuals with a higher number of alleles that are descended from New World Iberian breed type ancestors, there are drawbacks that preclude it from further consideration. First, it would be necessary to either hold the captured horses in temporary pens while the genetic testing took place, or to mark them, release them, await genetic results, recapture the horses, and then preferentially turn back only those with appropriate genetic associations. Whether the choice is prolonged captivity or repeated capture, neither is consistent with the policy directive that BLM should conduct wild horse management at the minimum feasible level. Second, testing the genetic makeup of over 2,000 animals would be prohibitively expensive. Rather than this alternative, BLM developed Alternative 2 to address a different way of potentially increasing the prevalence of genetic markers associated with the New World Iberian bred type.

2.6 Conformance with Existing Land Use Plans (LUPs)

The Proposed Action is in conformance with the land use plans as required by 43 CFR 1610.5-3(a). Any action in the Rawlins and Lander Field Offices is subject to decisions established by the Rawlins and Lander Resource Management Plans, approved December 24, 2008 and June 26, 2014 respectively, and amended September 21, 2015 (*Approved Resource Management Plan Amendment for Greater Sage-Grouse* and the *Record of Decision and Approved Resource Management Plan Amendments for the Rocky Mountain Region, Including the Greater Sage-Grouse Sub-Regions of Lewistown, North Dakota, Northwest Colorado, Wyoming*). The Red Desert HMA Complex has been designated as suitable for long term, sustained wild horse use in the Rawlins and Lander RMPs. The proposed capture, treatment, and removal conform to the land use decisions and resource management goals and objectives of the Resource Management Plans.

Wild horses managed on public lands have a variety of histories and originate from a variety of backgrounds. Genetic research has enabled the BLM to identify the genetic stock from which a wild horse population originates, thereby assisting in identifying the history of a population. The genetic roots of most wild horses in the Lander Field Office are predominantly American, and some have beginnings as recent as the period following World War II when horses that had been used by the U.S. Army Calvary were released on public lands. Occasionally, populations have been encountered whose genetic roots can be traced to the Spanish exploration period through the identification of genotypes associated with the New World Iberian (Spanish Colonial) breeds. Populations with this distinctive genotype provide a genetic resource that the majority of wild horses on public lands do not provide. Several lines of evidence make clear that Iberian influence in the gene pool of the Red Desert Complex HMAs is present, but not prominent (see Appendix 3).

Appendix L to the 2014 Lander RMP Record of Decision contains information regarding wild horse genetics. This information was primarily based upon interpretation of blood samples from 2001. Since that time, additional genetic testing at Antelope Hills in 2004 and 2012 and

improved understanding of the 2001 results indicate that some statements in the appendix do not reflect current information or understanding of the genetics of the Red Desert Complex HMAs, and the prevalence of the New World Iberian genotype. A summary of these reports by Dr. Paul Griffin (BLM Research Coordinator) indicates that the Antelope Hills HMA is neither genetically unique nor predominately of New World Iberian ancestry (see Appendix 3).

The Rawlins RMP can be accessed at: http://bit.ly/Rawlins_RMP
The Lander RMP can be accessed at: http://bit.ly/Lander_RMP

2.7 Relationship to Statutes, Regulations, or Other Plans

Conformance with Rangeland Health Standards and Guidelines: Alternative 2 would be in conformance with the BLM Wyoming "Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management" (BLM 1997). It would assist in maintaining the health of the public lands within each HMA and within the Complex. A copy of the BLM Wyoming "Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management" is available upon request from the BLM. Alternatives 1 and 3 would not be in conformance.

Relationship to Statutes, Regulations, or Other Plans: Public lands are managed under the FLPMA (1976), which provides that the public lands are to be managed in accordance with land use plans and under principles of multiple use and sustained yield to protect the quality of scenic, ecological, environmental, and archeological values; to preserve and protect public lands in their natural condition; to provide feed and habitat for wildlife and livestock; and to provide for outdoor recreation (43 U.S.C. 1701(a)(8) & 1732(a)). FLPMA also stresses harmonious and coordinated management of the resources without permanent impairment of the environment (43 U.S.C. 1702(c)).

Alternative 2: Proposed Action would be in conformance with the WFRHBA and PRIA, while Alternatives 1 and 3 would not be in conformance with the WFRHBA, Sections 1333(b)(2) and 1334, and its implementing regulations found at 43 CFR 4700, and PRIA Section 2(b)(4):

- 43 CFR 4700.0-6 (a): Wild horses shall be managed as self-sustaining populations of healthy animals and in balance with other uses and the productive capacity of their habitat.
- 43 CFR 4700.0-6 (e): Healthy excess wild horses for which an adoption demand by qualified individuals exists shall be made available at adoption centers for private maintenance and care.
- 43 CFR 4710.4: Management of wild horses shall be at the minimum level necessary to attain the objectives identified in approved land use 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 exist, the authorized officer shall remove the animals immediately.
- 43 CFR 4720.2-2: If the authorized officer determines that proper management requires the removal of wild horses and burros from private lands, the authorized officer shall obtain the written consent of the private owner before entering such lands. Flying aircraft over lands does not constitute entry.

Wild horse gather EAs have been completed which analyzed the impacts of various gather methods on wild horses, and other critical elements of the human environment, to achieve AML. For a list of these documents, see Appendix 2. These documents are available for public review at the Rawlins and Lander Field Offices.

The area was assessed per the Governor's Executive Order EO 2015-4 "*Greater Sage-Grouse Core Area Protection*". The proposed action falls within a Greater Sage-Grouse Priority Habitat Management Area (PHMA), and also contains Sagebrush Focal Area (SFA) and General Habitat Management Area (GHMA).

No federal, state, or local law, or requirement imposed for the protection of the environment would be threatened or violated under the proposed action described in detail in this EA.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Introduction

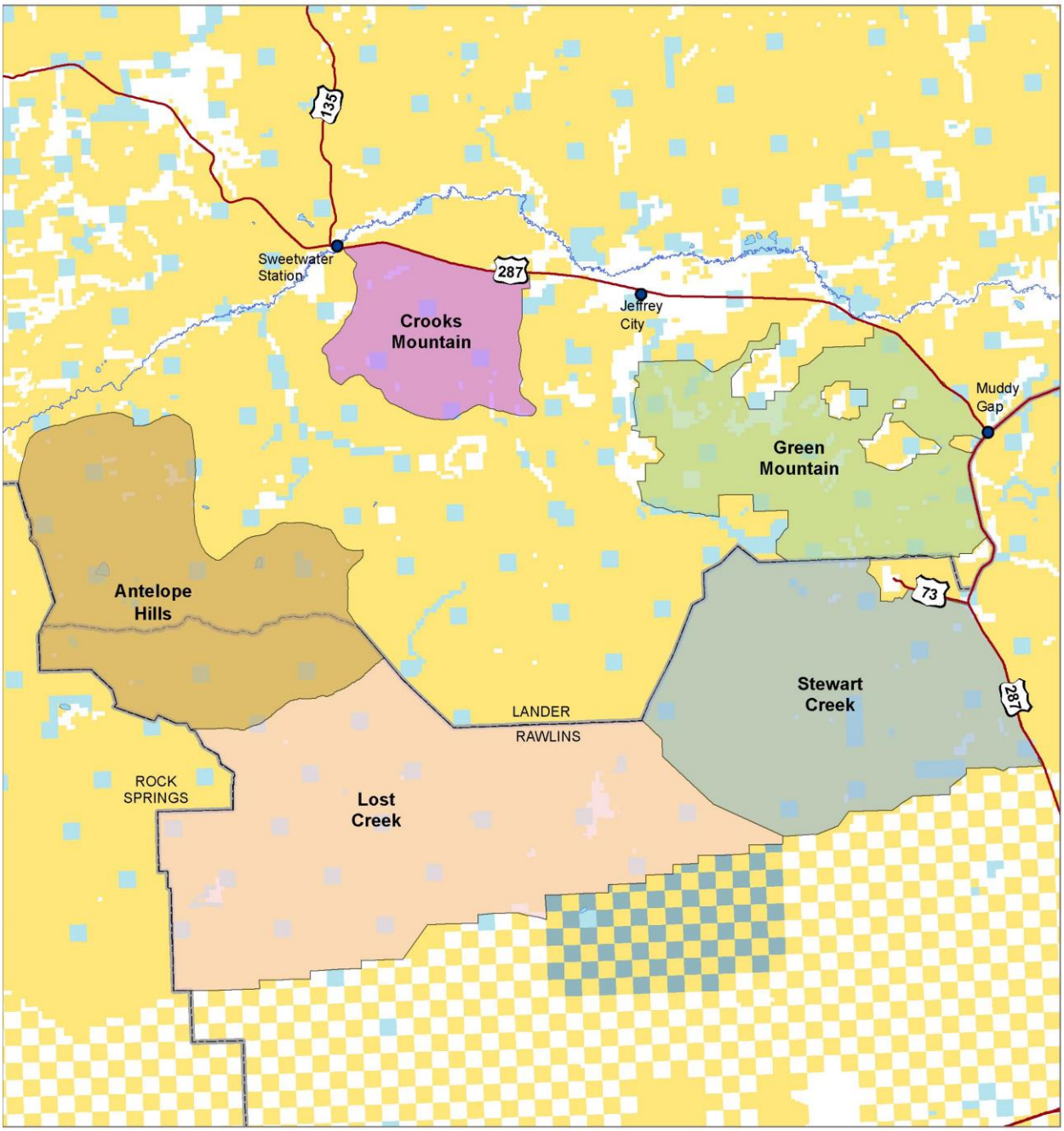
This section of the environmental assessment briefly discusses the relevant components of the human and natural environment which would be either affected or potentially affected by the alternatives. Direct impacts are those that result from management actions while indirect impacts are those that exist once the management action has occurred. By contrast, cumulative impacts 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 action. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Analysis related to maintaining the AMLs for the Red Desert Complex, specifically Stewart Creek, Lost Creek, Antelope Hills, Crooks Mountain, and Green Mountain HMAs, is tiered to the Final EISs for the Rawlins RMP (BLM 2008a, pp. 139-142) and Lander RMP (BLM 2014a, pp. 69-70), respectively.

3.1 Wild Horses

3.1.1 Affected Environment

The Complex is located in the Sweetwater, Carbon, Fremont and Natrona Counties west and south of Wyoming Highway 789/287 (See Map 1).

Map 1. Red Desert HMA Complex



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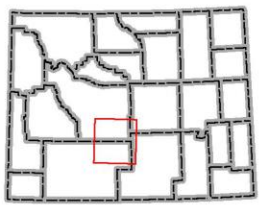
No warranty is made by the Bureau of Land Management (BLM) for use of the data for purposes not intended by BLM.

Red Desert Complex
Wild Horse Management Areas

- Highways
- BLM field office boundaries
- Bureau of Land Management
- Private
- State
- Wyoming Game & Fish Dept.
- Water



Date: 7/29/2015

Gather History and Population Estimates

Gathers have been conducted in the Red Desert HMA Complex numerous times since 1980; most recently in 2011. For gathers conducted within this timeframe and the number of horses gathered, refer to the Tables in Appendix 2.

Table 3 shows the population estimates for the five HMAs and the Complex from 2013-2016. The 2013 wild horse estimates were determined using the double observer method in the RFO, and direct count with a correction factor in the LFO. The 2014 estimate assumes a 20% growth rate for the adjusted estimate. In April of 2015 (prior to the foaling period), the BLM conducted simultaneous double-count aerial surveys in a mark recapture analysis framework. The Complex population was estimated at 1,821 adult animals. The data were collected using this method and then an analysis was completed to give the point estimate of abundance for the number of horses within each HMA and the Complex, and also uses a 90% confidence interval around those point estimates (Appendix 6).

Table 3. Estimated Horse Population by HMA and Year

HMA	Population Estimate 2013	Population Estimate 2014	Population Estimate 2015	Population Estimate 2016*
Stewart Creek	302	362	509	610
Lost Creek	100	120	234	280
Antelope Hills	94	112	231	277
Green Mountain	388	465	982	1,178
Crooks Mountain	140	168	229	275
Complex Total	1,024	1,227	2,185	2,620

*The 2016 population estimate uses the population estimate from Table 4(below) plus a 20% growth rate to account for foal production/animal death loss in 2015 and 2016.

Table 4 shows the population survey data collected in April, 2015, by HMA within the Complex, and their correlating AMLs.

Table 4. Estimated Red Desert HMA Complex Horse Population Inventory

HMA	Population Estimate April 2015	Population Estimate, 90% Confidence Interval	Established AML Range
Stewart Creek	424	405-447	125-175
Lost Creek	194	150-241	60-82
Antelope Hills	193	162-233	60-82
Crooks Mountain	191	167-222	65-85
Green Mountain	819	774-892	170-300
Complex TOTALS	**1821**	**1658-2035**	**480-724**

For the purposes of this EA, the point estimates of abundance were used, plus an additional number of animals to represent a 20% average growth rate, to estimate the numbers for each proposed alternative. The population estimates for 2015 show a marked increase greater than the expected 20% growth rate in 3 of the 5 HMAs. The factors that may have caused this are: 1) a new/different population survey method, 2) effectiveness of PZP has faded in treated mares (no mares have been treated since 2011), 3) mild winters resulting in lower death loss, 4) movement of horses between HMAs, and 5) higher foal survival.

Wild horse population numbers have the potential to double every four years (NAS, 2013). With fertility control vaccine treatment (PZP), growth rates can be reduced in the short term since treatments are generally effective for a year or more, with treated mares typically returning to background fertility levels by year 4 (Turner et al, 2007). Because mares gathered and released in the Complex were treated in the fall of 2011 (during the last gather and removal), population growth was reduced, but horse numbers currently exceed the high end of the AML by over 3.5 times.

BLM utilized the WinEquus model for the three alternatives to analyze possible differences in the wild horse populations between alternatives. Model results are displayed in detail in Appendix 5 (Population Model Overview). The modeling may not necessarily reflect actual on-the-ground results. The objective of the modeling exercise was to identify if any of the alternatives "crash" the population or cause extremely low population numbers or growth rates. Minimum population levels and growth rates determined from modeling were found to be sufficient to maintain a healthy population.

The Red Desert Complex has a diverse mixed ancestry with large numbers of ancestral genotypes present. Genetic similarity indices are helpful in determining those breeds that contributed to a population's genetic makeup. The primary genotypes found include: New World Iberian Breeds, Old World Iberian Breeds, North American Gaited Breeds, and Light Racing and Riding Breeds. Draft and pony breeds contribute to a lesser extent. Although all of these breeds contribute to the genetic makeup of the complex, none, including the New World Iberian genotype, can be identified as being a statistically dominant contributor. Large numbers of breeding horses have allowed genetic diversity to be maintained. This is indicated by low levels of inbreeding and a high genetic effective population size relative to the actual population (See Appendix 3).

3.1.2 Environmental Consequences

Effects Common to Action Alternative 1 and Alternative 2: Proposed Action

Over the past 35 years, various effects to wild horses as a result of gather activities have been observed and studied. Effects to wild horses would be both direct and indirect, occurring to both individual horses and the population as a whole.

The BLM has conducted wild horse gathers since the mid-1970s. During this time, methods and procedures have been identified and refined to minimize stress and adverse effects to horses during gather implementation. The Standard Operating Procedures in Appendix 1 would be

implemented to ensure a safe and humane gather occurs and would minimize potential stress and injury to wild horses.

Wild horse gather-related mortality averages about one percent (1.0%) nationwide. About one half of those horses included in all gather related mortality could be humanely euthanized due to pre-existing conditions in accordance with BLM policy (BLM 2015a). The other half is attributable to gather related injuries. These data confirm that the use of helicopters and motorized vehicles are a safe, humane, effective, and practical means for the gather and removal of excess wild horses (and burros) from the public lands. It is BLM policy to restrict the use of helicopters as a tool to gather wild horses from February 28 through July 1, except in the case of emergency, to minimize impacts to foals. The peak of foaling generally occurs during a four-week period from mid-April to mid-May for most wild horse herds.

Individual, direct effects to wild horses include handling stress incurred during capture, sorting, handling, and transportation of the animals. The intensity of these effects varies by individual horse and is manifested by behaviors ranging from nervous agitation to obvious physical distress.

A variety of injuries may occur after a wild 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, wild 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. Injuries resulting from kicks and bites or from collisions with corral panels or gates can occur. Injuries sustained by wild horses while being herded to trap site corrals by helicopter may include bruises, scrapes, or cuts to feet, legs, face, or body from rocks, brush or tree limbs. Wild horses may encounter barbed wire fences and receive wire cuts during gather activities but this type of injury is rarely fatal and can be treated on-site in consultation with a veterinarian.

To minimize the potential for injuries from fighting in the corral, the horses are transported from the trap site to the temporary (short-term) holding facility where studs are separated as quickly and safely as possible, then moved into large holding pens where they are provided with hay and water. On many gathers, no wild horses get injured from fighting.

Indirect individual effects are those which occur to wild horses after all handling and processing is completed. These may include miscarriages, increased social displacement, and conflict among studs. These effects are known to occur intermittently during wild horse gather operations. An example of an indirect individual impact would be a brief 1-2 minute skirmish between two studs opting for dominance and ending when one retreats. Injuries can also occur from these skirmishes and typically involve a bite or bruise from a kick. Like direct individual effects, the frequency of these effects 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 poor body condition and/or health.

Foals may be orphaned during a gather 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 health. Every effort is made to provide appropriate care to orphan foals. Veterinarians may be called to 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.

BLMs Use of Contraception in Wild Horse Management

Expanding the use of population growth suppression to slow population growth rates and reduce the number of animals removed from the range and sent to off-range pastures is a BLM priority. The WFRHBA of 1971 specifically provides for contraception and sterilization (Section 3.b.1). 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 the HMA may continue exerting negative environmental effects, as described in section 3.4, 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.

Successful contraception would be expected to reduce the frequency of horse gather activities on the environment, as well as wild horse management costs to taxpayers. Bartholow (2007) concluded that the application of 2 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. He also concluded that contraceptive treatment would likely reduce the number of horses that must be removed in total, with associated cost reductions in the number of adoptions and total holding costs. If applying contraception to horses requires capturing and handling horses, 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 suppression becomes less expensive if fertility control is long-lasting (Hobbs et al. 2000). Selectively applying contraception to older animals and returning them to the HMA could reduce long-term holding costs for such horses, which are difficult to adopt, and could reduce the compensatory reproduction that often follows removals (Kirkpatrick and Turner

1991). On the other hand, selectively applying contraception to younger animals can slow the rate of genetic diversity loss – a process that tends to be slow in a long-lived animal with high levels of genetic diversity – and could reduce growth rates further by delaying the age of first parturition (Gross 2000). Although contraceptive treatments may be associated with a number of potential physiological, behavioral, demographic, and genetic effects, detailed below, those concerns do not generally outweigh the potential benefits of using contraceptive treatments in situations where it is a management goal to reduce population growth rates (Garrott and Oli 2013).

The literature review is intended to summarize what is known and what is not known about potential effects of treating mares with PZP vaccine. As noted below, some negative consequences of vaccination are possible. PZP vaccines are administered only to females.

Whether to use or not use this method to reduce population growth rates in wild horses is a decision that must be made considering those effects as well as the potential effects of inaction, such as continued overpopulation and rangeland health degradation.

Reference in this text to any specific commercial product, process, or service, or the use of any trade, firm or corporation name is for the information and convenience of the public, and does not constitute endorsement, recommendation, or favoring by the Department of the Interior.

Under both Alternatives 1 and 2, a selected number of mares (as described in Sections2.2 and 2.3) would be treated with a liquid dose of PZP primer and with PZP-22 pellets prior to their release. Each of these mares, if pregnant, would be expected to foal normally during the following foaling season. The treated mares would not be expected to foal in the subsequent year following treatment. The PZP treatment would be expected to slow population growth starting in the second year after the gather, and to be effective for at least one year.

Porcine Zona Pellucida (PZP) Vaccine

The immune-contraceptive PZP vaccine is currently being used on over 75 areas managed for wild horses by the National Park Service, US Forest Service, and the Bureau of Land Management and its use is appropriate for free-ranging wild horse herds. Taking into consideration available literature on the subject, the National Research Council concluded in their 2013 report that PZP was one of the preferable available methods for contraception in wild horses and burros (NAS 2013). PZP 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 (NAS 2013), and in a population of feral burros in territory of the US (Turner et al. 1996). PZP is 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). It can easily be remotely administered in the field in cases where mares are relatively approachable.

Under the Proposed Action, the BLM would return to the HMA as needed to re-apply PZP-22 and / or ZonaStat-H and initiate new treatments in order to maintain contraceptive effectiveness in controlling population growth rates. 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. Once the population is at AML and population growth seems to be stabilized, BLM could use population planning software (WinEquus II, currently in development by USGS Fort Collins Science Center) to determine the required frequency of re-treating mares with PZP.

PZP Direct Effects

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. Research has demonstrated that contraceptive efficacy of an injected PZP vaccine is approximately 90% for mares treated twice with liquid PZP in the first year and boostered annually (Kirkpatrick et al., 1992). Turner et al (2007) found that the highest success for PZP-22 fertility control has been obtained when applied during the timeframe of November through February in one herd in Nevada. That study found the following effects of PZP-22 on contraception efficacy (representing the percent of treated mares that do not foal):

	Year 1	**Year 2**	**Year 3**	**Year 4**
Normal	94%	82%	68%	

Other applications of PZP-22 have not apparently led to such substantial or long-lasting results; Approximately 60% to 85% of mares are successfully contracepted for one year when treated simultaneously with a liquid primer and recently-produced PZP-22 pellets, but fewer in the second year (Rutberg et al. 2017). In addition, among mares, PZP contraception appears to be reversible, with most treated mares returning to fertility over time. The effect of PZP varies widely between individual horses. Administration of PZP has occurred for several years in this Complex, with the most recent applications in 2009 and 2011. The preponderance of evidence indicates that PZP is most effective one to two years post treatment, and local evidence seems to support that conception rates in the Complex should return to natural levels[4] in 3-5 years, post treatment.

PZP vaccine application at the capture site does not appear to affect normal development of the fetus or foal, hormone health of the mare or behavioral responses to stallions, should the mare already be pregnant when vaccinated (Kirkpatrick et al. 2002). The vaccine has no apparent effect on pregnancies in progress or the health of offspring (Kirkpatrick and Turner 2003).

The NAS (2013) criterion by which PZP is not a good choice for wild horse contraception was duration. The ZonaStat-H formulation of the vaccine tends to confer only one year of efficacy. Some studies have found that a PZP vaccine in long-lasting pellets (PZP-22) can confer multiple

[4] Untreated females showed average reproductive success of 53.8% (Turner, 2007); and 64.1% (Ransom, 2013)

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).

Following a gather, application of PZP for fertility control would reduce fertility in a large percentage of mares for at least one year (Ransom et al. 2011). Recruitment of foals into the population may be reduced over a three- year period. Gather efficiency would likely not exceed 85% via helicopter, and may be less with bait and water trapping, so there would 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.

In most cases, PZP contraception appears to be temporary and reversible (Kirkpatrick and Turner 2002, Joonè et al. 2017), does not appear to cause out-of-season births (Kirkpatrick and Turner 2003), and has no ill effects on ovarian function if contraception is not repeated for more than five consecutive years on a given mare. Recent research suggests that mares treated with PZP may experience longer lasting contraceptive effects than previously thought, and those effects may last even longer if the mare had been previously inoculated. Although the rate of long-term or permanent sterility following repeated vaccinations with PZP has not been quantified, it must be acknowledged that this could be a result for some number of wild horses receiving multiple repeat PZP vaccinations. Even though it is not the intent of PZP treatment, the permanent sterility of a fraction of treated mares is a potential result that would be consistent with the contraceptive purpose of applying the vaccine to wild mares.

Although most treatments with PZP would be reversible, repeated treatment with PZP may lead to long-term infertility (Feh 2012) and, perhaps, direct effects on ovaries (Gray and Cameron 2010). 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, but it is possible that result is specific to SpayVac, which may have lower PZP purity than ZonaStat or PZP-22 (Hall et al. 2016). Joonè et al. (2017) found effects on ovaries after SpayVac PZP vaccination in some treated mares, but normal estrus cycling had resumed 10 months after the last treatment. SpayVac is a patented formulation of PZP in liposomes that can lead to multiple years of infertility (Roelle et al. 2017) but which is not reliably available for BLM to use at this time. Kirkpatrick et al. (1992) noted effects on ovaries after three years of treatment with PZP. Observations at Assateague Island National Seashore indicate 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 return to ovulation (Kirkpatrick and Turner 2002). Other studies have reported that continued applications of PZP 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). Permanent sterility for mares treated consecutively 5-7 years was observed by Nunez 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.

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. 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 pups was compromised, nor is BLM aware of any such results in horses or 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 foal out of season or late in the year, and that foal survival was unaffected for foals born out of season (Kirkpatrick and Turner 2003). Nunez's (2010) research showed that a small number of mares that had been 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, which calls into question whether inferences drawn from island herds can be applied to western wild horse herds. Ransom et al. (2013), though, identified 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. Those results, however, showed that over 81% of the documented births in this study were between March 1 and June 21, i.e., within the normal spring season. Ransom et al. (2013) advised that managers should consider carefully before using PZP in small refugia or rare species. Wild horses and burros in Nevada do not generally occur in isolated refugia, and they are not a rare species. Moreover, an 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. Moreover, Ransom et al. (2013) found no negative impacts on foal survival even with an extended birthing season.

Mares that receive the fertility control treatment would experience increased but transient levels of stress from additional handling while they are being inoculated and freeze marked. Newly captured mares that do not have markings associated with previous fertility control treatments would be marked with a new freeze-mark for the purpose of identifying that mare, and identifying her PZP vaccine treatment history. This information would also be used to determine the number of mares captured that were not previously treated, and could provide additional insight regarding gather efficiency. There would be potential additional impacts to animals at the injection site following the administration of the fertility control vaccine, as noted below.

Most mares recover from the stress of capture and handling quickly once released back to the HMA, 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), 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. Use of remotely delivered, 1-year PZP is generally limited to populations where individual animals can be accurately identified and repeatedly approached. 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. (2017) 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. The longer term 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.

Indirect Effects

One expected long-term, indirect effect on wild horses treated with fertility control would be an improvement in their overall health. Many treated mares would not experience the biological stress of reproduction, foaling and lactation as frequently as untreated mares, and their better health is expected to be reflected in higher body condition scores (Nunez 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 mares' 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 (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., Roelle et al. 2010). 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. 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.' More research is needed to document and quantify these hypothesized effects; however, it is believed that repeated contraceptive treatment may minimize this rebound effect.

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. So long as the level of contraceptive treatment is adequate, the lower expected birth rates can compensate for any expected increase in the survival rate of treated mares. Also, 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 long term pastures (LTPs). A high level of physical health and future reproductive success of fertile mares within the herd would be sustained, as reduced population sizes would be expected to lead to more availability of water and forage resources per capita.

Reduced population growth rates and smaller population sizes would 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 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 to wild horses and

wildlife throughout HMA. With a more optimal distribution of wild horses across the HMA, at levels closer to a thriving ecological balance, there would also be less trailing and concentrated use of water sources, which would have many benefits to the wild horses still on the range. There would be reduced competition among wild horses using the water sources, and less fighting would occur among studs and individual animals to access 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 PZP booster treatment and repeated fertility control treatment continue into the future, the chronic cycle of overpopulation and large gathers and removals would no longer occur, but instead a consistent cycle of balance and stability would ensue, resulting in continued improvement of overall habitat conditions and animal health.

Behavioral Effects

The NAS report (2013) noted that all fertility suppression has effects on mare behavior, mostly as a result of the lack of pregnancy and foaling, and concluded that PZP was a good choice for use in the program. The result that PZP-treated mares may continue estrus cycles throughout the breeding season can lead to behavioral differences, when compared to mares that are fertile. Such behavioral differences should be considered as potential consequences of successful contraception.

Ransom and Cade (2009) delineate behaviors that can be used to test for quantitative differences due to treatments. 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. Nunez (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. Studies on Assateague Island (Kirkpatrick and Turner 2002) showed that once fillies (female foals) that were born to mares treated with PZP during pregnancy eventually breed, they produce healthy, viable foals.

In two studies involving a total of four wild horse populations, both Nunez et al. (2009) and Ransom et al. (2010) found that PZP-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). There was no evidence, though, that mare welfare was affected by the increased level of herding by stallions noted in Ransom et al. (2010). Nunez'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 Nunez et al. (2009, 2014, 2017) 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 Nunez et al. (2009, 2010, 2014, 2017) studied; they concluded that PZP-treated mares changing bands more frequently than control mares could lead to band instability. Nunez et al. (2009), though, cautioned against generalizing from that island population to other herds. 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. The authors (Nunez et al. 2014) concede that these effects "…may be of limited concern when population reduction is an urgent priority." 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 also states 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. Long-term implications of these changes in social behavior are currently unknown, but no negative impacts on the overall animals or populations welfare or well-being have been noted 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."

Nunez (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 need to 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 put 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)."

Genetic Effects of PZP Vaccination

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 recommended that managed herds of wild horses would be better viewed as components of interacting metapopulations, with the potential for interchange of individuals and genes taking place as a result of both natural and human-facilitated movements. In the last 10 years, there has been a high realized growth rate of wild horses in most areas administered by the BLM, 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 which would be expected to slow the rate of genetic diversity loss (Hailer et al., 2006). Based on a population model, Gross (2000) found that an effective way to retain genetic diversity in a population treated with fertility control is to preferentially treat young animals, such that the older animals (which contain all the existing genetic diversity available) continue to have offspring. Conversely, Gross (2000) found that preferentially treating older animals (preferentially allowing young animals to breed) leads to a more rapid expected loss of genetic diversity over time.

Even if it is the case that repeated treatment with PZP 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. 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 starting levels of genetic

diversity are low, initial population size is 100 or less, and the intrinsic population growth rate is low (5% per year), and very large fractions of the female population are permanently sterilized.

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). 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). This premise is based on an assumption that lack of response to PZP is a heritable trait, and that the frequency of that trait will increase over time in a population of PZP-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). Although this topic may merit further study, lack of clarity should not preclude the use of immunocontraceptives to help stabilize extremely rapidly growing herds.

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. 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 and Pryor Mountains), 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 used in the type of widespread or prolonged manner that might be required to cause a detectable evolutionary response.

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 such 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 PZP; 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 PZP (which generally has a short-

acting effect); the number of mares treated with multiple booster doses of PZP; and the actual size of the genetically-interacting metapopulation of horses within which the PZP treatment takes place.

PZP would have little effect on the occurrence of genes associated with New World Iberian breed types because retained mares would receive PZP treatment (as noted in Section 2.1) without regard to phenotype. Previous gathers have not apparently caused any decrease in the relative similarity to New World Iberian breed types. Furthermore, PZP is expected to be only temporarily effective, such that mares treated with PZP would still be expected to produce foals in the future.

Genetic Sampling

A hair (and follicle) sample would be taken from some of the retained wild horses, typically from the mane, in order to continue ongoing monitoring of genetic diversity in the Complex. No impacts have been identified from collecting hair samples. Based on genetic testing from previous gathers (Appendix 3), the Complex demonstrates adequate genetic diversity in terms of heterozygosity and a lack of evidence of widespread inbreeding. It appears that the ancestry of horses was composed of a wide variety of breed types. Due to the proximity and generally unfenced boundaries between HMAs, adequate movement rates of individual animals between HMAs have maintained relatively high genetic variability throughout the Complex, compared to the mean levels of diversity observed in other wild horse HMAs and Complexes. Wild horse movements among the five HMAs are apparent through trails and seasonal variation in distribution. Evidence of extensive intermingling of horses between the five HMAs also comes from the genetic monitoring data, and the extremely low pairwise F_{ST} values (NAS 2013). It is recognized that individually, the AML for wild horses in three of the HMAs (Lost Creek, Antelope Hills, and Crooks Mountain) may not provide for a genetically diverse population. However, as indicated, these horses interact with each other among herd areas. Certainly, at the time scale of horse generations, the interactions and exchange of individuals ensures genetic variability.

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

Transport, Short-Term Holding, and Adoption (or Sale) Preparation

Horses would be gathered into temporary traps and transported to temporary holding corrals to be processed. Those horses not removed would be released back into the HMA. The rest would be transported from the capture/temporary holding corrals to the designated BLM off-range corral facility(s) in accordance with BLM Instruction Memorandum 2015-151(BLM 2015b). From there, they would be made available for adoption or sale to qualified individuals or placed in long-term pastures.

Wild horses selected for removal from the range are transported to the receiving off-range corral in straight deck semi-trailers or goose-neck stock trailers. Vehicles would be inspected by the BLM Contracting Officer's representative (COR) or Project Inspector (PI) prior to use to ensure wild horses can be safely transported and that the interior of the trailer is in a sanitary condition. Wild horses would be segregated by age and sex and loaded into separate compartments. A small number of mares may be shipped with foals. Transportation of recently captured wild horses between gather holding facility and BLM off-range corral (prep facility) would be limited to a maximum of 8 hours. During transport, potential effects 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 be seriously injured or die during transport.

Upon arrival at the short-term holding facility, recently captured wild horses would be off-loaded by compartment and placed in holding pens where they would be fed good quality hay and water. Most wild horses begin to eat and drink immediately and adjust rapidly to their new situation. Lactating mares and young foals are put in a separate pen to encourage pairing. At the off-range corral facility, a veterinarian would examine each load of horses and provide recommendations to the BLM regarding care, treatment, and if necessary, euthanasia of the recently captured wild horses. Wild horses in very thin condition or animals with injuries would be sorted and placed in hospital pens, fed separately and/or treated for their injuries as indicated. Recently captured wild horses, generally mares, in very thin condition may have difficulty transitioning to feed. Some mares may lose their pregnancies. Every effort is taken to help the mare make a quiet, low stress transition to captivity and domestic feed to minimize the risk of miscarriage or death.

Euthanasia and Sale without Limitation

While humane euthanasia and sale without limitation of healthy horses for which there is no adoption demand is authorized under the WFRHBA, Congress prohibited the use of appropriated funds between 1987 and 2004 and again starting in 2010 through the appropriations language each fiscal year through 2016 for this purpose. See, e.g., *Consolidated and Further Continuing Appropriations Act, 2015*, Pub. L. 113-235, 128 Stat. 2130, 2399 (Dec. 16, 2014). Even during the interval between fiscal years 2005 and 2009 the BLM chose not to destroy excess wild horses due to concerns about public and Congressional reaction to large-scale horse slaughter. Sales of wild horses are conducted in accordance with Instruction Memorandum No. 2014-132, *Guidance for th*e *Sale of Wild Horse and Burros* (BLM 2014b).

Impacts of Alternative 1: Remove all wild horses outside of HMA boundaries and utilize fertility control

Approximately 2,096 wild horses would be gathered from the gather area (approximately 80% of the total population). Approximately 578 horses gathered from outside HMA boundaries would be removed. Horses that are gathered within the individual HMA boundaries would be returned to those HMAs. Approximately 855 mares one year or older would be treated with PZP and freeze marked, before being released. Mares that are pregnant at the time of treatment would be expected to foal during the 2017 foaling season, but would not be expected to foal the following 1 or 2 years. The PZP treatment would be expected to slow population growth starting in 2018 and be effective for 1-3 years following treatment. This alternative would slow population growth, but it would not reduce the number of wild horses within the Complex.

The horses would be gathered and sorted according to gather SOPs (Appendix 1, Section A), which reduces injury and fighting among individual horses. However, the current social structure of the wild horse population would be altered upon release of the horses back into the Complex. They may end up in different bands than they were gathered with. There would also be continued competition for available forage and water resources since the low AML would be exceeded by over four times until a gather occurred. This competition would more noticeable in drought years. A gather to remove excess horses could occur the next year, resulting horses being rounded up in two consecutive years.

Selective retention of horses exhibiting the New World Iberian phenotype would not be possible because all horses captured within the HMA would be returned to the HMA. Selective removal criteria would not be implemented and genetic composition would continue to evolve naturally. This would be unlikely to affect the relative prevalence of the New World Iberian phenotype and associated genotype, because the frequency of that phenotype (and, hopefully, associated genotype) returned would be the same as its frequency in horses gathered from the Complex. Current genetic diversity, as measured by heterozygosity and allelic diversity, is high, reflecting a widely mixed source population from many domestic breeds (Appendix 3). It is likely that any individual genes that originated from New World Iberian ancestors have been spread widely across the population over many generations of genetic interchange. As a result, it is expected that the genotypes of a random sample of retained horses would likely have such genes at the same frequency as they are currently found in the population.

PZP would have little effect on the occurrence of the New World Iberian Genotype because all captured mares would be treated regardless of phenotype or genotype, and because PZP is only temporarily effective.

Impacts of Alternative 2: Proposed Action--Remove to low AML and utilize fertility control

BLM would gather approximately 2,096 wild horses from the entire gather area, completing one HMA and surrounding area before moving on to the next. Approximately 578 horses gathered from outside HMA boundaries would be permanently removed. Most of the horses gathered within the Complex would also be removed. The post-gather population of wild horses for the

Red Desert Complex would be slightly above the combined low range of AML (approximately 524). The BLM would ensure wild horse numbers within each HMA would not be below the respective low range of AML. Any mares older than 1 year of age that are to be released back into the HMAs, would be treated with PZP. The number of mares treated and released would be small due to the inability to gather all horses in some areas due to terrain and tree cover. The current high wild horse numbers and the inability to gather all the horses in some HMAs, may result in the majority of the mares needed to achieve the low AML number not being gathered, and subsequently not treated with PZP.

The current social structure of the wild horse population would be altered by the removal of approximately 2,096 horses, but the competition for forage and water resources would be reduced. Based on past gather and removal experience, The BLM expects that the horses remaining in the HMAs would adjust and reestablish a social structure and that any resultant negative impacts would be outweighed by the positive benefits resulting from reduced competition. No long term negative impacts to the populations are expected. This removal would ensure the health of the horses and reestablish ecological balance. It would also protect and preserve other uses of the landscape.

Selective retention criteria would be used throughout this Complex to maintain healthy age structure as outlined in WO-IM-2010-135 and to enhance or maintain herd health, genetic diversity, and herd uniqueness in accordance with the Lander and Rawlins RMPs. Selective retention criteria will seek to retain desired phenotypes. These phenotypes will vary by HMA and field office. In general, they will be in accordance with WO guidance and will seek to retain healthy horses with good conformation, size, disposition, and coloring. It is impossible to select for a genotype based strictly on visual characteristics. At best, selections can be made based on visually recognizable traits commonly associated with a genotype. Selective retention criteria as described in the Rawlins RMP also has the objective of increasing the occurrence of the New World Iberian genotype in the Lost Creek HMA. To accomplish this, BLM wild horse specialists would retain horses from the Lost Creek HMA which display popularly recognized visual characteristics commonly attributed to the New World Iberian phenotype. It is expected that this action would increase the frequency of horses with demonstrable phenotypic traits that are associated with the New World Iberian breed types, into the future. It is possible that these physical traits commonly thought to be associated with the New World Iberian genotype are not actually correlated with DNA markers that have been associated with New World Iberian breeds. DNA samples (a minimum of 25 per HMA) would be taken only from retained horses and photographs would be taken to compare visual characteristics with genetic results determined in a laboratory. Results from genetic analyses are not typically available until several months after delivery of the samples to the laboratory. Because all the herds are genetically very similar and have at least some Spanish ancestry, this method of genetic sampling with photographs for comparison would be used with all retained horses, but only in Lost Creek would horses be selected for characteristics commonly thought of as being associated with the New World Iberian phenotypes. The comparison of photographs and genetic results would be used by the BLM in the future to determine if selective retention based on visual traits is an effective tool for preserving the New World Iberian genotype.

PZP would have little effect on the occurrence of the New World Iberian genotype because its effects are temporary and because a significant portion of the retained population would not be gathered or treated.

It is also unlikely that removals would substantially reduce genetic diversity or the relative prevalence of the New World Iberian phenotype and associated genotype, even though current genetic analysis does not indicate a predominance of this genotype in the Complex. Current genetic diversity, as measured by heterozygosity and allelic diversity, is high, reflecting a widely mixed source population from many domestic breeds (Appendix 3). It is likely that any individual genes that originated from New World Iberian ancestors have been spread widely across the population over many generations of genetic interchange. As a result, it is expected that the genotypes of a random sample of retained horses would likely have genes at the same frequency as currently found in the population. Whether or not additional efforts to identify and retain characteristics that are popularly associated with an Iberian phenotype would increase the prevalence of such genes would be determined through the comparison of photography and genetic analysis.

In accordance with the land use plans, management practices would continue to be implemented post-gather with the goal of increasing desired phenotypes and genotypes including the New World Iberian genotype, where applicable, and, inasmuch as it is possible. The first of these would be continued DNA sampling and analysis in conjunction with future gathers. Done regularly, this would allow BLM to monitor the relative prevalence of the New World Iberian genotype throughout the Complex as well as the overall genetic health and diversity of the population and to evaluate the effectiveness of management practices geared toward increasing certain phenotypes and genotypes through selective retention criteria. The second management practice would be monitoring individual HMAs and documenting any recognizable migratory movement between HMAs. Both of these actions are outside the scope of this document, but are noteworthy as they relate to the management actions outlined within this document.

Impacts of Alternative 3: No Action--No gather or removal and no fertility control

No wild horses would be gathered and no fertility control treatment would be implemented at this time, however, a gather would be planned as soon as possible to achieve a TNEB in the Complex and to be in conformance with existing law, regulation, policy, and RMPs. As a result, there would be no change to the social structure of the wild horses. Projected population increases would result in minimal potential for inbreeding over the long term, but would continue to result in increasing competition for available forage and water resources, and eventually lead to long-term deterioration of wild horse health. See Sections 3.3.2 and 3.4.2 for impacts to soils and watershed, vegetation, and special status plants.

Lactating mares, foals, and older animals would be affected more than other horses in the population as they are most susceptible to stress, including forage and water depletion. Social stress among animals would likely increase as a shortage of resources increased.

The body condition of horses would be expected to deteriorate as a result of declining quality and quantity of forage and from the need to travel further from water to find forage. Drought

also has an impact on the amount and quality of forage that is produced on the range. As natural fluctuations of forage production and competition for forage between livestock, wildlife, and wild horse increases, livestock operators may choose to take non-use. If livestock operators take non-use, the operation of livestock water sources would likely decrease, further reducing the availability and reliability of many water sources currently used by wild horses. The potential risk of injury or death would increase as horses search and compete for forage and water. The search for water and forage would also increase the chances of horses to stray outside of HMAs.

No selective removal criteria would be implemented and genetic composition would continue to evolve naturally. This is unlikely to affect the relative prevalence of the New World Iberian phenotype and associated genotype, because BLM would be taking no action to change the relative frequency of that phenotype. Current genetic diversity, as measured by allelic diversity, is high, reflecting a widely mixed source population from many domestic breeds (Appendix 3). It is likely that any individual genes that originated from New World Iberian ancestors have been spread widely across the population over many generations of genetic interchange. As a result, it is expected that the genotypes of a random sample of retained horses would likely have genes at the same frequency as currently found in the population.

3.2 Wildlife, Threatened and Endangered Species, Special Status Species, and Migratory Birds

3.2.1 Affected Environment

The mosaic of plant communities and topographic features found throughout the Red Desert supports a wide variety of wildlife species that use the various habitats for resting, courtship, foraging, travel, food and water, thermal protection, escape cover and reproduction. The Complex has been used by livestock for over 100 years and fences are limited. However, in general the Complex has very low levels of other types of disturbance to wildlife habitat. These disturbances include a few improved county and BLM roads, several powerlines, and small energy projects related to uranium mining and oil and gas development. Due to this lack of major disturbances, the Stewart Creek HMA was selected as a control study site for Greater Sage-Grouse from 2007-2010 to compare with development impacts from the Atlantic Rim Natural Gas Development Project located south and west of Rawlins.

Species which commonly occur include coyote, badger, bobcat, desert cottontail, jackrabbit, Wyoming ground-squirrel, golden eagle, kestrel, horned lark, meadowlark, raven, magpie, common nighthawk, and other small mammals and birds. Mule deer, elk and pronghorn, utilize the gather area year-round and approximately 13% of the area is identified as crucial winter range for mule deer and pronghorn and winter or crucial winter range for elk. Antelope and mule deer populations are currently below herd unit population objectives, while elk populations are at their objective. For a complete description of species and habitats found within BLM jurisdiction in the Red Desert Complex, see the Rawlins RMP (2008a, FEIS p. 3-143 to 150) and the Lander Field Office RMP (BLM 2013d, FEIS p. 392-421). A summary of additional wildlife resources identified as being potentially impacted by the project is provided below.

Threatened, Endangered, Proposed and Candidate Species:

Potential Black-footed Ferret (Endangered; Non-Essential, Experimental Population [Federal Register October 30, 2015, 10(j) Rule)] habitat (white-tailed prairie dog towns) exists in the Complex. Past surveys conducted in relation to other development activities have not recorded the presence of black-footed ferrets. Horse trap sites and staging areas associated with gathers are never placed in prairie dog towns due to the possibility of horses breaking their legs in the burrows or degrading prairie dog habitat. This action would have no impacts to black-footed ferrets and this species will not be addressed further in the document.

The yellow-billed cuckoo, Canada lynx, Preble's meadow jumping mouse, and Wyoming toad are not present and do not have habitat present; therefore, there would be no effect to these species as a result of implementing the proposed gather. No water depletions are associated with the proposed gather; therefore, there would be no effect to any federal listed aquatic species present in or downstream of the North Platte River.

BLM Wyoming State Sensitive Species

A number of animal species potentially present have been accorded "sensitive species" status. Sensitive mammal species that have the potential to occur, or that may have habitat located within the gather area include the Wyoming pocket gopher, pygmy rabbit, swift fox, spotted bat, long-eared myotis, fringed myotis, Townsend's big-eared bat, and white-tailed prairie dog.

Sensitive bird species that have the potential to occur, or may have habitat located within the area include the ferruginous hawk, mountain plover, Greater Sage-Grouse, long-billed curlew, burrowing owl, sage thrasher, loggerhead shrike, Brewer's sparrow, sage sparrow, and bald eagle. Numerous other migratory birds, including sagebrush obligate species, also occur.

BLM records indicate that there are approximately 30 Greater Sage-Grouse (GRSG) leks and associated nesting habitat within or immediately adjacent to the Stewart Creek and Lost Creek HMAs, and approximately 16 occupied Greater Sage-Grouse leks and associated nesting habitat within the Antelope Hills, Crooks Mountain, and Green Mountain HMAs. There are also approximately 31 occupied Greater Sage-Grouse leks within the middle habitat surrounded by the Complex. In accordance with BLM policies and guidance outlined in the RMPs, as amended, timing stipulations and surface disturbance restrictions would be used to determine the location of the trap sites during the gather (Appendix 1).

Of the approximately 753,000 acres making up the Complex, 512,500 acres (68%) is within GRSG Priority Habitat Management Area (PHMA) and 240,500 acres (32%) of the Complex is within General Habitat Management Area (GHMA). Half of the PHMA contains Sagebrush Focal Area[5] (SFA) (approximately 254,000 acres). The RMP Amendment for Greater Sage-

[5] SFAs are areas of highest habitat value for GRSG … for the following reasons:

- They contain high-quality sagebrush habitat and the highest breeding bird densities

Grouse (BLM 2015c) requires that within PHMAs, BLM "Manage herd management areas (HMAs) in GRSG habitat within established appropriate management level (AML) range to achieve and maintain GRSG habitat…"(p. 51). In addition, SFAs will be "Prioritized for vegetation management and conservation actions in these areas, including, but not limited to land health assessments, wild horse and burro management actions, review of livestock grazing permits/leases, and habitat restoration" (p. 38).The BLM is also required to consult with the Wyoming Game and Fish Department (WGFD) on any project in PHMA as well as to comply with seasonal timing limitations, distance from leks for surface disturbance and disruptive activities, and other protective measures.

With adequate or surplus precipitation during the growing season, residual vegetative cover during the following spring helps to conceal nests from predators and provide hiding cover and adequate food for chicks. With this recent trend, the result has been an upward trend in number of GRSG observed on leks in 2014 and 2015. For the leks within the Complex, maximum males counted in 2015 totaled 945 birds, with an additional 699 males counted on leks located in the middle. Research on GRSG from the Stewart Creek HMA associated with the Atlantic Rim Natural Gas Project showed nesting hens selecting for big sagebrush mean canopy cover of 39 percent and a mean height of 21 inches. It also showed hens moving up in elevation from lower elevation leks, probably relating to selection of the big sagebrush habitat just described, and since higher elevations would correlate to higher precipitation, improved understory herbaceous for nesting cover, and increased forb composition important in the diets of young GRSG chicks.

Other sensitive species that have the potential to occur, or may have habitat include the Western boreal toad, Great Basin spadefoot toad, and the Northern leopard frog.

3.2.2 Environmental Consequences

Impacts of Alternative 1

BLM wildlife biologists would review proposed trap locations to avoid adverse impacts to wildlife, including occupied GRSG leks, raptor nests, big game crucial winter ranges and other BLM sensitive species habitats. The biologists would also coordinate with the WGFD to identify required SOPs to reduce or eliminate negative effects to wildlife species during trap location site selection. Trap sites would be located to avoid trampling of sagebrush and other shrubs that provide browse for big game and habitat for other wildlife species.

The gathers would occur in mid-summer or later, therefore disturbance to ground nesting birds would be minimal since the chicks of all species would have fledged. Areas exhibiting active Wyoming pocket gopher activity and white-tailed prairie dog towns would be avoided for trap sites to avoid disturbance to these species. Some concentrated disturbance may occur during the

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- They have been identified as essential to conservation and persistence of the species
- They represent a preponderance of current Federal ownership
- In some cases, they are next to protected areas that serve to anchor the conservation importance of the landscape" (BLM 2015d, p. 17)

actual gathering activity from horses falling thru/crushing shallow burrows; which also occurs as large animals naturally traverse the rangeland.

Wildlife adjacent to trap sites would be temporarily displaced during capture operations by increased activity during trap setup, from helicopter noise, and vehicle traffic, but in most cases displacement should only last 2-3 days in each trap area. Reduction of wild horse numbers outside of HMAs would result in reduced competition for forage and water resources between wild horses and wildlife. Short-term stress and displacement would occur to wildlife during the gather operations, and again when subsequent gathers occurred to reduce the horse population levels to AML.

Wildlife would still be competing with wild horses within the Complex for available forage, space, and water resources as the horse numbers would remain far above AML. These impacts would be higher for elk, than for antelope and mule deer, due to the higher diet overlap between elk and wild horses for grass species. However, during periods of drought and lower forage production, competition for forage with other wildlife species would increase. As wild horse populations increase in the mid and long-term, competition for forage, space and water may lead to displacement of wildlife species, particularly big game, which may result in the use of less preferred habitat, lower animal condition, and lower capability to survive harsh winters. Greater forage use by increasing wild horse populations would potentially result in lower visual security for nesting GRSG and lower nesting success. These potential impacts would also increase during drought years with reduced plant vigor and production. Although these potential impacts may be lessened with reduced stocking and/or elimination of livestock grazing, wild horses graze further from water sources and often spend time on higher terrain, where their forage use would overlap more with nesting GRSG habitat, than compared to cattle grazing. Disturbance associated with wild horses along stream bank riparian habitat and adjacent upland habitat would be reduced outside the Complex only. Riparian habitat within the Complex would continue to be affected by above AML wild horse use, reducing the quality of GRSG late brood-rearing habitat. This would also increase over time as the horse population increases. This would result in continued impacts to all aquatic species due to increased sedimentation and degradation of habitats (See further discussion in Section 3.3.1 and 3.5.1). Although negative impacts associated with this Alternative would not be as great as Alternative 3, the current trend for both riparian and upland vegetation would not achieve the criteria of GRSG SFA habitat.

Impacts of Alternative 2: Proposed Action

Impacts would be more beneficial and widespread compared to Alternative 1. The same number of horses would be gathered, but the number of wild horses removed would be far greater, thereby reducing riparian and upland vegetation forage removal post-gather. The effects of reducing wild horse numbers to the low AML would help to maintain the population within AML for a longer duration, reducing competition for forage and water resources, as well as nesting habitat and hiding cover with wildlife species. More vegetation (hiding cover) and forage would be available for GRSG during critical nesting and brood-rearing periods, which may increase nesting success and populations. There would be reduced forage competition with elk that would help to maintain the numbers and health of this elk herd. The ability of wildlife populations to endure periods of drought or severe winter conditions would be enhanced by

promoting the highest habitat quality under this Alternative. Future gathers would not be needed until wild horse numbers once again exceed the high AML. Riparian resources would not be used as heavily, leaving more vegetation for forage and hiding cover, and improving bank and stream condition and water quality. This is the only Alternative that would continue to maintain or improve resource values supporting SFA criteria for GRSG habitat.

Impacts of Alternative 3: No Action

Wildlife would not be temporarily displaced or disturbed as a result of gather operations. However, there would be continually increasing competition with wild horses for forage resources, space, and in some situations, limited water. Although diet overlap is highest between wild horses and elk, fecal analysis data[6] shows higher wild horse use of winterfat during the winter, which may increase diet overlap with antelope and mule deer. The continued competition for resources would lead to increased stress or displacement of native wildlife species, use of less preferred habitat, and greater potential for reduced fitness and increased animal mortality during severe climate seasons. Wildlife may move to locations outside of the Complex, outside of their traditional home ranges, however, these areas would also likely be occupied by horses, as the population continued to grow. The effects would be greater in limited crucial use habitat areas such as winter habitat, birthing/nesting areas, water locations, and in migration habitats. Additionally, increased competition between wild horses and wildlife species for forage resources, particularly in the spring when plants make and store carbohydrates, would impede long-term vegetation recovery, and encourage non-native or invasive plants to become established, reducing the more desirable species used by wildlife.

Wild horse grazing has been associated with reduced plant diversity, altered soil characteristics, lower grass cover, lower grass density, and 1.6 to 2.6 times greater abundance of cheatgrass (Beever et al. 2008, pp. 180-181). GRSG need grass- and shrub-cover for protection from predators, particularly during nesting season (Connelly et al. 2000, pp. 970-971). Reduction in shrub and grass cover can result in increased predation on both nests and birds, leading to lower nesting success and population. Changes in vegetation diversity and cover may also reduce insects important in GRSG diets, as well as to other wildlife species. These potential impacts would increase during drought years with reduced plant vigor and production. Although these potential impacts may be lessened with reduced stocking and/or elimination of livestock grazing, under this Alternative, wild horses would have to graze further from water sources and since they often spend time on higher terrain, their forage use would overlap more with nesting GRSG habitat, than compared to cattle grazing. In addition to effects in sagebrush habitats, free-roaming wild horses can also degrade important meadow and spring brood-rearing habitats that provide forbs and insects for chick survival (Beever and Aldridge 2011, p. 277; Crawford et al. 2004, p. 11; Connelly et al. 2004, p. 7-37), as streams and springs within sagebrush ecosystems receive heavy use by horses (Crane et al. 1997, p. 380). The effect of expanding horse herds on water and riparian resources due to increasing trampling and sedimentation, and reducing aquatic or riparian vegetation negatively affects all wildlife, including aquatic species, by degrading their

[6] Fecal samples collected for vegetation species composition analysis over various seasons and years between 2002 and 2011. Raw data available in RFO files.

habitats. This Alternative would not maintain or enhance resource values supporting the designation of SFA for GRSG habitat.

3.3 Soils, and Watershed

3.3.1 Affected Environment

The soils in the Red Desert Complex are highly variable in depth and texture as would be expected with the great variability in geology and topography that characterizes the area. Generally, the western third is a mix of sandy soils with high wind erosion potential and clayey soils with high water erosion potential, low bearing strength and varying amounts of salts. The eastern third has more loamy inclusions in the form of undulating uplands and alluvial complexes, with moderate erosion potential, while the middle third is a mixture of both. Virtually any soil condition that may be encountered in the region can be found somewhere within the Red Desert Complex. More specific soils information can be found in the soil surveys located in the BLM files in the RFO and LFO.

The southern portions of the Complex extend into the Continental Divide closed basin. The northern portion is part of the North Platte River drainage, including Crooks Creek, Arapahoe Creek, Willow Creek, Cottonwood Creek, and other small tributaries. Additional land management guidance is provided by various agencies, compacts and agreements that are focused primarily but not exclusively upon the North Platte River Drainage. There are few riparian areas, located along the limited perennial drainages, lakes, and below seeps and springs which do not flow very far.

Data collected from rain gauges within the Lost Creek and Stewart Creek HMAs has reflected a 10 year average (2005-2014) of about 91% of normal precipitation. The long term trend of precipitation data collected since 1986 (30 years) has been downward. Personal observations of longer trend related to ground water and vegetation response have also been downward, with reservoirs and playa lakes that used to fill with water most years now more commonly dry, with sagebrush encroachment into formerly meadow habitat. Within the recent Standards and Guidelines evaluation period (BLM 2013b), there were drought years in 2006 and 2012. The three HMAs encompassing the Northern portion of the Complex have received normal or above normal precipitation five out of 14 years from 2000 through 2014 (BLM Rain Gauge Data). The LFO portion of the Complex has seen several drought years since the year 2000; 2002, 2012, and 2013 were particularly dry years, resulting in low forage production and plant vigor. Additionally, the persistence of upland species within the riparian systems indicates a drying of the riparian areas. As the wild horse population increases, horses must increase their range in search of available forage and water. The BLM works with livestock permittees to manage the rangelands within the HMAs to maintain a balance between use and available forage during drought or poor forage production years by adjusting the amount of livestock use.

Soil and watershed condition and trend have primarily been evaluated by the amount of plant cover and litter and the amount and/or reduction in bare ground. Within the Stewart Creek grazing allotment there are five pace frequency transects, established in 1980 and re-read in 2012, that showed an average decline in bare ground on three transects from 44 percent to 23 percent, and from 55 percent to 36 percent on the remaining two sites. There are also four line-

point transects, established in 1995 and re-read in 2012, which also show reductions in bare ground from 40 percent to 23 percent at two sites and from 52 percent to 41 percent at the remaining two sites. In the adjacent Cyclone Rim grazing allotment one pace frequency transect showed a decline in bare ground from 69 percent to 27 percent between 1980 and 2012, while the remaining transects had static or small decreases bare ground over the same time period.

During this same period, livestock actual use has transitioned from higher levels of sheep use to dominance of cattle use, or in the case of Stewart Creek, all cattle use. The number of livestock permittees has also shrunk in both grazing allotments during this period of time--a reflection in the conversion to cattle and changing economics within the livestock industry, which has led to more livestock nonuse of permitted AUMs. However, in the late 1990's and early 2000's, wild horse numbers were above AML in both the Lost Creek and Stewart Creek HMAs. At that time, utilization studies indicated moderate to high use in riparian habitat and light to moderate use in sites adjacent to riparian habitats. Wild horse numbers exceeding the high AML were identified as a contributing factor to riparian area degradation within the Lost Creek, Stewart Creek, and the portion of the Antelope Hills HMA within the Cyclone Rim Allotment to not meeting the standards for rangeland health in 2002 (BLM 2003). Following this assessment, there have been changes in livestock management, additional water developments, and protection of historic seeps and riparian habitat to improve animal use and distribution across the Complex. Implementation and completion of these projects may have influenced the assessment of the lower half of the Complex completed in 2012 (BLM 2013b). These allotments were found to be meeting upland and riparian standards, with a static to upward trend in soils and watershed health.

3.3.2 Environmental Consequences

Impacts of Alternative 1

Gather operations would result in disturbance to the soil surface and may cause some soil compaction at the trap sites and holding locations. Short-term trails and soil compaction may also develop adjacent to the trap site where animals enter the trap. Soil movement could occur during and after runoff events, but would only have a minimal local effect. Increased erosion would continue until the vegetation recovers and stabilizes the soil. It is unlikely that any soil movement would reach drainages that would increase sediment loading into the North Platte River drainage since trap sites would be located away from perennial water sources.

Wild horses captured outside the HMA boundaries would be removed. Soils in these areas would receive minimal year-long grazing by wild horses, and would be grazed by livestock following the permitted numbers and season-of-use. Current trends in increased plant cover and litter in the RFO, and corresponding decreases in bare ground should continue, improving soils and watershed health. The overall net reduction in wild horses would have a beneficial effect on soils and vegetation, but not as much when compared to the Alternative 2: Proposed Action. Wild horse population growth would be slower when compared to Alternative 3. As a result, there would be a potential for short term improvement to rangeland health outside of the HMAs only. The AML would continue to be exceeded within the Complex and wild horse populations would continue to increase but at a slightly slower pace. Year-long grazing use by wild horses

would continue to cause deterioration of riparian habitat where it is not fenced for controlled use, and it may cause areas receiving concentrated use to shift from an improving trend (reduced bare ground) to static or downward trend in upland locations.

Impacts of Alternative 2: Proposed Action

The disturbance associated with capture and removal operations would be the same as for Alternative 1. However, the gather and removal operations would result in lowering wild horse populations to the low end of AML, reducing year-long grazing from wild horses far greater than either Alternative 1 or Alternative 3. Low levels of wild horses and managed livestock grazing would continue to support improving soil and watershed health trends across most of the Complex. Levels of bare ground would continue to decrease, and improved plant cover and litter would result in increased moisture infiltration and retention, nutrient cycling, and add to organic matter in the soil surface horizon. Riparian habitat frequently used by wild horses and livestock should improve, depending on livestock season and duration of use and the development of additional water sources. However, effects of long-term hydrologic drought would continue to lead to the drying out of riparian habitat. Proper livestock management should maintain or enhance soil stability and plant cover, although species composition in riparian areas would continue slowly shift to plants with lower moisture requirements.

Impacts of Alternative 3: No Action

Wild horse population control measures would not be implemented and gather operations would not occur. This would allow wild horse populations to continue to increase within and outside of the Complex. Soil exposure and watershed deterioration would be similar, although greater than Alternative 1, since they would occur at a faster pace due to no fertility control slowing the population growth and the lack of removal of any wild horses. Year-long grazing use by wild horses would continue to cause deterioration of riparian habitat where it is not fenced for controlled use. There would also be an increase in the potential for larger areas receiving concentrated use to change from an improving trend (reduced bare ground) to static or downward trend in upland locations. These potential impacts to soil and watershed health would be higher than Alternative 1. During drought years, these impacts would increase in amplitude and rate of deterioration of soil resources, and would increase the potential for soil movement into the North Platte River drainage.

3.4 Vegetation, Special Status Plants

3.4.1 Affected Environment

There are a variety of vegetation types in the Complex, although the dominant vegetation type is sagebrush/grass. Other upland types found include saltbush, greasewood, grassland, mountain shrub, and conifer forest. Common upland plant species include Wyoming and mountain big sagebrush, black sagebrush, Douglas' and rubber rabbitbrush, snowberry, bitterbrush, mountain mahogany, winterfat, Oregon grape, Gardner's saltbush, black greasewood, Indian ricegrass, needle-and-thread, bottlebrush squirreltail, Sandberg's and mutton bluegrass, bluebunch and thickspike wheatgrass, basin wildrye, green needlegrass, Idaho fescue, king-spike fescue, Junegrass, and threadleaf sedge. Forbs are abundant, particularly at higher elevations receiving

ten inches or more precipitation annually. Common forbs include phlox, buckwheat, sandwort, bearded-tongue, daisy, locoweed, lupine, paintbrush, sego lily, death-camas, goldenweed, aster, violet, buttercup, bluebells, hawksbeard, and yarrow. Native plants comprise the principle species on most sites, although cheatgrass is present in some areas, particularly on sandy soils.

Riparian habitat is rare, occupying about one percent of the landscape. Community types consist of riparian grassland and willow-riparian. Common plant species include Nebraska and beaked sedge, Liddon's sedge, Douglas sedge, tufted hairgrass, redtop, mat muhly, alkali bluegrass, alkali sacaton, alkali cordgrass, inland saltgrass, basin wildrye, Kentucky bluegrass, spike-sedge, American and alkali bulrush, other sedges and rushes, brookgrass, coyote willow, Booth' willow, Geyer willow, gooseberry, and shrubby cinquefoil. Forbs are more abundant on non-saline sites, and include buttercup, plantain, prickly-lettuce, willow-weed, mint, speedwell, monkey flower, gentian, meadow pussytoes, checker-mallow, cinquefoil, aster, sunflower, wild licorice, strawberry, clover and native thistles.

Wild horses generally prefer perennial grasses as forage when available. Fecal analysis from the Stewart Creek HMA in the spring and fall documented 98 percent diet of grasses and sedges, while fecal analysis from the Lost Creek HMA generally shows wild horses selecting these same species 70-80 percent of the time. The principle change is during winter conditions, when wild horses may select more shrubs, primarily winterfat, and during severe periods it became the dominant plant consumed. In comparison, cattle diets at Stewart Creek were similar during the spring, but contained over 20 percent shrubs during the fall, and antelope diets consisted of 84 percent shrubs during the spring and 99 percent shrubs during the fall, primarily big sagebrush. Diets of elk on Crooks Mountain and Green Mountain would have a high overlap with wild horse diets, similar to the cattle diets already discussed. Wild horse diets at the Lost Creek and Stewart Creek HMAs were led by bluegrass, followed by needle-and-thread and bluebunch wheatgrass, with Indian ricegrass also commonly selected for at Lost Creek. Cattle diets in the Stewart Creek grazing allotment were similar to that of wild horses, except for more sedge in the spring diet, and generally reflects what are the most common and available grass species for ungulates to forage upon[7].

Condition and trend in upland vegetation in the Lost Creek and Stewart Creek HMAs has been collected from pace frequency transects established in 1980 and line-point transects established since 1995, with all transects re-read in 2012. During most of this timeframe, wild horses numbers were at AML and livestock use was declining following sheep conversions to cattle and reduced stocking rates after the Seven Lakes Grazing EIS (1979) was implemented. Projects associated with the EIS included the drilling and equipping of over twenty water wells, most of them in the Stewart Creek grazing allotment, and intended to provide reliable water and proper distribute summer cattle use. However, the combination of large mill fans and high winds resulted in the failure of the pumping facilities, which were later replaced with generators and more recently solar arrays. The majority of these wells currently pump about 3-4 gallons per minute (gpm) and water up to 150 cattle and/or wild horses per day during the peak summer period. Besides varying livestock turn-out location between the east and west sides of the

[7] Fecal samples collected for vegetation species composition analysis over various seasons and years between 2002 and 2011. Raw data available in RFO files.

allotment, these wells that are primarily located on the west side, provide the opportunity to affect the distribution of livestock use by changing which wells are on versus the ones that are off. For more recent livestock stocking rates and operation descriptions, refer to the Livestock Grazing Section 3.6.

All five pace frequency transects and the four older line-point transects were re-read and photographed as part of the watershed assessment conducted in 2012 and the report written in 2013. These studies show decreased numbers of rhizomatous wheatgrass and increased bunchgrasses, primarily Indian ricegrass, needle-and-thread, and little bluegrass (2013b). All of these species are native plants, however, rhizomatous wheatgrass is the least desirable, most grazing tolerant species, and has also decreased in other allotments once changes in grazing management of livestock were implemented. There were also many young plants observed, including grasses, forbs and shrubs, as a result of wet years in 2009-2011, and grazing management that promoted their establishment. Another element of the watershed assessment included establishment or re-read of eight Habitat Assessment Framework (HAF) transects in GRSG nesting/early brood-rearing habitat. The transects depict healthy big sagebrush stands with adequate understory cover, and varying forb cover depending on elevation and precipitation. However, the severe drought year observed in 2012 has since led to decreased cover of sagebrush, particularly in the southwest portions of the Stewart Creek HMA.

Condition and trend in riparian vegetation in the Lost Creek and Stewart Creek HMAs has primarily been through the use of photo-points and personal observations. The overall drying hydrologic trend has resulted in reduced ground water and sagebrush encroachment along lower Stewart Creek, in-sufficient water in upper Lost Soldier Creek to support beaver colonies once present there, and reduced runoff and collection of water in playa lakes within the Cyclone Rim grazing allotment. Wetlands at Lumen Well in Cyclone Rim were fenced for wildlife in the early 1980s to preclude ungulate grazing. In areas of riparian habitat that stay wetted, past compliance checks and utilization studies had shown moderate to high use, resulting in changes in management and later on not meeting Standards of Rangeland Health for riparian/wetland habitat. As a result, Kinch-McKinney spring in Cyclone Rim grazing allotment and lower Stewart Creek in the Stewart Creek grazing allotment, were both protected with exclosure fences with off-site water developed to improve riparian habitat condition on public lands. Chicken Springs, located on private and public land, was fenced out and excluded from ungulate grazing in 1996, and now supports riparian vegetation instead of bare ground. Riparian habitat at and above A&M Reservoir has been excluded from ungulate grazing since the mid-1990s as well, and now supports healthy riparian vegetation. Lost Soldier Creek has improved by restricting livestock grazing during the summer (hot season) and minimizing wild horse numbers when gathers have occurred. Riparian pastures were established at Bull's Creek (2004) and upper Stewart Creek (2006) that have improved riparian habitat on State of Wyoming lands by eliminating summer grazing. Desired grazing species, such as Nebraska sedge and tufted hairgrass, now have the entire growing season for plant growth that should maintain or expand their vigor, production and cover. Openings for plants that reproduce by seed have been reduced, which has led to decreased observations of meadow thistle. In addition, flows into upper Stewart Creek, Lost Soldier Creek, and upper Osborne Draw (above and below A&M Reservoir), have been augmented with well water, which provides additional drinking water and enhances riparian vegetation.

Monitoring in the Antelope Hills HMA, Crooks Mountain HMA, and Green Mountain HMA have primarily been focused on riparian condition in the form of frequency transects, photo points and stubble height evaluations. Upland line point intercept transects established and evaluated between 1999 and 2010, and more recently in 2014 and 2015 indicate a high degree of variability in conditions in upland ecosystems, with most sites falling within a mid to late seral state of ecological succession. Riparian areas make up less than 1 percent of the ecological types in the HMAs. Conditions in these systems prior to 2011 have generally been below what is expected for the site with inadequate residual stubble height to promote soil stability and water retention. Species vigor on riparian areas has been poor, with higher than expected percentages of bare ground, and encroachment of upland species. Utilization by livestock and wild horses in riparian systems between 2011 and 2013 continued to result in inadequate residual cover. However, conditions have steadily improved in 2014 and 2015 due to favorable climate conditions and livestock herding efforts by grazing permittees. Immigrant Springs and Sulfur Bar Spring (in the Antelope Hills HMA), and Soap Holes and Haypress Creek (in the Crooks Mountain HMA) represent the common areas where vegetation objectives consistently are not met. LFO staff observations indicate concentrations of wild horses at all of these locations. Conversely, upland conditions are generally regarded as good with plant community composition and cover represented within the range of variability that is appropriate for the ecological sites based on the observations of resource professionals and more recent line point intercept transect data collected in 2014 and 2015. Where site characteristics fall outside the normal range of variability, the conditions are believed to be the result of extensive drought conditions, as livestock stocking rates are extraordinarily light at approximately 20 acres/AUM, and use levels have been light (see Section 3.6 for more information).

Threatened, Endangered, Proposed and Candidate Species

One federally designated threatened, endangered, proposed, or candidate plant species has the potential to be present--Ute ladies'-tresses (Threatened). The federally listed Ute ladies'-tresses occurs in riparian habitat, which is found in the area, but surveys have not found any populations. Project activities would not take place in riparian habitat; therefore gather activities would result in no impacts to Ute ladies'-tresses.

The blowout penstemon and Colorado butterfly plant and its Critical Habitat are not present and do not have habitat present; therefore, there would be no effect to these species as a result of implementing the proposed gather.

Sensitive Plant Species

Sensitive plants that have the potential to occur include the Cedar Rim thistle, Ownbey's thistle, persistant sepal yellow cress, Laramie false sagebrush, and Gibben's penstemon. Prior to placement of horse gather holding facilities, desktop analyses would be conducted to identify areas with known special status plant species (SSPS) or potential habitat. Analyses would be based on occurrence records and potential occurrence modeling data from the Wyoming Natural Diversity Database, as well as BLM internal records. Onsites would be completed for all trap locations and results would guide holding facility placement to avoid SSPS and potential habitat. Therefore, there should be no impacts to SSPS as a result of implementing the gathers beyond what occurs normally by wild horse movements.

Invasive and Noxious Weeds
Federal agencies are directed by Executive Order 13112, Invasive Species, to expand and coordinate efforts to prevent the introduction and spread of invasive plant species and to minimize the economic, ecological, and human health impacts that invasive species cause. Weed populations are generally found along dirt roads and two-tracks, in areas of animal (livestock, wild horses and wildlife) concentration, in areas of oil and gas development, and in areas of intense recreational use. Motorized vehicles transporting seeds can be a major source of new infestations of weed species. Within the Lander BLM Field Office portion of the Complex, the Fremont County Weed and Pest (FCWP) inventoried for the presence of noxious or invasive species in 2007 and are scheduled to re-inventory in 2018. From the inventory in 2007, Early Detection Rapid Response Areas (EDRR) were established where noxious weeds were found and have been visited for treatment at least one time every year. From the 2007 inventory, the FCWP determined that the LFO portion of the Complex was relatively weed-free. The RFO portion of the Complex has not been completely inventoried, but areas inventoried so far are relatively weed-free.

Noxious and invasive species known to occur in the Complex include: Russian knapweed, spotted knapweed, houndstongue, Canada thistle, saltcedar, Russian olive, leafy spurge, whitetop (hoary cress), perennial pepperweed, Swainson pea, black henbane, halogeton, cheatgrass, and Russian thistle. Most of these infestations are small and have been kept in control using the Integrated Pest Management (IPM) approach.

Post–gather weed monitoring of trap sites would be performed for 1-3 years after the project. If noxious weeds are found, the site would gain EDRR status and would be treated every year as needed.

3.4.2 Environmental Consequences

Impacts of Alternative 1

Gather operations located inside and outside the Complex would result in trampling of vegetation at the trap sites and holding locations. The number of trap sites used during a gather can fluctuate depending on horse distribution, terrain, and seasonal limitations on horse movement (i.e. temperature, precipitation). Each trap site and holding facility varies in size, but is generally less than two acres. If a particular trap site is used, wild horses would be kept there until they can be loaded onto semi-truck trailers and moved to a processing facility. The amount of time wild horses stay at a trap site is generally less than one day. Upland vegetation would be disturbed by trap site construction, and short-term trails may be created near the trap sites. Any vegetation removed would be minimal and localized. These sites are used infrequently, providing the herbaceous vegetation time to recover. However, there could be loss of some vegetation, primarily big sagebrush, within these small concentrated use areas. Overall, the total acreage disturbed would be small in relation to the gather area and these impacts would be on a local scale only. Monitoring post-gather would ensure that any temporary trap site that did not reclaim adequately would receive additional management. In order to avoid riparian area disturbance, trap sites and holding locations would not be located within or directly adjacent to riparian habitat; thus these areas would not be disturbed by gather operations.

The removal of an estimated 578 wild horses from outside HMAs and the implementation of fertility control would eliminate year-long grazing use by wild horses and increase forage availability for livestock and wildlife in the short-term. This would also promote continued improvement in vegetation condition, primarily plant cover and litter, in conjunction with the use of good livestock management practices. Riparian systems outside the Complex, would initially receive more rest that would improve plant vigor and promote expansion of desirable plant species. In the mid and long-term, these beneficial effects to riparian and upland vegetation would decrease as wild horses within HMAs increased and moved outside the Complex. Within the Stewart Creek HMA this rate of movement by wild horses outside could increase if livestock numbers decrease resulting in fewer water wells being pumped. The 20 percent reduction in wild horses would have a beneficial effect on vegetation outside of the Complex, but not as much when compared to Alternative 2: Proposed Action. Wild horse population growth would be slower when compared to Alternative 3. As a result, there would be a potential for short-term improvement to riparian health and adjacent upland rangeland health outside of the Complex only.

Within the Complex, perennial upland vegetation and riparian would continue to receive increasing year-long grazing as wild horse numbers slowly increase following the fertility control, which is not conducive to maintaining plant health and vigor of desirable species. Plants draw nutrients from reserves in their roots to initiate plant growth in the spring, which must be replenished during the growing season to maintain or expand the root system. Repeated moderate to heavy grazing throughout the growing season does not allow these nutrients to be replaced, resulting in shrinkage of the root system and reduced plant vigor and forage production. This trend could also increase the potential for increases in less desirable native species, such as thickspike wheatgrass and little bluegrass, or invasive species like cheatgrass and alyssum. Bluegrass is currently the highest component of wild horse diets in the Stewart Creek and Lost Creek HMA data[8], and is considered an "increaser" species compared to most other bunchgrasses which are "decreaser" species with higher grazing use during the growing season. However, continued high use of bluegrass could lead to greater amounts of other plant species as wild horse numbers increase. The current high wild horse numbers when combined with actual use levels of livestock use, would result in reduced plant vigor and production of desirable species within riparian habitat and upland vegetation adjacent to this habitat or to other water sources. Negative trends in riparian habitat health already observed would continue or worsen. The effects of these negative trends in vegetation condition for riparian habitat and upland vegetation would be greater during years with lower than average growing season precipitation, and would likely extend further away from water sources. In the Stewart Creek grazing allotment, the potential for negative trend in upland vegetation health would increase if fewer water wells are turned on, resulting in more concentrated grazing around water wells that are being pumped to provide water for livestock and wild horses. .

Water developments constructed (authorized in the 2011 Green Mountain Common Allotment (GMCA) final grazing decision) would result in adjustments in managed livestock use which

[8] Fecal samples collected for vegetation species composition analysis over various seasons and years between 2002 and 2011. Raw data available in RFO files.

would reduce livestock use in nearby riparian areas. However, most wild horses would continue to utilize "favored" watering sites which would result in continued concentrated riparian use and degradation. Negative impacts from this alternative would be greater when compared to Alternative 2: Proposed Action, and less than those for Alternative 3.
Reclamation efforts would be less likely to succeed as the wild horse population increases. Oil and gas well pads would require fencing for initial recovery of vegetation; however, once fences were removed, grazing by wild horses would result in loss of vegetation and destabilization of soils similar to adjacent rangelands. Linear features are rarely fenced due to both the cost and restrictions they would place on movement of wildlife, wild horses, and livestock. These sites would likely receive grazing use that would reduce or eliminate desirable species and promote weeds, less palatable native plant species and bare ground which would, in turn, lead to increased soil erosion and water runoff into drainages and adjacent rangelands.

Impacts of Alternative 2: Proposed Action

The impacts associated with wild horse capture and removal operations would be the same as for Alternative 1. However, wild horse numbers would be reduced to the low end of AML, which would have the greatest benefit to vegetation resources of all the alternatives, both inside and outside of the Complex. Outside the Complex the vegetation response would be similar to Alternative 1 in the short term, but would also extend into the mid and long-term since fewer horses would be likely to move outside the Complex in search of forage, water, or due to competition with other wild horses, wildlife, or livestock. This would extend the period of time that benefits to plant vigor and forage production would occur. Long-term benefits to vegetation may also promote the expansion of desirable plant species, resulting in increased species composition, site stability, and reduced potential for invasion and/or expansion of invasive, non-native species.

Impacts to vegetation resources would also be beneficial with the reduction in wild horse numbers and the use of fertility control to slow future population growth. Lower numbers of wild horses with year-long use, in combination with livestock grazing involving some type of deferred-rotation grazing systems, would provide the optimum opportunities for maintaining or improving plant vigor, production and species composition in both riparian and upland vegetation communities. Desirable bunchgrasses, such as Indian ricegrass, needle-and-thread, bluebunch wheatgrass, bottlebrush squirreltail, green needlegrass, and basin wildrye, should be maintained or enhanced by reducing grazing use through all or a portion of the growing season. Key species in riparian habitat, such as Nebraska sedge and tufted hairgrass, would have a greater potential to be maintained or enhanced. A few key riparian areas where wild horses always use, even at lower population levels, may remain in their current condition. Effects of long-term hydrologic drought, that results in the drying out of riparian habitat, would still continue and not be changed by lower levels of use by wild horses or managed use of livestock grazing. The use of pumped water wells to vary seasonal distribution of grazing use by livestock and wild horses in the Stewart Creek grazing allotment could be employed. Water developments constructed (authorized in the 2011 GMCA final grazing decision) within the Antelope Hills HMA would result in improved livestock management which would reduce livestock use in nearby riparian areas. Reduced numbers of wild horses would still utilize "favored" watering sites which would result in continued concentrated riparian use and degradation in these

localized areas, however, most riparian habitat should improve with less use. This would also help promote improved upland plant vigor and production, and expansion of herbaceous species where sagebrush die-off occurred after the 2012 drought.

Impacts of Alternative 3: No Action

Wild horse population control measures would not be implemented, no gather operations would occur, and wild horse numbers would continue to increase within and outside of the Complex. Negative impacts to vegetation resources would be greater than Alternative 1, and far greater than Alternative 2. Outside of the Complex, year-long use by wild horses would continue and increase as the wild horse population grows and the potential for additional wild horse movement outside of the Complex increases. Grazing use by wild horses and livestock (when present) would continue to overuse desirable plant species in riparian habitat, resulting in lower plant vigor and production, and increase the potential for reduced species composition and an increase in less desirable species, such as Baltic rush, alkali sacaton, mat muhly, Kentucky bluegrass, arrowgrass, and dandelion. At higher levels of utilization of riparian habitat, species of willow may also be overgrazed and reduced in vigor, production, and composition. These impacts to herbaceous and woody species would be compounded by additional years of below average precipitation during the growing season, and the continued drying out of these riparian systems due to the long-term hydrologic drought this region has been experiencing since the 1980s. Currently, there are no areas identified with downward trend in upland vegetation condition, however, as levels of forage use increase in the mid and long-term, the potential for reduced vigor and production of desirable plant species, particularly adjacent to water sources and riparian habitat, would increase. However, wild horses roam much further away from water sources than cattle, so the negative impacts to plant vigor and production may occur further away, as well as close to water sources. These impacts would also extend out farther from water sources as wild horse populations increase and during years with below average precipitation during the growing season. This would also be accompanied by increased potential for the introduction and/or expansion of invasive, non-native plant species where native plant species are being overused. Livestock grazing management may have to change in other pastures or allotments that are not affected by wild horse populations, which could negatively affect vegetation resources where wild horses are not present. However, higher wild horse populations could increase the potential for the fencing of private and state lands, which could lead to improved vegetation conditions in those locations once wild horse use is excluded and good livestock management practices are followed. Reclamation projects of disturbed sites would be difficult to achieve successful results without fencing them to exclude grazing use by wild horses and/or livestock.

Inside of the Complex, wild horse numbers and use would be the highest, resulting in similar impacts as described in the paragraph above, but would occur more quickly in localized areas in the short-term and become broader in effect in the mid and long-term. As wild horse populations increase, the potential to restrict or eliminate livestock use would increase, particularly during years with below normal precipitation. Reducing livestock numbers, and/or deferring turn-out of livestock until after the growing season would reduce the negative impacts upon vegetation resources described above. However, in the Stewart Creek grazing allotment, elimination of livestock use could result in water wells not being pumped. This would concentrate wild horses

on remaining water sources, further adding to the negative effects described above, and potentially leading to loss of riparian vegetation and increased levels of bare ground. It could also increase the potential for movement out of the Complex, particularly during drought years, when there may not be adequate water for wild horses or other users.

3.5 Recreation

3.5.1 Affected Environment

The public enjoys seeing wild horses roaming free. Although demand is not high, some people (residents and nonresidents) make special trips to see wild and free-roaming horses in their natural environment.

Other recreation is quite dispersed with the greatest amount occurring during the hunting seasons for the various game animals and birds. Primary recreational activities other than hunting include camping, hiking, rock hounding, photography, wildlife and wild horse viewing, off highway vehicle (OHV) use, and sightseeing. While varied recreation activities and values occur, the one most likely to be affected is hunting.

Several of the gathers are proposed in elk and pronghorn hunt units currently under Wyoming Game and Fish special management criteria. This means that the Wyoming Game and Fish reduces the amount of special draw licenses to ensure a higher male to female ratio and therefore a higher chance for a hunter to harvest a trophy class animal. In addition, because tag numbers in remain fairly low, hunters expect to be able to find solitude and high numbers of male animals.

3.5.2 Environmental Consequences

Impacts of Alternative 1

Rangeland health would improve only slightly when compared to the Proposed Action. The aesthetic quality of recreational opportunities, such as hiking, wildlife viewing, and hunting are not expected to be as beneficial as Alternative 2: Proposed Action. Opportunities to view wild horses in the Complex would continue, however, they would be mostly limited to the HMA boundaries. Gather activities may interrupt or interfere with viewing opportunities and make horses harder to find in the short term. Fertility control treatment would be expected to slow population growth; opportunities to view mares with foals during the next 2-3 years would be slightly reduced over the present situation. Viewing opportunities associated with the presence of wild horses would continue to increase.

The gather operation could occur during fall hunting seasons. If gathering occurs during hunting season, the hunting experience could be diminished within hearing distance of the helicopter, paths of horses being gathered, and a resultant increased awareness of game animals to activity. Affected hunters would likely relocate to areas of the hunt unit not affected by the gather activities. This relocation can reduce visitor satisfaction with the hunting opportunities and experience, and or increase hunter densities in areas not disturbed by the gathers. If elk or other

big game become displaced due to increasing wild horse populations, the quality of hunting opportunities and hunter success would likely be reduced.

Impacts of Alternative 2: Proposed Action

Impacts associated with capture and removal operations would be similar to Alternative 1. Fewer wild horses would be available for viewing following the gather because excess horses within and outside the Complex would be removed to the low AML. As a result, habitat conditions are likely to improve at a much faster rate than under Alternative 1, resulting in indirect benefits to wildlife (higher reproduction rates, greater hiding cover, less competition for forage/better body condition, etc.) and recreationists (more wildlife). In years 2-3 following the gather, viewing opportunities of mares with foals would be slightly reduced as a result of removing excess wild horses and applying fertility control to a small portion of the mares. Quality of hunting opportunities would be maintained.

Impacts of Alternative 3: No Action

Impacts from gather operations discussed under Alternative 1 and Alternative 2: Proposed Action would not occur. However, the impacts from high horse numbers would be similar to but greater than Alternative 1.

3.6 Livestock Grazing

3.6.1 Affected Environment

The rangelands in the HMAs provide seasonal grazing for cattle and sheep (See Table 5).

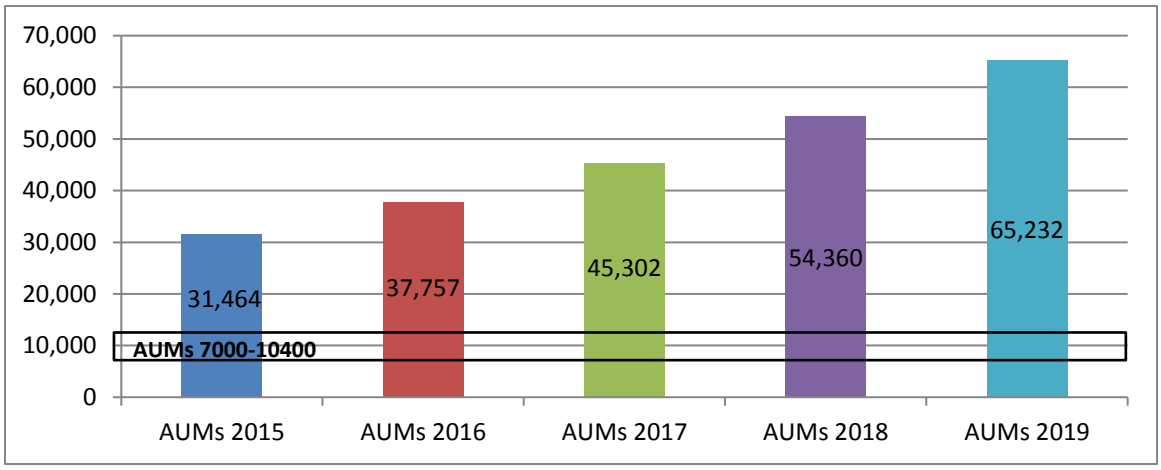
Table 5. Red Desert Complex Allotments

Allotment Name and Number	HMA	Number and Kind of Livestock	Authorized Use Period	BLM AUMs	Exchange Of Use AUMs	Number of Permits within the Allotment
Alkali Creek Sheep #17057	Crooks Mountain	2,686 S	04/01-04/30, 10/02-10/31	1,060	0	1
Antelope Hills #17055	Antelope Hills	1,581 C 2,868 S	05/20-09/20, 05/20-10/01	8,365	1,225	10
Arapahoe Creek #17056	Crooks Mountain, Green Mountain	2,756 C 2,422 S	05/01-10/01, 11/01-03/31	15,077	0	12
Mountain #32030	Green Mountain	371 C	05/01-11/16	1,976	305	2
Whiskey Peak Incommon #12003	Green Mountain	1010 C 2,528 S	06/01-12/31, 07/16-11/30	7,739	0	2

Allotment Name and Number	HMA	Number and Kind of Livestock	Authorized Use Period	BLM AUMs	Exchange Of Use AUMs	Number of Permits within the Allotment
Stewart Creek #10102	Stewart Creek	89 C 760 C 505 C 48 C	11/1-4/30 5/16-12/30 5/1-11/16 5/28-8/30	8,380	0	4
Cyclone Rim #10103	Lost Creek, Antelope Hills	600 C 2043 C 5930 S 3580 S 811 S 170 S	5/1-12/15 11/1-4/30 10/1-4/15 11/1-3/31 5/25-12/9 5/1-7/15	27,292	0	4

Available forage production within the Complex is allocated to livestock and wild horses. Forage use is authorized to livestock operators based on the Animal Unit Month (AUM) of vegetation production. An AUM is the amount of forage needed to maintain a 1,000 lb. cow and her calf for one month. Approximately 71,000 BLM AUMs of forage have been authorized yearly to the livestock operators (Table 5). Actual use of this allocation varies by year due to precipitation kind, amount and timing; vegetation production; economic and labor fluctuations; and operational needs of the ranch. In the following equation, an Animal Unit (AU) is an adjustment applied to an AUM depending on the animal being compared. The standard AU for wild horses is 1.2. This is based on the efficiency of digestion of feed the horse exhibits vs the standard of a 1,000 lb. cow. Approximately 10,500 AUMs would be used by wild horses at high AML (724 Horses x 1.2 Horses/AU x 12 Months). As wild horse numbers increase, forage used by wild horses naturally increases. Currently (2016), wild horses use approximately 27,000 AUMs more than they would at high AML (Figure 4).

Figure 4. Projected AUMs of forage required to maintain wild horses



The above Figure shows the AUMs required to maintain wild horse numbers (See Figure 3) beginning in 2015. AUMs required to maintain wild horses within the AML range is 7,000 to 10,400.

Two grazing allotments in the RFO occur within the Stewart Creek and Lost Creek HMAs (Map 2), Stewart Creek and Cyclone Rim. Stewart Creek grazing allotment boundary is similar to the HMA boundary, except, the allotment also includes a pasture of about 5,000 acres that contains the town of Bairoil and the Lost Soldier and Wertz oilfields. This grazing allotment is totally fenced to control livestock use, although portions of the west boundary are let-down during the winter to facilitate antelope movement. There are four livestock operations permitted to graze cattle; three with spring through fall use comprising 94 percent of authorized grazing use, and one small permit with winter use. The total authorized grazing use on public lands is 8,267 Animal Unit Months (AUMs), although actual use between 2003 and 2014 averaged 62 percent with a range of 2,314 to 7,573 AUMs. Since 2012, one new livestock operation has used the two largest grazing permits that comprise 92 percent of the authorized public land AUMs. This livestock operation initially reduced stocking rates voluntarily due to reduced forage availability as a result of the severe drought in 2012, the effects of which also carried over into 2013. In addition, several old water wells were re-equipped with solar pumping systems to improve the number and location of reliable water sources. With their private investment into ten new solar arrays and pumps, along with the eight provided by BLM and other partners, this livestock operation is working to improve livestock distribution of use and more fully utilize their grazing permits.

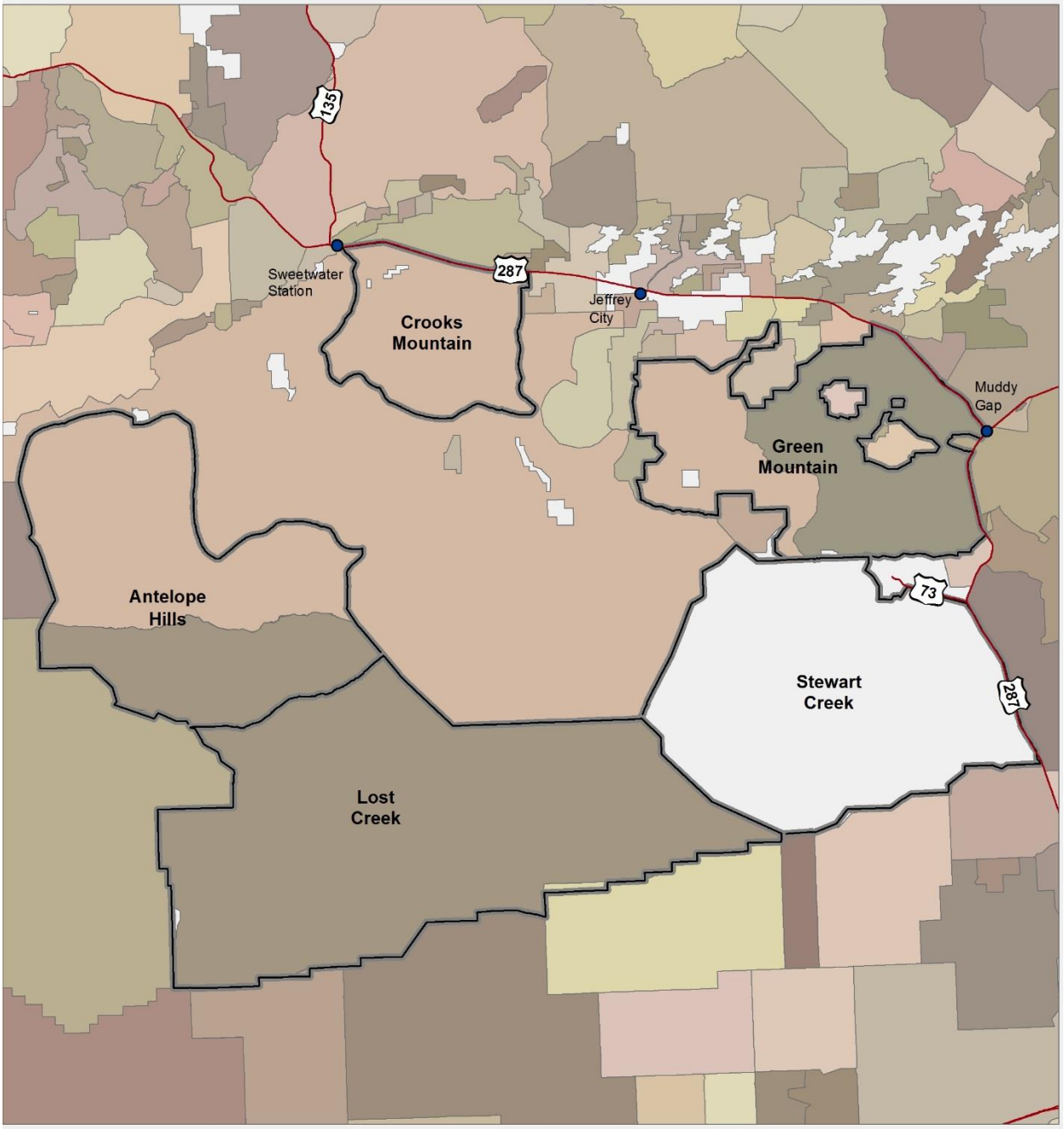
Cyclone Rim grazing allotment encompasses all of the Lost Creek HMA in the southern portion, and part of the Antelope Hills HMA along the northern border. This grazing allotment is not fenced along the northern border where it follows Cyclone Rim. There are six livestock operations permitted to graze cattle (57 percent of allotted AUMs) and sheep (43 percent), with over three-quarters of the grazing use permitted during the fall and winter. The total authorized grazing use on public lands is 27,292 AUMs, although actual use between 2003 and 2014 averaged 35 percent with a range from 7,334 to 11,309 AUMs. Grazing use has primarily been made by three livestock operations, one with summer cattle use, one with winter cattle and sheep use, and one with winter sheep use. All three of these livestock operations are fairly consistent in their year-to-year grazing use, and have increased voluntary nonuse during drought years. The lack of fencing along Cyclone Rim and winter let-down fencing along the northeast border results in reduced cattle use on the northern portion of the grazing allotment, due to the concern of lost cattle if they drift north and into other grazing allotments. There has been limited conversion to solar pumping systems on water wells, with generators still in use that are moved to different well locations to manage livestock distribution of use.

The Stewart Creek and Cyclone Rim grazing allotments were assessed for meeting the Standards for Rangeland Health (BLM 2003 and BLM 2013b), and initially failed Standard #2 for Riparian Health partly due to livestock grazing. As a result, an exclosure was constructed on lower Stewart Creek in Stewart Creek grazing allotment and a spring development/exclosure was constructed at Kinch-McKinney Spring in Cyclone Rim grazing allotment to protect and enhance these sites, which were meeting Standard #2 in the latest assessment. In addition, BLM has worked with grazing permittees in the Stewart Creek grazing allotment to protect riparian habitat on private and State of Wyoming lands by constructing exclosures and riparian pastures to further improve riparian area management. These projects result in removing access by livestock and wild horses to natural water sources, which now require pumping of water wells to provide adequate water during most of the summer and fall months. Water wells are used on the western

two-thirds of this allotment to rotate seasonal grazing use to improve perennial plant vigor and production. Within the Cyclone Rim allotment, one solar-equipped water well is operated by the BLM to provide an alternate water source, in addition to water wells being operated by the permittee. However, the low of amount of summer livestock grazing does not require as much water pumping when compared to the Stewart Creek allotment.

Five grazing allotments in the LFO occur within the Antelope Hills, Crooks Mountain, and Green Mountain HMAs. In 2011, the GMCA was divided into four smaller allotments (Antelope Hills, Arapahoe Creek, Alkali Creek Sheep, and Mountain). Permitted use in the GMCA averaged approximately 47,672 total AUMs from 1980-2010 with actual use averaging approximately 48% of total permitted use. The actual use from 1980 ranged from approximately 7,735 AUMs in 2002 up to 34,903 AUMs in 1994. In 2011, the LFO issued a final grazing decision that modified the existing grazing rotation, implemented new grazing infrastructure and vegetation standards, and reduced AUMs by approximately 45%. The resulting permitted use for the Antelope Hills, Arapahoe Creek, Alkali Creek Sheep, and Mountain allotments is approximately 26,476 total AUMs. Total authorized used since 2011 has averaged less than 70% ranging from 6,846 AUMs in 2013 to 13,153 AUMs in 2012. While 2014 and 2015 represented improvements in forage production, livestock permittees continued to take various levels of voluntary non-use. Like the RFO, this nonuse has been voluntarily taken by permittees due to drought and reduced vegetation production. Livestock grazing permittees in the Antelope Hills, Arapahoe Creek, and Alkali Creek Sheep allotments are required to meet stubble height and other vegetation monitoring standards. This portion of the Complex has more natural perennial water sources and water wells are not as relied upon for livestock watering.

Map 2. Allotments within the Red Desert HMA Complex



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Miles

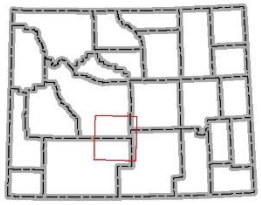
No warranty is made by the Bureau of Land Management (BLM) for use of the data for purposes not intended by BLM.

Allotments within the Red Desert Complex

Highways

Wild Horse HMA boundary

Allotments are shown below HMAs in varying colors



Date: 7/31/2015

The former GMCA was evaluated for rangeland health in 2002, including the Antelope Hills, Crooks Mountain, and Green Mountain HMAs. An update to the 2002 evaluation was conducted in 2010 and supplemental information regarding rangeland health was incorporated into the environmental analysis for permit renewal. The general findings of both the 2002 and 2010 evaluations indicate that upland range conditions are acceptable and meet the Wyoming Standards for Rangeland Health. Conversely, riparian conditions and the adjacent uplands within 300 feet, have been identified in degraded condition with a high degree of departure from what is expected for these sites and thus do not meet the Wyoming Standards for Rangeland Health. Recent observations continue to support the findings of the 2002 and 2010 evaluations. Failure to meet rangeland health standards has been attributed largely to livestock grazing, with areas of concentration associated with wild horses and wildlife. Specifically, the areas of Immigrant Springs and Sulfur Bar located in the Antelope Hills HMA, as well as Soap Holes and East Arapahoe Creek in the Crooks Mountain HMA have higher concentrations of wild horses that contribute to riparian use.

Quantitative monitoring data within the HMAs are limited and primarily focused on riparian condition based on the qualitative assessments conducted in 2002. Frequency data was collected between 2002 and 2008 at 17 separate riparian sites within the former GMCA, 8 of which were located in or adjacent to the Antelope Hills, Crooks Mountain and Green Mountain HMAs. These data indicate a higher percentage of bare ground than expected, with declining levels of vegetative cover, and a lack of age class diversity in woody species. Additionally, the persistence of upland species within the riparian systems indicates a drying of the riparian areas. Congruent stubble height data collected in these same locations indicated continued overgrazing resulting in inadequate residual cover to maintain soil stability and foster riparian recovery. However, following changes in grazing management (2011-Present), the more recent stubble height data indicates that stubble height objectives of 4-6 inches are generally met within riparian key areas. The exception to this is in the vicinity of Immigrant Spring, Sulfur Bar, and Soap Holes where objectives have not been met on average over the past 3 out of 5 years. If stubble height requirements are reached or exceeded, permittees are required to remove livestock from either the selected regions or eventually from the allotment. While it is difficult to draw conclusions from or separate wild horse and livestock utilization in these systems, the continued inability to meet stubble height objectives can reasonably be attributed to both livestock and wild horse use.

Fencing is primarily used to manage livestock within designated pastures or grazing allotments. Fencing can help reduce impacts to soil and plants by providing rest or deferment from livestock use. Because of the number of HMAs within the Red Desert Complex, there is a limited amount of fencing within the gather area when compared to adjacent areas of both field offices.

3.6.2 Environmental Consequences

Impacts of Alternative 1

The proposed gather could directly interfere with livestock operations within or adjacent to the HMAs. Gather operations may temporarily cause some disturbance to livestock, especially when the livestock are also being gathered and moved. Livestock operators would be notified prior to

the gather, enabling them to take precautions and avoid conflict with gather operations. If gather operations are conducted after the authorized grazing period, the interference to livestock operations could be eliminated, but most operators have livestock use permitted during the summer and fall.

Over the short term (1-3 years), the quantity of forage for livestock use would be fully available outside the Complex where wild horses would be removed. In addition, there would be decreased competition for water resources and reduced fence damage and associated maintenance costs incurred by permittees. Over the mid to long-term, these benefits to livestock grazing would decrease as the potential for wild horses to move outside of the HMAs increases. However, during drought years, the potential for wild horse movement outside of the HMA boundaries may be even greater, resulting in increased competition with livestock for forage and water. In Stewart Creek allotment, under drought conditions (which average one out of five years—see Section 3.4.1), combined with wild horse numbers over four times AML, livestock operators may reduce or eliminate cattle. In pastures where livestock use was not being made, water wells that are maintained by the permittee would not be turned on which would limit water availability, further encouraging horses to leave this HMA and affect other livestock operations outside the HMA.

Within HMAs, wild horses would be gathered, mares would be fertility treated, and the horses would be placed back into their respective HMAs. Since the horse numbers would still exceed the AML, there would be continued competition with livestock for forage and water. As wild horse populations increase, livestock operators may have to decrease or remove livestock, with these impacts likely greater to those operations with fall or winter permitted seasons of use. Livestock operators may have to further decrease livestock use or eliminate livestock use all together in some areas within HMAs in drought years. Livestock operators may be asked to turn on and maintain all water wells to provide adequate water for livestock and wild horses, instead of leaving some water wells off to rotate distribution of grazing use (for further discussion, see Section 3.4.1). This would increase the time spent on management of livestock and facilities. Displacement of livestock would continue around water sources. However, as time progresses, livestock and wild horse conflicts would increase as the horse population increases due to direct competition for forage, space, and water. All operators are required to meet rangeland health requirements, and some livestock operators are required to meet additional requirements in order to continue using their permits. Where minimum stubble height requirements are already met by wild horse use, livestock operators may not be able to turn out their livestock, causing a direct impact to their operations.

An estimated 27,000 AUMs are used by wild horses beyond what would be used at AML. By fall of 2017, this number of AUMs would equal the current actual use being made by livestock grazing within the Complex, and when added together would equal the entire AUM level permitted to livestock operators. In drought years there would not be adequate forage to meet this demand and livestock use would be reduced. Over the mid to long-term (3+ years), wild horse numbers would increase because of the fertility control treatments would no longer be effective. As a result, there would be greater competition with permitted livestock for forage and water, and the potential that livestock use would be reduced or eliminated would increase, particularly during drought years.

As wild horse populations increase, the potential for movement outside of the Complex would also increase, as available forage, water, and space would become more limiting within HMAs. As the wild horses expand their range, additional livestock operators would be impacted, including those with large amounts of private land. Landowners would request lawful removal of wild horses from private land as wild horses return to areas outside HMAs. Range conditions within HMAs would deteriorate, which may further restrict livestock use, and even after wild horses are gathered in the future, long-term vegetation recovery may require continued reduced use to non-use by livestock operators. A TNEB would not exist within the HMAs and ability to achieve rangeland health standards would become increasingly difficult. In addition, rangeland health would be slow to recover once degraded, since some portions of the Complex receive only five to seven inches of precipitation annually, which could further extend the time period of reduced flexibility and capability for livestock operations to use their permitted AUMs.
A complete analysis of livestock grazing and grazing impacts within a portion of the Red Desert Complex can be found in the Green Mountain Common Grazing Allotment EA located at:

http://bit.ly/Green_Mtn_EA.

Grazing is also addressed in the Record of Decision and Approved Rawlins Resource Management Plan (BLM 2008b, p. 18-19; BLM 2008a, p. 4-69 to 4-82), Great Divide Basin/Ferris Mountain and Seminoe Mountain Watersheds Standards and Guidelines Assessment (BLM 2013b), and the Lander RMP (FEIS) (BLM 2013d p. 479-487).

Impacts of Alternative 2: Proposed Action

Impacts associated with capture and removal operations would be similar to Alternative 1. Short-term impacts associated with wild horse removals from outside HMAs would also be similar to Alternative 1. Benefits to livestock operations outside of HMAs would occur in the mid and long-term, in terms of reduced competition between livestock and wild horses for forage and water, reduced fence maintenance, and increased availability of forage for livestock, when compared to Alternatives 1 and 3. Conflicts between livestock and wild horses would also not occur when wild horses are not present in grazing allotments outside of HMAs, and since the potential for their movement would be reduced since populations would be at AML.

Within HMAs, livestock/wild horse conflicts would be fewer when compared to Alternatives 1 and 3 because there would be fewer wild horses. Competition for forage and water would be reduced, and some water wells could be left off at varying times to rotate distribution of grazing use to improve plant vigor and rangeland condition. Reduced populations of wild horses in conjunction with livestock management would promote maintenance and/or recovery of most areas supporting riparian habitat. Flexibility in livestock management would be enhanced, since the numbers of livestock, season of use, and level of permitted AUMs used would be based on climate and management needs, and not on the population of wild horses. Levels of actual AUM use by livestock would vary between 40 and 80 percent of permitted AUMs due to climate and/or management needed to achieve Standards for Healthy Rangelands. Requests by livestock permittees and/or private landowners to remove wild horses from private lands would be decreased, and the potential that these lands would be fenced and no longer accessible by wild

horses would be lessened. With wild horse numbers reduced to the lower end of AML and birth control measures implemented, future wild horse gathers would be more infrequent, further reducing disturbance to livestock and management operations.

Impacts of Alternative 3: No Action

A wild horse gather would not take place and population control methods would not be implemented. This would allow wild horse populations to continue to increase and likely continue expanding outside of established HMAs. Forage use demand would increase exponentially as horse populations continue to expand. An estimated 27,000 AUMs are needed by wild horses beyond what would be used at high AML. The additional forage demand would increase to an estimated 35,000 AUMs in 2017, which is equal to the current actual use of AUMs by livestock. With annual increases in wild horse populations, the total forage needs for the projected 2019 wild horse population, over 65,000 AUMS, would approach that which has been authorized for livestock, 71,000 AUMs, within the Complex (Figure 4).

Livestock operators may have to further decrease livestock use or eliminate livestock use all together in some areas to compensate for the increased forage use by wild horses. In some areas, particularly adjacent to water sources, livestock and wild horse conflicts would increase as the wild horse population increases due to direct competition for forage, space, and water. Fence maintenance costs would increase as livestock permittees attempt to restrict wild horse movement outside of the Complex. However, conflicts within the Complex would be reduced as permitted livestock grazing becomes more restricted or eliminated. All operators are required to meet rangeland health requirements, and some livestock operators are required to meet additional requirements in order to continue using their permits. Where minimum stubble height requirements are already met by wild horse use, livestock operators may not be able to turn out their livestock, causing a direct impact to their operations.

Wild horse use would not be limited to HMAs. As the wild horses expand their range, additional livestock operators would be impacted, including those with large amounts of private land. Requests for lawful removal of wild horses from private land would likely increase as horse ranges expand in search of forage, water and space. Range conditions within HMAs would deteriorate more quickly than Alternative 1, which may result in lower amounts of or elimination of livestock grazing, particularly during drought. Degraded range conditions may further restrict flexibility of livestock use, and even after wild horses are gathered in the future; long-term vegetation recovery may require continued reduced use to non-use by livestock operators. A TNEB would not exist within the Complex and ability to achieve rangeland health standards would become increasingly difficult. In addition, rangeland health would be slow to recover once degraded, since some portions of the Complex receive only five to seven inches of precipitation annually, which could further extend the time period of reduced flexibility and capability for livestock operations to use their permitted AUMs.

3.7 Cultural Resources

3.7.1 Affected Environment

Prehistoric sites known to exist within the HMAs include open camps and lithic scatters. Historic sites include trash dumps, trails, roads, and structures associated with early settlement and commerce, or with the local ranching industry. Additionally, stone circle sites, rock alignments, rock art and other sites potentially sensitive to Native American Tribes may occur. Cultural Resource program support for the wild horse capture would consist of file search (Class I) and/or intensive field (Class III) inventories, and, if necessary, mitigation of impacts or relocation of the proposed temporary horse holding sites. Support includes consultation with the Wyoming State Historic Preservation Office according to the Wyoming State Protocol agreement of the BLM National Cultural Resources Programmatic Agreement, which states inventory may not be required for "Animal traps and corrals in use for three days or less" (SHPO Protocol Appendix B-21).

3.7.2 Environmental Consequences

Impacts of Alternative 1 and Alternative 2: Proposed Action

Prior to construction, all gather sites and temporary holding facilities would be surveyed for historic properties by the RFO and LFO archeologists, and a determination made if a Class III inventory is necessary. If cultural resources are encountered at proposed gather sites or temporary holding facilities, those locations would not be utilized unless they could be modified to avoid or mitigate adverse impacts to significant cultural resource site(s). Direct or indirect impacts to cultural resources are not anticipated to occur from implementation of Alternative 1 or 2: Proposed Action.

Within the Complex, impacts to historic properties from trampling during the gather operations would not exceed what occurs from natural horse movements. Fewer horses would result in reduced potential disturbance to historic properties from trampling or rubbing.

Impacts of Alternative 3: No Action

At the present time and for the short-term, taking no action to remove excess wild horses would not be expected to adversely affect historic properties. However, a substantial increase in the number of wild horses over time may adversely affect historic properties from trampling, rubbing or otherwise changing the character of a site.

4.0 CUMULATIVE IMPACTS

NEPA regulations define cumulative impacts as impacts on the environment that result from the incremental impact of the Proposed Action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such actions (40 CFR 1508.7). Reasonably foreseeable future actions are those for which there are existing decisions, funding, formal proposals, or which are highly probable, based on known opportunities or trends. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Past, Present, and Reasonably Foreseeable Actions

All resource values described for the Affected Environment have been evaluated for cumulative impacts. If there are no direct or indirect impacts to said resources, there are likewise no expected cumulative impacts. The Past, Present, and Reasonably Foreseeable Future Actions applicable to the assessment area are identified in Table 6. Assessment areas are determined by what is practical and reasonable for each resource. These activities can reduce the quantity and quality of vegetation, as well as quality and quantity of water, and result in human presence.

Table 6. Past, Present, and Reasonably Foreseeable Future Actions

Project – Name or Description	Status (x)		
	Past	Present	Future
Livestock grazing	x	x	x
Wild horse gathers	x	x	x
Mineral exploration/Oil and gas exploration/Abandoned mine land reclamation	x	x	x
Recreation	x	x	x
Water and spring development	x	x	x
Fence construction (including protective fencing)	x	x	x
Invasive weed inventory/treatments	x	x	x
Wildlife/Big game studies		x	x
Wild horse issues, AML adjustments and planning	x	x	x

The BLM is likely to conduct substantially similar gather, treatment and removal of wild horses within these HMAs during the period of 2017 to 2019 to maintain or achieve wild horse populations within AML, maintain fertility control treatments, and prevent deterioration of range health. Beginning in the fall of 2016, the grazing permittees will start constructing the Granite Creek Rocks Fence in the Antelope Hills Allotment to improve riparian habitat. This fence would bi-sect the northern portion of the Antelope Hills HMA. This fence was carefully designed to mitigate impacts to wild horses migrating through the HMA, while protecting wetland habitat from livestock grazing use (portions of the fence will be removable--removed when livestock are not present).

Other foreseeable activities currently being proposed within the gather area include the following[9]:

- Continental Divide-Creston Natural Gas Project. This is a proposed infill drilling of natural gas wells in the western portion of the Complex. This area has already experienced development for oil and gas and involves drilling additional wells and constructing associated infrastructure.
- Riley Ridge to Natrona Project. This is a proposed pipeline project that stretches from near Big Piney, Wyoming, to almost Casper, Wyoming. This project would traverse the West and Northern portions of the Complex.
- Sheep Mountain Uranium Project. This is an operational uranium mine that is in the northern portion of the Complex.
- Lost Creek Uranium In Situ Recovery Project Modifications EIS. This is a proposed expansion of the operational in situ uranium mine in the central portion of the Complex.

Effect of Past, Present, and Reasonably Foreseeable Future Actions
The resources evaluated in this section for cumulative effects include: Wild Horses, Wildlife, Livestock Grazing, Vegetation, Soils, Watershed, and Recreation.

4.1 Wild Horses

Numerous gathers of wild horses have occurred throughout the Red Desert Complex and gather area in the past. The most recent gather was in November of 2011; these gathers were necessary to bring the population in line with population management goals. Repeated horse gathers or gathers conducted too frequently can affect wild horse behavior making them harder to capture and places added stress on those captured and processed. Fertility control has been implemented in the past.

All of the above projects and activities would have impacts on wild horses from increased surface disturbance which results in vegetation removal, increased human presence, increased risk of horse/vehicle collisions, and could displace wild horses during construction and operation.

The gathers represent the largest and most direct impacts to horses and the highest proportion of the population. These stresses affect far more horses when numbers are allowed to significantly exceed the AML range. As a result of leaving the population above AML, future gathers would be unavoidable and the horses would be subject to additional gathers in order to achieve AML and conformance with existing law, regulation, and policy. Alternative 1, when combined with these past, present, and reasonably foreseeable future actions, and the identified mitigation measures for projects, the potential for adverse cumulative impacts to wild horses would be higher than for Alternative 2. Alternative 1 would have a larger cumulative impact on horses within the HMA because it authorizes a gather for PZP treatment while Alternative 3 would not authorize any gathers thereby avoiding gather related impacts.

[9] For more information on these projects, see the BLM NEPA Hotsheet (BLM 2016).

Implementation of Alternative 2: Proposed Action, would benefit wild horses because there would be improved quality and quantity of resources (forage, water, and space). The application of fertility control and removals of horses to the lower limit of the AML would slow population growth over the next 2-3 year period, thereby further reducing the need to remove large numbers of horses. The gathers represent the largest and most direct stresses to horses and the highest proportion of the population. These stresses affect far more horses when numbers are allowed to significantly exceed the AML range. No other projects or predators remove large numbers of horses from the population. As a result of the removal of horses, there would be fewer horses potentially affected by vegetation removal and increased human activity during construction and operation of projects. These impacts, when combined with past, present, and reasonably foreseeable future actions, and the identified mitigation measures for projects, would further reduce the potential for adverse cumulative impacts to wild horses compared to Alternatives 1 and 3.

Implementation of Alternative 3: At the current rate of annual population growth, the projected wild horse population could exceed 4,000 animals within 4 years. Left unchecked, irreparable damage to the habitat could result in the need to remove all wild horses from the Red Desert Complex. Genetic variability would be the highest in the short term, but this alternative could lead to a catastrophic loss of diversity if resources cause a future population crash. When combined with past, present, and reasonably foreseeable future actions, and the identified mitigation measures for projects, the potential for adverse cumulative impacts to wild horses would be higher than for the other alternatives.

4.2 Wildlife, Threatened and Endangered Species, Special Status Species, and Migratory Birds

Historic use by livestock and wild horse grazing, recreation, mineral exploration, and mining have likely impacted wildlife, special status species, and migratory bird habitat within the gather area, especially near water locations. These activities have resulted in the loss and alteration of habitat and disruption of movement patterns. The current overpopulation of wild horses is also increasing the competition for available forage, water and thermal protection. Cumulative impacts associated with range management, such as construction of water projects and invasive weed treatments to enhance rangeland condition, are beneficial for wildlife and wildlife habitat.

The cumulative impacts associated with implementation of Alternative 2: Proposed Action would lead to overall improvement of rangeland resources and wildlife habitat. If Alternative 1 were selected it would only lead to improvement of rangeland resources and wildlife habitat outside of the HMA boundaries where horses were removed. Under Alternative 2, the improvements would be seen on a larger scale and last longer as fewer horses would inhabit the Complex. Under Alternative 1, vegetation outside of the HMA boundaries would improve until horses re-inhabit them in search of food and water as a result of competition from horse populations being above AML within the HMAs. Under Alternative 2: Proposed Action, wild horse populations would be managed within the AML range over the next 3-4 year period. As a result, fewer wild horses would be present and the quality and quantity of these resources would be expected to improve or at least be maintained. When combined with past, present, and reasonably foreseeable future actions, and the identified mitigation measures, the potential for

adverse cumulative impacts to wildlife habitat from implementation of Alternative 2 would be negligible.

No long-term cumulative benefits to any rangeland user would be expected with implementation of the No Action Alternative. The No Action Alternative would be expected to result in rangeland deterioration, and lead to long-term reduction of range and riparian health. Once range and riparian health is reduced past a certain point, any management actions are unlikely to significantly improve habitat for wildlife, sensitive species, or other values without considerable monetary and time input.

4.3 Livestock Grazing, Vegetation, Soils and Watershed

The vegetation within the Red Desert Complex has been utilized since the area was first settled. Domestic livestock have grazed all portions of the gather area in the past and are expected to continue in the future. Water is a limiting resource in some areas. As a result, existing water sources tend to be heavily utilized by livestock, wildlife, and wild horses which results in soil compaction, soil exposure and erosion, streambank alteration, and competition for clean water.

Implementation of Alternative 1 or 2 would contribute to isolated areas of vegetation disturbance as a result of the gather activities. Under Alternative 1 and Alternative 3, AML would still be exceeded. High horse numbers, when combined with other foreseeable future actions such as recreation, mineral exploration and reclamation, livestock grazing, and invasive weed treatment, would result in greater risk to the resources. Forage use/loss by horses and livestock is greater than the loss from other ongoing and proposed projects. Also the riparian degradation associated with this level of use would exceed the significance criteria identified, as the areas would not be maintaining a proper functioning condition riparian rating. Under the Proposed Action, however, the achievement of AML in conjunction with proper livestock grazing management and other foreseeable future actions such as recreation, mineral exploration and reclamation, and invasive weed treatment, would contribute to improved vegetative resources and achieve a TNEB.

Under Alternative 1 and 2, where horses are removed, excessive use by wild horses would not occur at water sources, and utilization and competition between animals would be reduced. Key forage and browse species would improve in health, abundance and robustness, and would be more likely to set seed and reproduce, which in turn would contribute to improvements in rangeland health.

Implementation of the No Action Alternative would result in continued expansion in extent and severity of degradation of vegetation in upland and riparian areas by wild horses due to increasing population. In the long term, this would result in more palatable native vegetation being replaced by more opportunistic native and/or non-native species. These species tend to both expand in disturbed soil and be less palatable. Past degradation would not be offset and downward trends would continue to occur. When combined with past, present, and reasonably foreseeable future actions the potential for cumulative impacts to livestock grazing, vegetation, and soils is expected to be higher than Alternative 1 and 2 due to continually increasing wild horse populations.

4.4 Recreation

Implementation of any of the alternatives would allow for continued viewing of wild horses.

Under Alternative 1, the aesthetic values provided in association with a variety of recreational opportunities would be dependent on where the activity is sought. Viewing of wild horses outside of the HMA boundaries would be difficult as most of these horses would be removed. While inside the HMA boundaries, encounters with wild horses would still be available as they currently exist. Other recreational opportunities, other than wild horse viewing, would be better outside the HMA boundaries as competition decreases and forage resources improve.

Implementation of Alternative 2 would result in horses being harder to find as a result of a lower population. Other various recreational opportunities would benefit from fewer horse encounters by maintaining horses within AML.

Implementation of the No Action Alternative would allow for recreational opportunities as they currently exist. Viewing opportunities of wild horses would be greater; however, heavy utilization of vegetation would occur, impacting the aesthetic values associated with various recreational opportunities. As animal health declines or animals leave the HMAs in search of food and water, some recreational opportunities would be less enjoyable. Increased horse numbers can interfere with recreation activities also, which would occur more frequently under this alternative. When combined with past, present, and reasonably foreseeable future actions the potential for cumulative impacts to recreation is expected to be higher under Alternative 1 and 3 due to less aesthetic values, and increased encounters with horses during recreation activities.

5.0 MITIGATION MEASURES AND SUGGESTED MONITORING

The BLM Contracting Officer Representative and Project Inspectors assigned to the gather would be responsible for ensuring contract personnel abide by contract specifications and standard operating procedures and policies (SOPs). Ongoing rangeland, riparian, and wild horse monitoring would continue, including periodic aerial population surveys.

The Red Desert Complex horses and rangeland health would continue to be monitored post-gather. Data would be collected which would assist the BLM in determining whether existing AMLs are appropriate or need future adjustment (either increase or decrease). Data collected would include observations of animal health and condition, climate (precipitation), utilization, distribution, population survey, range condition and trend, riparian health, among other items.

Project design features and monitoring are incorporated into the proposed action through SOPs, which have been developed over time. These SOPs (Appendices 1 and 4), along with BLM IMs 2010-135 (BLM 2010a), 2015-070 (BLM 2015a), 2015-151 (BLM 2015b) represent the "best methods" for reducing stress and injury associated with gathering, handling, transporting, collecting herd data and applying fertility control.

Based on the analysis of impacts above and consideration of all design features, wild horse gather best management practices, and standard operating procedures presented as part of the proposed action and alternatives, no mitigation measures are proposed or required.

6.0 RESIDUAL IMPACTS

There would be residual impacts associated with the implementation of Alternatives 1 and 3 and would result from the horse population levels being above a thriving natural ecological balance. Forage and water resources would continue to receive high use, and rangeland health would continually degrade as horse populations continued to increase and expand the rangeland they use. This level of use would increase slower under Alternative 1, but would still occur at natural rates as soon as the effectiveness of PZP faded 2-3 years after treatment. Under Alternative 3, the rate of population increase would continue at the present rate, therefore the deterioration of riparian areas and vegetation would continue as present rates. These effects would continue to be observed until horse populations were reduced to the AML as established under the approved Rawlins and Lander RMPs. Also the riparian degradation associated with this level of use would exceed the significance criteria identified, and thus be out of conformance with, the RMPs, as the riparian habitat would not be maintaining a proper functioning condition riparian rating.

Alternative 1 and Alternative 2 would have other residual impacts as well. Horses that were gathered may be more wary of human interactions as a result of the gather process. Some horses may be more likely to run from humans, vehicles, and aircraft. Horses that were gathered and released may become more difficult to gather in the future. Individual horses react differently to these experiences, some horses become intolerant of human presence and interaction, while others do not show any reaction to gather activities and others become less fearful. Most individual horses recover from these activities quickly and resume normal horse behavior within 24 hours of being released. Just as individual horses react differently to being gathered, so do bands, herds, and populations. Because wild horse gathers are relatively infrequent, it is not expected that these residual impacts will be significant.

7.0 TRIBES, INDIVIDUALS, ORGANIZATIONS, OR AGENCIES CONSULTED

Tribes, individuals, organizations, and agencies were included in the scoping process (Appendix 7). The letter soliciting scoping comments for the proposed gather in the Red Desert Complex was mailed February 20, 2015. In addition, public hearings are held annually on a state-wide basis regarding the use of motorized vehicles, including helicopters and fixed-wing aircraft, in the management of wild horses. 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 High Desert District Office hosted the state-wide meeting on May 5, 2015; the current gather operation SOPs were reviewed in response to the concerns expressed and no changes to the SOPs were identified.

List of Preparers

BLM Rawlins Field Office
Benjamin Smith, Wild Horse & Burro Specialist, Team Lead
Tim Novotny, Assistant Field Manager – Resources
Mike Calton, Rangeland Management Specialist
Andy Warren, Supervisory Rangeland Management Specialist
Mary Read, Wildlife Biologist
Heath Cline, Supervisory Wildlife Biologist
Natasha Keierleber, Archeologist
David Hullum, Outdoor Recreation Planner
Susan Foley, Soil Scientist/Weed Coordinator
Jennifer Fleuret, Program Manager
Kelly Owens, Hydrologist
Susan Foley, Planning and Environmental Coordinator

BLM Lander Field Office
Trent Staheli, Rangeland Management Specialist/Wild Horse & Burro Specialist (Acting),
Clay Stott, Wild Horse & Burro Specialist
Scott Fluer, Wild Horse & Burro Specialist
Rubel Vigil, Jr, Assistant Field Manager – Resources
Tim Vosburgh, Wildlife Biologist/T&E Plants
Melissa Rutledge, Rangeland Management Specialist
Curtis Bryan, Supervisory Rangeland Management Specialist
Krystal Hazen, Archeologist
Jared Oakleaf, Outdoor Recreation Planner
Jeremie Artery, Natural Resource Specialist

Washington Office
Dr. Paul Griffin, Wild Horse and Burro Specialist, Research Coordinator

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APPENDIX 1 Standard Operating Procedures for Wild Horse Gathers

Gathers are conducted by utilizing contractors from the Wild Horse Gathers-Western States Contract or BLM personnel. The following standard operating procedures (SOPs) for gathering and handling wild horses apply whether a contractor or BLM personnel conduct a gather. For helicopter gathers conducted by BLM personnel, gather operations would be conducted in conformance with the *Wild Horse Aviation Management Handbook* (BLM 2009b), IM 2015-151, and IM 2015-070.

Prior to any gathering operation, the BLM would provide for a pre-gather evaluation of existing conditions in the gather area(s). The evaluation would include animal conditions, prevailing temperatures, drought conditions, soil conditions, road conditions, and a topographic map with WSA boundaries, the location of fences, other physical barriers, and acceptable gather locations in relation to animal distribution. The evaluation would determine whether the proposed activities would 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 would be apprised of all conditions and would be given instructions regarding the gather and handling of animals to ensure their health and welfare is protected.

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

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

1. Helicopter Drive Gathering. This gather method involves utilizing a helicopter to herd wild horses into a temporary gather site.

2. Helicopter Assisted Roping. This gather method involves utilizing a helicopter to herd wild horses to ropers.

3. Bait Trapping. This gather method involves utilizing bait (e.g., water or feed) to lure wild horses into a temporary gather site.

The following procedures and stipulations would be followed to ensure the welfare, safety and humane treatment of wild horses in accordance with the provisions of 43 CFR 4700 and IM 2015-151.

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:

1. All gather sites 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 gather locations as determined

by the COR/PI. All gather sites and holding facilities not located on public land must have prior written approval of the landowner.

2. The rate of movement and distance the animals travel shall not exceed limitations set by the COR who would 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 would account for the different factors listed above and concerns with each HMA.

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

    a. Gather sites 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 high for burros, and the bottom rail of which shall not be more than 12 inches from ground level. All gather sites and holding facilities shall be oval or round in design.

    b. All loading chute sides shall be a minimum of 6 feet high and shall be fully covered with plywood or metal without holes.

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

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

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

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

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

6. Alternate pens, within the holding facility shall be furnished by the Contractor to separate mares or jennies with small foals, sick and injured animals, strays, 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 would 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 would 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 gather site, 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 would be at the discretion of the COR.

7. The Contractor shall provide animals held in the gather sites 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 gather site 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 would supply certified weed free hay if required by State, County, and Federal regulation.

8. 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.

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

10. The Contractor shall restrain sick or injured animals if treatment is necessary. The COR/PI would 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.

11. 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 gather sites 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 gather site. This determination would be at the discretion of the COR or Field Office Wild Horse & Burro Specialist.

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

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

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

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

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

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

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

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

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

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

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

    c. The rate of movement and distance the animals travel shall not exceed limitations

set by the COR/PI who would consider terrain, physical barriers, weather, condition of the animals and other factors.

C. Use of Motorized Equipment

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

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

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

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

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

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

    - 11 square feet per adult horse (1.4 linear foot in an 8 foot wide trailer);

- 8 square feet per adult burro (1.0 linear foot in an 8 foot wide trailer);
- 6 square feet per horse foal (0.75 linear feet in an 8-foot-wide trailer);
- 4 square feet per burro foal (0.5 linear feet in an 8-foot-wide trailer).

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

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

D. Safety and Communications

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

2. 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 would 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.

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

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

5. Should the contractor choose to utilize a helicopter the following would apply:

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

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

E. Site Clearances

1. 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.

2. Prior to setting up a gather site or temporary holding facility, the BLM would 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 gather site or temporary holding facility may be set up. Said clearance shall be arranged for by the COR, PI, or other BLM employees.

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

4. No surface disturbing activities or surface occupancy within a 0.6-mile radius of the perimeter of occupied or undetermined Greater Sage-Grouse leks inside PHMA.

5. No surface disturbing activities within 0.25-mile radius of the perimeter of occupied or undetermined Greater Sage-Grouse leks inside GHMA.

6. No surface disturbing and/or disruptive activities or surface occupancy would occur within Greater Sage-Grouse nesting habitat from March 15 through June 30 in the LFO.

7. No surface disturbing and/or disruptive activities would occur within Greater Sage-Grouse PHMA nesting habitat, or within 2 miles of the lek or lek perimeter outside PHMA from March 15 through July 14 in the RFO (BLM 2015c, p. 36).

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 would be made available to the extent possible; however, the primary considerations would 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 would not be allowed to come into direct contact with wild horses 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 any time or for any reason during BLM operations.

H. Responsibility and Lines of Communication

- Rawlins Field Office – Contracting Officer's Representative/Project Inspector: Benjamin Smith
  Alternate – Contracting Officer's Representative/Project Inspector: Scott Fluer
- Wyoming State Office – Contracting Officer's Representative/Project Inspector: N/A

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 Rawlins and Rock Springs Assistant Field Managers for Renewable Resources and the Rawlins and Rock Springs Field Managers will take an active role to ensure the appropriate lines of communication are established between the field, Field Office, District Office, State Office, National Program Office, and BLM Holding Facility offices. All employees involved in the gathering operations would keep the best interests of the animals at the forefront at all times.

All publicity, formal public contact and inquiries would be handled through the Assistant Field Manager for Renewable Resources and District Public Affairs Officer. These individuals would be the primary contact and would coordinate with the COR/PI on any inquiries.

The COR would 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 would be vigorously enforced.

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

APPENDIX 2 Historical Gather Environmental Analyses and Tables

1. Lander Resource Area Wild Horse Herd Management Plan, Lander Herd Management Area Evaluation / Capture Plan and the associated Environmental Analyses WY-036-EA3-010 and WY-036-EA3-013, 1993.

2. The Great Divide Resource Area Wild Horse Herd Management Area Evaluation / Capture Plan and the associated Environmental Analyses WY-037-EA4-122 and WY037-EA4-121, 1994.

3. Wild Horse Gathering Inside and Outside of the Muskrat Basin, Rock Creek Mountain, Dishpan Butte and Conant Creek Wild Horse Herd Management Areas, EA No. WY-050-EA1-039, 2001.

4. Wild Horse Gathering Inside of the Green Mountain Wild Horse Herd Management Area EA No. WY-050-EA2-031, 2002

5. Wild Horse Gathering Inside and Outside of the Crooks Mountain Wild Horse Herd Management Area, EA No. WY-050-EA2-032, 2002.

6. Antelope Hills/Cyclone Rim Horse Management Area Capture/Removal and Fertility Control Lander Field Office, EA No. WY-050-EA4-060, 2004.

7. North Lander HMA Complex (Conant Creek, Rock Creek Mountain, Dishpan Butte and Muskrat Basin) Capture/Removal and Fertility Control Lander Field Office EA No. WY-050-EA4-061, 2004.

8. Green Mountain Horse Management Area Capture/Removal and Fertility Control Lander Field Office, EA No. WY-050-EA5-133, 2005.

9. Crooks Mountain Horse Management Area Capture/Removal and Fertility Control Lander Field Office, EA No. WY-050-EA06-129, 2006.

10. Removing Excess Wild Horses From the Adobe Town and Salt Wells Creek HMAs of the Rawlins and Rock Springs Field Offices EA No. WY030-05-EA-158, 2006.

11. Removing Excess and Stray Wild Horses From the Area North of Interstate 80 and West of US HWY 287 in the Rawlins Field Office, EA No. WY030-06-EA-165, 2006.

12. Adobe Town – Salt Wells Creek Herd Management Complex – Management Action and Environmental Assessment EA No. WY040-07-EA-37, 2007.

13. Wild Horse Gathering for the North Lander Complex Wild Horse Herd Management Areas (Conant Creek, Dishpan Butte, Rock Creek Mountain and Muskrat Basin)

Capture/Removal and Fertility Control, Lander Field Office, EA No. EA WY-050-EA08-95, 2008.

14. Wild Horse Gathering for the Red Desert Complex Wild Horse Herd Management Areas (Lost Creek, Stewart Creek, Green Mountain, Crooks Mountain, Antelope Hills), EA No. WY-030-2009-0258-EA, 2009.

15. Adobe Town – Salt Wells Creek Herd Management Area Complex Wild Horse Gather, EA No. WY-040-EA10-109, 2010.

16. Wild Horse Gathering for the North Lander Complex (Conant Creek, Dishpan Butte, Rock Creek Mountain and Muskrat Basin HMAs), EA No. WY-050-EA12-33, 2012.

Historic Gather Numbers: Lost Creek and Stewart Creek HMAs

Year	**HMA Name**	**Number Gathered**	**Number Removed**
1986	Lost Creek, Stewart Creek & Antelope Hills/Cyclone Rim (Previously Seven Lakes HMA)	88	88
1987	Lost Creek, Stewart Creek & Antelope Hills/Cyclone Rim (Previously Seven Lakes HMA)	184	184
1988	Lost Creek, Stewart Creek & Antelope Hills/Cyclone Rim (Previously Seven Lakes HMA)	63	63
1989	Lost Creek, Stewart Creek & Antelope Hills/Cyclone Rim (Previously Seven Lakes HMA)	154	154
1995	Lost Creek & Stewart Creek (Gathered and documented as one)	121	121
1997	Lost Creek & Stewart Creek (Gathered and documented as one)	190	143
1998	Lost Creek & Stewart Creek (Gathered and documented as one)	81	50
2001	Lost Creek HMA	302	302
2001	Stewart Creek HMA	105	105
2002	Lost Creek HMA	21	21
2002	Stewart Creek HMA	283	283
2003	Stewart Creek HMA	94	94
2006	Lost Creek HMA	285	231
2006	Stewart Creek HMA	267	212
2009	Stewart Creek HMA	305	212
2009	Lost Creek HMA	287	224
2011	Lost Creek HMA	114	73
2011	Stewart Creek HMA	205	106
	TOTALS:	**3,149**	**2,666**

Historic Gather Numbers: Antelope Hills/Cyclone Rim HMA

Year	HMA Name	Number Gathered	Number Removed
1986	Antelope Hills/Cyclone Rim	88	88
1987	Antelope Hills/Cyclone Rim	184	184
1988	Antelope Hills/Cyclone Rim	63	63
1989	Antelope Hills/Cyclone Rim	154	154
2000	Antelope Hills/Cyclone Rim	59	59
2001	Antelope Hills/Cyclone Rim	50	50
2004	Antelope Hills/Cyclone Rim	258	208
2009	Antelope Hills/Cyclone Rim	144	77
2011	Antelope Hills/Cyclone Rim	156	80
	Totals	**1,156**	**963**

Historic Gather Numbers: Crooks Mountain HMA

Year	HMA Name	Number Gathered	Number Removed
1985	Crooks Mountain	708	708
1996	Crooks Mountain	380	319
1998	Crooks Mountain	295	220
2002	Crooks Mountain	103	103
2006	Crooks Mountain	74	74
2009	Crooks Mountain	26	0
2011	Crooks Mountain	72	17
	Totals	**1,658**	**1,441**

Historic Gather Numbers: Green Mountain HMA

Year	HMA Name	Number Gathered	Number Removed
1980	Green Mountain	255	255
1984	Green Mountain	199	199
1993	Green Mountain	413	318
1995	Green Mountain	107	88
1996	Green Mountain	105	105
1997	Green Mountain	220	145
2002	Green Mountain	155	155
2003	Green Mountain	75	75
2005	Green Mountain	574	490
2006	Green Mountain	89	89
2009	Green Mountain	472	330
2011	Green Mountain	352	240
	Totals	**3,016**	**2,489**

APPENDIX 3 Genetic Diversity and Variability

Definitions

It is worth noting some definitions here, for clarity. A "gene" is a common term for a segment of DNA (on a specific site on a chromosome) that is responsible for the physical and heritable characteristics or phenotype of an organism. A specific gene location can be identified as a "locus" (plural: loci), and the observed variations of DNA sequence for a given locus are called "alleles." At each locus, one alleles is inherited from the mother, and one from the father. If every individual in a genetic population has the same allele, then the alleles for that locus are monomorphic for that population, but if there is more than one allele, then the population is polymorphic at that locus. Polymorphic alleles can be used as "markers" that may be more or less associated with horses that are known to have descended from a given breed type.

A "genome" is defined as the entirety of the genetic information (DNA) in an individual's cells. Sometimes, this is also referred to as a "genotype." However, "genotype" may also refer to the specific set of alleles for a subset of genes that codes for a certain set of identifiable traits (e.g., the phenotype that is associated with that genotype). A "phenotype" is the set of observable characteristics of an individual resulting from the interaction of its DNA with the environment. Usually, references to a horse's phenotype are made with respect to some aspects of its appearance such as its size, aspects of its conformation, coat color, facial shape, etc. Such phenotypic indicators that are often associated with New World Iberian horse breed types (see section 2.3) could be influenced by both genetics and environment, so they may or may not be reliable indicators of the degree of genetic similarity to a putative ancestral Iberian horse.

In light of these definitions, the term "New World Iberian genotype" has the potential to be misleading. There is no single "New World Iberian" genome, because the exact makeup of each individual horse's genetic complement is unique. Therefore, the sense of the term "New World Iberian genotype" that BLM uses in management is the one that is associated with a specific subset of genes that have been associated with horses of New World Iberian breed type ancestry. This is the common sense of the term, reflecting the truism that closely related individuals may share a number of the same alleles because they inherited them from a common ancestor. This might commonly be referred to as possessing many of the same genes, but it is more accurate to say that they share the same alleles. Individuals that ostensibly have common ancestry and which probably share a large number of alleles at many different loci may share visibly identifiable traits, and are sometimes grouped into named breeds. Because these breeds are made up of individuals with similar genetic background they usually have similar phenotypes. Dr. Sponenburg's analysis (Sponenberg and Reed, unpublished) is posited on the assumption that some phenotypic traits are particularly associated with descendants of New World Iberian breed type ancestors, and BLM is using those assumptions in criteria for identifying which horses to preferentially retain in Alternative 2. It is expected that management actions that increase the prevalence of phenotypic traits that have been historically associated with that breed type will also increase the prevalence of genetic markers that are associated with the New World Iberian breed type. Under Alternative 2, BLM would send out samples of retained horse DNA for analysis, to test the assumed correlation between phenotype and genotype.

Summaries of Dr. Cothran's Analyses with Respect to Genetic Diversity

Blood or tissue (hair follicle) samples were collected for genetic analysis in conjunction with gathers in the Red Desert Complex beginning in 2001. This sampling was used to monitor genetic baseline data related to genetic diversity (e.g. heterozygosity, allelic diversity, and possible affinities with major breed types). Blood samples were replaced by hair follicle samples beginning in 2009. These samples were analyzed by Dr. E. Gus Cothran, (Equine Genetics Laboratory, Texas A&M University). Those analyses did not explicitly account for the genetic interconnectedness of the horse breeding population in the Complex; analyses were made at the level single HMAs. Dr. Cothran's (2001, 2006, 2010) reports indicate that horses of the Red Desert have a mixed ancestry, including some component of Iberian ancestry along with other horse breeds. Recent analysis of genetic samples from the Complex indicates that the herds do not have a consistently high level of Iberian (Spanish) ancestry. Several lines of evidence make clear that Iberian influence in the gene pool of this Complex is present, but not prominent.

Dr. Cothran's conclusions and recommendations regarding genetic diversity in single HMAs of the Red Desert Complex of HMAs are summarized as follows:

Summary of the Lost Creek HMA

"Genetic variability of this herd is fairly high. The values related to allelic diversity and heterozygosity are high. Genetic similarity results suggest a herd with mixed ancestry that primarily is North American. There is a possibility of some, although limited, Iberian ancestry." (Cothran 2010a)

All three reports for samples from this HMA (Cothran 2001, 2006, 2010a) indicate that horses in the Lost Creek HMA had high levels of genetic variation, as measured by allelic diversity. Heterozygosity (Ho) levels depended on the sample; Ho was found to be lower than the feral herd average in the 2001 sample, but higher than the feral herd average in 2006 and 2009 (Table 2, in Cothran 2001, 2006, 2010a). As measured with respect to feral herd averages, it appears that variation as measured by heterozygosity increased between the 2001 and 2006 sampling occasions, despite a short-term reduction in the number of horses living in the area, to 25% of its 2001 size.

Recommendations for the Lost Creek HMA

"Current variability levels are high enough that no action is needed at this point. The herd should be monitored to make sure population size remains stable or increase to make sure no dramatic reductions in variability take place." (Cothran 2010a)

Summary of the Stewart Creek HMA

"Genetic variability of this herd is generally high. The values related to allelic diversity are near above average while heterozygosity is high. The herd appears to be in genetic equilibrium despite a high percentage of alleles at risk of loss. Genetic similarity results suggest a herd with mixed ancestry that primarily is North American." (Cothran 2010b

"The most likely ancestry is with North American breeds and the evidence for Iberian heritage may be due to the Spanish heritage of many of the North American breeds." (Cothran 2010b).

Recommendations for the Stewart Creek HMA
"Current variability levels are high enough that no action is needed at this point. The herd should continue to be monitored to make sure that population size does not fall to low levels (less than 100)." (Cothran 2010b)

Summary of the Antelope Hills HMA
The 2004 genetic sample for the Antelope Hills/Cyclone Rim area showed genetic variability to be near or slightly above the average for wild herds (Cothran 2008). The 2012 genetic sample suggested that there had been a recent addition of many individuals to the local gene pool (Cothran 2013), which is consistent with the hypothesis that horses generally move throughout and interbreed across the Complex. The 2012 sample included genetic markers suggesting greatest overall similarity with North American breeds some similarity to the New World Spanish horse breeds, even though the highest similarity was to Light Racing and Riding Breeds, and measures of similarity across many breed types were not statistically distinguishable. Those results are consistent with the overall conclusion that Red Desert Complex horses comprise a herd of mixed ancestry with some Spanish contributions.

Recommendations for the Antelope Hills HMA
This herd has reasonably high genetic variability so that no action need be taken at this time (Cothran 2013). However, the AML for this herd is fairly low so it will be prudent to continue monitoring genetic diversity into the future.

Summary of the Green Mountain HMA
"Genetic diversity is just above the average for a feral horse population. The herd appears to be near genetic equilibrium which suggests that this could be an old population or at least has had few disturbances within the past several generations. This also could simply be chance. The distribution of variants would suggest the origin of the herd is a combination of North American saddle horse breeds and Spanish Breeds." (Cothran 2003a)

Recommendations for the Green Mountain HMA
"No immediate action is indicated. Genetic variation is adequate and population appears stable. Future action depends upon the population size of the herd. If the herd is below 100 adult horses then continued monitoring will be needed. Although the herd appears stable the genetics can change rapidly when the herd size is maintained below 100." (Cothran 2003a)

Summary of the Crooks Mountain HMA
"The herd has high genetic variation. The pattern and allelic diversity suggest a population of mixed origins. Genetic similarity indicates the origins are primarily of North American riding horses. Genetic variants suggest there also is some (but possibly limited) Spanish contribution. Genetic similarity does not indicate a close connection with any other feral herds but it will require additional information about locations to confirm this." (Cothran 2003b)

Recommendations for the Crooks Mountain HMA
"No immediate action is needed. Genetic variation is high and there does not appear to be a severe risk of loss of variation unless the population size is very small (less than 50 adult horses).

If population size is kept near 100 adults, variation should be maintained above the feral average for several generations." (Cothran 2003b)

The following general points relate to maintenance of genetic diversity in the Red Desert Complex.

- When considering the potential loss of genetic diversity, horses in the five HMAs of the Complex should be considered as part of a single genetically interacting subpopulation, and that subpopulation should be considered to be part of a larger metapopulation of interacting subpopulations. There is a large degree of gene flow between the five HMAs of the Complex, as well as with other HMAs in Wyoming. This is evidenced by the close clustering of these HMAs on trees of relatedness in Dr. Cothran's reports, as well as by the extremely low pairwise F_{ST} values (less than 0.053) between all reported pairs of Red Desert HMAs (NAS 2013).
- In general, smaller, isolated populations (<200 total population survey size) may be particularly vulnerable when the number of animals participating in breeding drops below a minimum needed level (Coates-Markle, 2000), for a long time. The Complex is not isolated, and the number of horses there is not small. For example, low F_{ST} values suggest that, over the time scale of horse generations, there is a high degree of interchange with Divide Basin (F_{ST} between Divide Basin, Stewart Creek, Lost Creek, and Antelope Hills is less than 0.04; NAS 2013). Also, even if some degree of PZP immunization reduces reproduction for treated horses for a short time period, it is expected that the number of horses in the Complex will grow quickly after any proposed gather.
- In general, small populations may not be able to maintain self-sustaining reproductive ability over the long term, unless there is a natural or management-induced influx of genetic information from neighboring herds. An exchange of only 1-2 breeding age animals per generation is expected to maintain the genetic resources in small populations of about 100 animals, thus obviating the need for larger populations in all cases (Singer, 2003). The number of animals in the Complex is not expected to get close to 100 animals. Despite this, if genetic diversity monitoring in the future ever does indicate cause for concern, it will be possible to introduce horses from other HMAs, which is consistent with current BLM policy (BLM Handbook H-4700-1).
- There is little imminent risk of inbreeding because most wild horses sampled to date in the Complex have large amounts of genetic heterozygosity, genetic resources are lost slowly over periods of many generations, wild horses are long-lived with long generation intervals, and there is little imminent risk of inbreeding or population extinction (Singer, 2003).
- Genetic diversity tends not be lost quickly in wild horses. Per-generation loss of heterozygosity in a closed population is expected to be proportional to $(1\text{-}1/N_e)$, where N_e is the genetic effective population size. N_e is difficult to calculate for wild horses, since the calculation is complicated by many factors inherent in wild horse herds. Mixed ancestry and low levels of inbreeding are associated with relatively high values for N_e. A guideline of N_e=50 or more is currently being applied in wild horse populations (BLM Handbook H-4700-1). Horses in the HMAs of the Red Desert Complex are managed based on the understanding that the horses have the potential to, and do move between the different HMAs, making them part of a larger population of genetically interacting individuals.

Even after the proposed action gather, it is expected that N_e in the population of wild horses that includes the entire Complex would well exceed that threshold.

The following summarizes what is known about the Complex as it pertains to genetic diversity:

- Ne (genetic effective population size) for Complex has not been estimated, but a diverse mixed ancestry and the historically large average number of breeding horses appears to have maintained genetic diversity in the past, including after periodic gathers that reduced population survey population size. This past evidence of genetic diversity having been maintained is indicative of low levels of inbreeding, and fairly high Ne, relative to actual population size.
- There is known movement between the HMAs of the Complex (Green Mountain, Antelope Hills/Cyclone Rim, Stewart Creek and Lost Creek) and this helps to diversify these gene pools and contribute to high levels of herd heterozygosity and allelic diversity.
- Current levels of genetic diversity, as measured by the most recent monitoring data for microsatellite alleles, are high. Loss of genetic diversity due to the proposed gather is expected to be low because the population is large to begin with, has high pre-existing levels of heterozygosity, low levels of inbreeding, extensive movements across the Complex, and because it is expected that the population will continue to grow after the gather.
- Three genetic reports from the Lost Hills HMA showed high levels of genetic variation, as measured by allelic diversity, with variation increasing between 2001 and 2006 despite a herd reduction to 25% of its 2001 size.

The following summarizes what is known about the Red Desert HMA Complex as it pertains to genetic similarity:

- Recent analysis of genetic samples from the Complex indicates that the herds do not have a consistently high level of Iberian (Spanish) ancestry. Several lines of evidence make clear that Iberian influence in the gene pool of this Complex is present, but not prominent. Dr. Cothran (2010b) suggested that the source of the Iberian ancestry, to the extent that it is present, could be from North American Breeds, some of which include components of Iberian genetic diversity.
- Herds in the Red Desert Complex were consistently identified as being genetically similar, and of mixed origins.
- In trees of relatedness, Red Desert Complex horses do not nest consistently with particular breed types. More specifically, the following results suggest that the strength of the association between Red Desert horses and Iberian breed was dependent on the particular sample of horses in various years. In 2001, the 27 horses sampled from Eagles Nest did not cluster with with any single breed (Cothran 2001; Figure 1). The 48 samples from Lost Creek in 2006 clustered clearly with the Morgan horse breed (Cothran 2006). The 30 samples from 2009 clustered most closely with the Exmoor Pony of Britain (Cothran 2010).

- In a more recent analysis of 68 domestic breeds and samples from 44 feral herds in North America, horse herds from the Red Desert Complex clustered together. Only the Morgan horse breed nested within that cluster, with no Iberian breed in the Red Desert cluster (Cothran and McCrory 2014).
- Coefficients of genetic similarity between sampled horses in each of those three years did not consistently show a pattern of relatedness to New World or Old World Iberian breed ancestry that was statistically distinguishable from several other categories of horse ancestry. Table 3 in each of Cothran's (2001, 2005, 2010) analyses vary in the strength of association between Complex horses and Iberian breeds, as measured by the value of Rogers' genetic similarity coefficient, *S*. In 2001, the standard errors and confidence intervals for *S* were statistically indistinguishable for Light and Racing breeds, Oriental and Arabian breeds, Old World Iberian breeds, New World Iberian breeds, North American Gaited breeds, Heavy Draft breeds, and True Pony breeds (Figure 3-1).

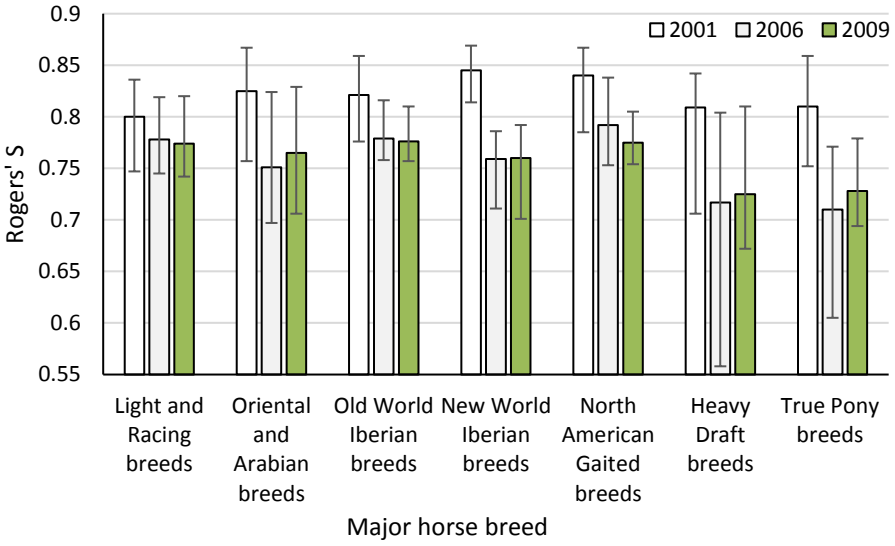

Figure 3-1. Coefficient of genetic similarity (Rogers' S) between sampled Red Desert Complex horses in 2001, 2006, and 2009, and various major horse breed types. Error bars indicate upper and lower confidence intervals. In each year, error bars for the measure of similarity between sampled Red Desert horses overlap for many major breed types, indicating a lack of statistically significant difference.

Further detail on expected loss of genetic diversity

All three reports from Cothran (2001, 2006, 2010) indicate that horses in the Red Desert herd had high levels of genetic variation, as measured by allelic diversity. Heterozygosity (Ho) levels depended on the sample; Ho was found to be lower than the feral herd average in the 2001 sample, but higher than the feral herd average in 2006 and 2009 (Table 2, in Cothran 2001, 2006, 2010).

It is expected that heterozygosity (one measure of genetic diversity) will be lost from a population at a rate described by the following equation, where H_1 is the expected heterozygosity one generation into the future, H_0 is the current level of heterozygosity, and N_e is the genetic effective population size.

$$H_1 = (1-1/2N_e)H_0$$

For example, if N_e is 100, then a population can be expected to lose 0.5% of its heterozygosity per generation. Generation time can be approximated as half of the lifespan, or about 10 years for horses. Effective genetic population size can be estimated by the following formula, where N_m is the number of breeding males and N_f is the number of breeding females.

$$N_e = 4N_mN_f/(N_m + N_f)$$

For example, in a population with 50 breeding males and 100 breeding females, N_e would be 133 horses.

Immediately after the proposed gather, the number of horses on the Red Desert Complex is expected to be approximately 1,020 males and 1,020 females for Alternative 1 and 240 males and 240 females for Alternative 2. In both cases, those numbers would subsequently increase due to population growth. BLM recognizes that not all of these animals will necessarily breed, particularly the males. Also, BLM recognizes that PZP-treated mares may not breed for one or two seasons after treatment; it is expected that they will, however, return to breeding after that. Nonetheless, based on the above equations, would be approximately 2040 under Alternative 1 and approximately 480 under Alternative 2. The resulting per-generation expected loss of genetic diversity as a result of this gather is expected to be small: less than 0.1% under Alternative 1, and less than 0.2% under Alternative 2. Moreover, the population is expected to increase in size somewhat after the gather, due to reproduction, such that the number of breeding individuals will increase, with correspondingly lower loss of genetic diversity. As a result, the proposed gather is not expected to cause substantial loss of genetic diversity.

Further analysis on lack of statistically significant change in relative similarity to New World Iberian breed types

The following analysis helps to answer the question, "Is there evidence of a decline over time in the relative contribution of New World Iberian ancestry, as measured in sampled horses in 2001, 2006, and 2009?" An examination of the ratios of sampled horses' Rogers similarity coefficient for New World Iberian breed type in the numerator, and the Rogers similarity coefficient for other major breed types in the denominator indicate that there has not been a change in the relative contribution of New World Iberian genetic material in sampled horses over time.

As shown in figure 3-1, the Rogers similarity coefficients are not constant for sampled horses in the three sampled years. Some of this variation can be explained by changes in the markers used for analysis, some can be explained by imprecision in the estimates due to the sampled animals, and some may or may not be due to change in relative contributions of different major breed types over time. Confidence intervals around each of the estimated coefficient values reflect

uncertainty in the specific coefficient estimates. It may appear at first glance that the similarity between sampled horses and the various breed types decreased between 2001 and 2006. As pointed out by FOA in their comment letter, though, the genetic loci sampled in 2001 were blood markers and biochemical markers ('allozymes'), whereas the genetic loci sampled in 2006 and 2009 were variable nuclear tandem repeat markers ('microsatellites'). Because the same exact markers were not used in all years, measures of similarity to various major breed types may differ between 2001, as opposed to 2006 and 2009.

Despite apparent changes in the absolute value of Rogers similarity coefficients in any of the three years, one may ask what the ratio of Rogers similarity coefficients for two breed types is, within each sampled year. If the relative contribution of New World Iberian genetic material decreased from 2001 to 2009, then one would expect the relative ratio of the similarity coefficients to change. In mathematical terms this can be expressed as follows.

Define the symbol $R_{breed,year}$ as the Rogers similarity coefficient for a given major breed type and year. Cothran reported R values for seven major breed types (Light and Racing breeds, Oriental and Arabian breeds, Old World Iberian breeds, New World Iberian breeds, North American Gaited breeds, Heavy Draft breeds, and True Pony breeds). In each of his reports (Cothran (2001, 2006, 2010) included a measure of uncertainty for each of those measures, shown as 'Std,' the standard error of the estimate. Standard errors are a measure of precision, and can be used to estimate confidence intervals around a given estimate. Usually, standard errors are shown with the lower case sigma symbol 'σ,' where standard error for a given similarity coefficient could be subscripted by breed type and year. For example, the standard error for the similarity coefficient to New World Iberian (NWI) breed type in 2001 could be indicated as $\sigma_{NWI,2001}$.

Define the symbol '$z_{NWI,breed,year}$' as the ratio of Rogers similarity coefficient for New World Iberian breed types divided by the Rogers similarity coefficient for a different breed type, for a given year. For example, '$z_{NWI,LR,2001}$' as the ratio of the Rogers similarity coefficient of New World Iberian (NWI) in 2001 in the numerator, divided by the Rogers similarity coefficient of Light and Racing (LR) breed types in 2001 in the denominator:

$$z_{NWI,LR,2001} = \frac{R_{NWI,2001}}{R_{LR,2001}}$$

If a sample of horses has roughly equal levels of similarity to New World Iberian breed types and some other breed type, then that ratio would be close to one.

The confidence interval for the above ratio can be approximated using the Taylor method (also known as the delta method), based on the values of $R_{NWI,2001}$, $\sigma_{NWI,2001}$, $R_{LR,2001}$, and $\sigma_{LR,2001}$, and taking into account what critical t-value (t_{crit}) is desired to reflect acceptable levels of type I error rate (Franz 2007). Continuing with the same example, the upper and lower limits of the confidence interval would be defined by:

$$z_{NWI,LR,2001} \pm t_{crit} \sqrt{\frac{\sigma_{LR,2001}{}^2}{R_{LR,2001}{}^2} + \frac{\sigma_{NWI,2001}{}^2}{R_{NWI,2001}{}^2} - 2\frac{\sigma_{LR,2001} * \sigma_{NWI,2001}}{R_{LR,2001} * R_{NWI,2001}}}$$

The benefit of examining these ratios and their associated confidence intervals is that one may examine the relative contributions of New World Iberian breed type genetic markers, relative to various breed types. All ratios for the figure below (Figure IV-1) were calculated by comparing similarity coefficients only within single years (2001, 2006, or 2009).

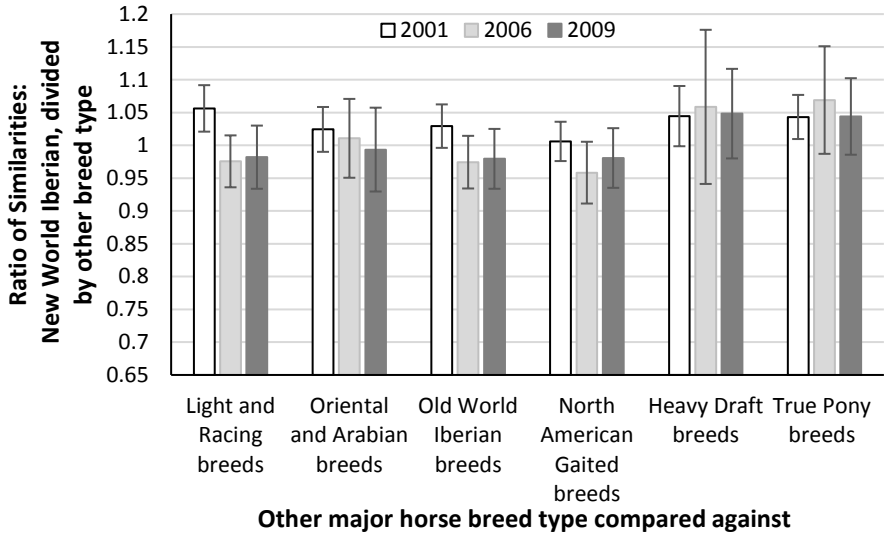

Figure 3-2. Ratios of Lost Creek genetic similarity coefficient (Rogers' S) for New World Iberian breed type, divided by genetic similarity coefficient for various other breed types. Values are based on Cothran (2001, 2006, 2010). Error bars indicate 80% upper and lower confidence intervals. For most major breed types, error bars for the ratios overlap over time, indicating a lack of statistically significant difference between sampling occasions.

Figure 3-2, above, reflects 80% confidence limits, which will always be narrower than the more typically analyzed 90% or 95% confidence intervals. Despite using only 80% confidence intervals, this measure of precision indicates that any apparent changes in the values of ratios did not change substantially over time. Statistically significant changes would typically be indicated by having non-overlapping confidence intervals. With the possible exception of the relative contribution of Light and Racing breeds, there appears to be no statistically meaningful change in the relative similarity of sampled horses to the New World Iberian, relative to any other major breed type, in the three sampled years. With regards to the Light and Racing breed type, 80% confidence intervals for the 2001 ratio and the 2009 ratio do overlap very slightly. It may be, though, that there has been some minor degree of increase in the genetic contribution of descendants of Light and Racing breed type horses, relative to New World Iberian type horses. One plausible explanation for this could be that the 2001 samples happened to include individuals with a lower relative contribution of Light and Racing breed type alleles, compared to the population at large. It is unclear whether this is a cause for major concern about change in the relative contribution of New World Iberian ancestry in the most recent sample. However, one may conclude that the relative change of New World Iberian types with respect to all other major breed types did not appear to have any statistically significant decrease, based on the sampled individuals.

What does this analysis indicate about whether or not there has been a decline in the relative contribution of horses with New World Iberian genetic markers in the Lost Creek samples? The apparently statistically stationary values for the ratios of similarity coefficients for comparisons across most major breed types can be interpreted as an indication that the relative similarity of sampled Lost Creek horses to the New World Iberian breed types has not substantially changed over the 2001, 2006, and 2009 sampling intervals.

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APPENDIX 4 Standard Operating Procedures for Application of Fertility Control

The following management and monitoring requirements are part of the Alternatives analyzed.

- The 22-month pelleted PZP vaccine would be administered by trained BLM personnel.

- 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 jabstick 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.

- Delivery of the vaccine would be as an intramuscular injection while the mares are restrained in a working chute. 0.5 cubic centimeters (cc) of the PZP vaccine would be emulsified with 0.5 cc of adjuvant (a compound that stimulates antibody production) and loaded into the delivery system. The pellets would be loaded into the jabstick for the second injection. With each injection, the liquid and pellets would be propelled into the left hind quarters of the mare, just below the imaginary line that connects the point of the hip and the point of the buttocks.

- All treated mares will be freeze-marked with two 3.5-inch letters on the left hip, and a smaller number on the left side of the neck to track what HMA that mare came from, for treatment tracking purposes. This step is to enable researchers to positively identify the animals during the research project as part of the data collection phase.

- At a minimum, estimation of population growth rates using helicopter or fixed wing surveys will be conducted the year preceding any subsequent gather. During these surveys it is not necessary to identify which foals were born to which mares, only an estimate of population growth is needed (i.e. # of foals to # of mares).

- Population growth rates of herds selected for intensive monitoring will be estimated every year post-treatment using helicopter or fixed wing surveys. During these surveys it is not necessary to identify which foals were born to which mares, only an estimate of population growth is needed (i.e. # of foals to # of mares). If during routine HMA field monitoring (on-the-ground), if data on mare to foal ratios can be collected, these data should also be shared with the National Program Office (NPO) for possible analysis by the USGS.

- A PZP Application Data sheet will be used by the field applicators to record all the pertinent data relating to identification of the mare (including a photograph if the mares are not freeze-marked) and date of treatment. Each applicator will submit a PZP Application Report and accompanying narrative and data sheets will be forwarded to the NPO (Reno, Nevada). A copy of the form and data sheets and any photos taken will be maintained at the field office.

- A tracking system will be maintained by NPO detailing 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 applied by HMA.

APPENDIX 5 Population Model Overview

WinEquus is a program used to simulate the population dynamics and management of wild horses created by Stephen H. Jenkins of the Department of Biology, University of Nevada at Reno. For further information about this model, you may contact Stephen H. Jenkins at the Department of Biology/314, University of Nevada, Reno, NV 89557.

Detailed information is provided within the WinEquus program available at http://unr.edu/homepage/jenkins, including background about the use of the model, the management options that may be used, and the types of output that may be generated.

The population model for wild horses was designed to help the BLM evaluate various management strategies that might be considered for a particular area. The model uses data on average survival probabilities and foaling rates of horses to project population growth for up to 20 years. The model accounts for year-to-year variation in these demographic parameters by using a randomization process to select survival probabilities and foaling rates for each age class from a distribution of values based on these averages. This aspect of population dynamics is called environmental stochasticity, and reflects the fact that future environmental conditions that may affect wild horse population's demographics can't be established in advance. Therefore each trial with the model will give a different pattern of population growth. Some trials may include mostly "good" years, when the population grows rapidly; other trials may include a series of several "bad" years in succession. The stochastic approach to population modeling uses repeated trials to project a range of possible population trajectories over a period of years, which is more realistic than predicting a single specific trajectory.

The model incorporates both selective removal and fertility treatment as management strategies. A simulation may include no management, selective removal, fertility treatment, or both removal and fertility treatment. Wild horse and burro specialists can specify many different options for these management strategies such as the schedule of gathers for removal or fertility treatment, the threshold population size which triggers a gather, the target population size following a removal, the ages and sexes of horses to be removed, and the effectiveness of fertility treatment.

To run the program, one must supply an initial age distribution (or have the program calculate one), annual survival probabilities for each age-sex class of horses, foaling rates for each age class of females, and the sex ratio at birth. Sample data are available for all of these parameters. Basic management options must also be specified.

Population Modeling – Red Desert Creek Complex

To complete the population modeling for the Red Desert Complex, version 1.40 of the WinEquus program, created April 2, 2002, was utilized.

Objectives of Population Modeling

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?
- What effects do the different alternatives have on the genetic health of the herd?

Population Data, Criteria, and Parameters utilized for Population Modeling

All simulations used the survival probabilities, foaling rates, and sex ratio at birth that was supplied with the WinEquus population model for the Garfield HMA: Sex ratio at Birth: 47% Females; 53% Males

The following percent effectiveness of fertility control was utilized in the population modeling for Alternative 1: Year 1: 94%, Year 2: 82%, Year 3: 68%

The following table displays the removal parameters utilized in the population model for the Proposed Action and all Alternatives:

Removal Criteria

Age	***Percentages for Removals***	
	Females	**Males**
Foal	100%	100%
1	100%	100%
2	100%	100%
3	100%	100%
4	100%	100%
5	0%	0%
6	0%	0%
7	0%	0%
8	0%	0%
9	0%	0%
10-14	0%	0%
15-19	0%	0%
20+	0%	0%

The following table displays the contraception parameters utilized in the population model for Alternative 1:

Contraception Criteria (Alternative 1)

Age	**Percentages for Fertility Treatment**
Foal	0%
1	100%
2	100%
3	100%
4	100%
5	100%
6	100%
7	100%
8	100%
9	100%
10-14	100%
15-19	100%
20+	100%

Population Modeling Criteria

The following summarizes the population modeling criteria that are common to all alternatives:

- Starting Year: 2016
- Initial gather year: 2016
- Gather interval: regular interval of three years
- Gather for fertility treatment regardless of population size: No
- Continue to gather after reduction to treat females: N/A
- Sex ratio at birth: 53% males
- Percent of the population that can be gathered: 80%
- Minimum age for long-term holding facility horses: Not Applicable
- Foals are not included in the AML
- Simulations were run for 10 years with 100 trials each

The following table displays the population modeling parameters utilized in the model:

Population Modeling Parameters

Modeling Parameter	Alternative 1 Fertility Control Only (Treat & Release)	Alternative 2 (Remove to Low Limit of Management Range & Fertility Control)	Alternative 3 (No Removal & No Fertility Control)
Management by removal and fertility control	Yes	Yes	N/A
Management by removal only	No	No	N/A
Threshold Population Size for Gathers in the HMAs	1,703 for the Complex. This is the number of wild horses projected to be inside of the Complex with 482 outside of the HMA boundaries.	125 Stewart Creek 60 Lost Creek 170 Green Mountain 65 Crooks Mountain 60 Antelope Hills	N/A
Target Population Size Following Gathers	1,703 for the Complex. This is the number of wild horses projected to be inside of the Complex with 482 outside of the HMA boundaries.	125 Stewart Creek 60 Lost Creek 170 Green Mountain 65 Crooks Mountain 60 Antelope Hills	N/A
Gather for fertility control regardless of population size	Yes	Yes	N/A
Gathers continue after removals to treat additional females	Yes	Yes	N/A

Results of WinEquus Population Modeling

Population modeling was completed for the proposed action and the alternatives. One hundred trials were run, simulating population growth and herd demographics to determine the projected herd structure for the next four years, or prior to the next gather. The computer program used simulates the population dynamics of wild horses. It was written by Dr. Stephen H. Jenkins, Department of Biology, University of Nevada, Reno, under a contract from the National Wild Horse and Burro Program of the Bureau of Land Management and is designed for use in comparing various management strategies for wild horses.

Data from the January 2000 Clan Alpine study, in Nevada, determined the fertility rates for the 2-year PZP vaccine with the treatment of 96 mares. The test resulted in fertility rates in treated mares of 6% year one and 18% year two.

Interpretation of the Model

The estimated populations for the population modeling consist of: 2,185 wild horses in the Red Desert Complex based on the April 2015 population survey plus a 20% foal crop. Year one is the baseline starting point for the model, and reflects wild horse numbers immediately prior to the gather action and also reflects a slightly skewed sex ratio which favors males. A sex ratio of 53:47 was entered into the model for the post gather action population. In this population modeling, year one would be 2015. Year two would be exactly one year in time from the original action, and so forth for years three, four, and five, etc. Consequently, at year eleven in the model, exactly ten years in time would have passed. In this model, year eleven is 2025. This is reflected in the Population Size Modeling Table by "Population sizes in ten years" and in the Growth Rate Modeling Table by "Average growth rate in 10 years." Growth rate is averaged over ten years in time, while the population is predicted out the same ten years to the end point of year eleven. The Full Modeling Summaries contain tables and graphs directly from the modeling program.

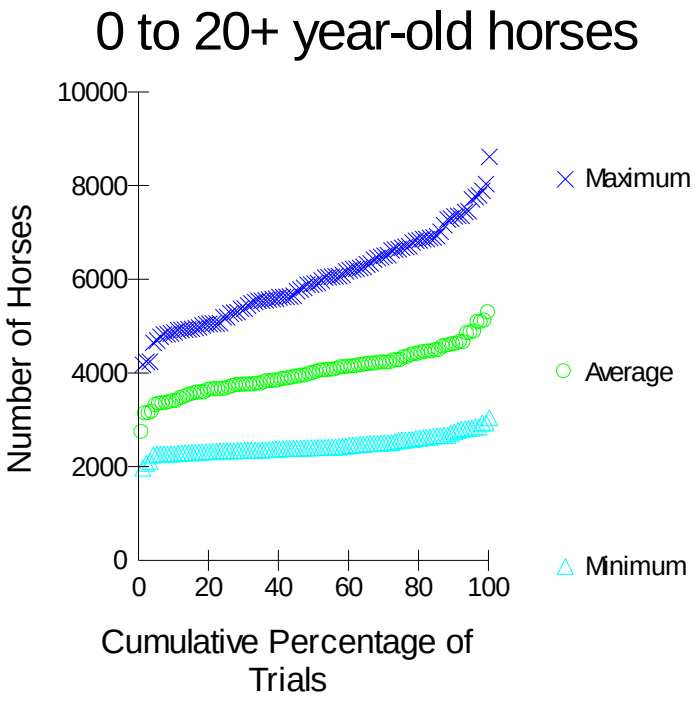
The initial herd size, sex ratio and age distribution for 2016 was structured by the WinEquus Population Model using data from the horses gathered and removed during the 2011 gather. This initial population data was then entered into the model and the model was used to predict various outcomes of the different alternatives, including the No Action Alternative for comparison purposes.

The parameters for the population modeling were:

1. Gather when population exceeds 1,703 wild horses in the Red Desert Complex for Alternative 1 and 724 wild horses in the Red Desert Complex for Alternative 2.
2. Foals are not included in AML
3. Percent to gather: 80%
4. Three years between gathers
5. Number of trials: 100
6. Number of years: 10
7. Initial calendar year: 2016
8. Initial population size: 2,185 wild horses in the Red Desert Complex.
9. Population size after gather would be: 480 wild horses in the Red Desert Complex.
10. Implement selective removal criteria
11. Fertility control Yes for Alternative 1 and Yes for Alternative 2, the Proposed Action

Alternative 1-

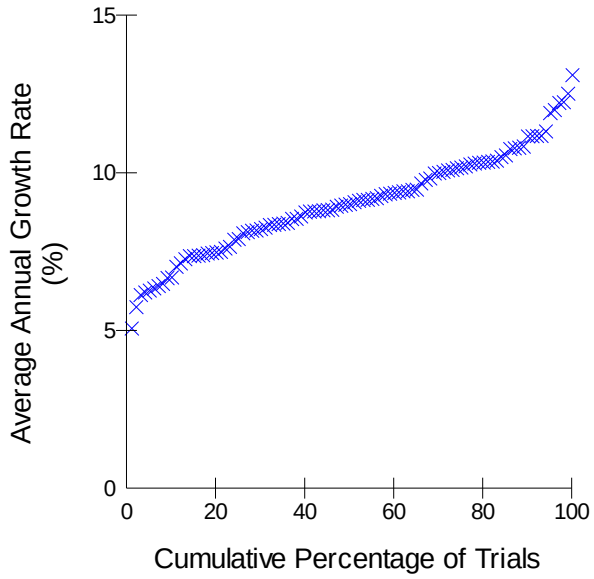
Population Size and Modeling Graph and Table (Fertility Control Only (Treat & Release))



POPULATION SIZES IN 11 YEARS*			
	MINIMUM	**AVERAGE**	**MAXIMUM**
Lowest Trial	1992	2733	4149
10th Percentile	2301	3391	4910
25th Percentile	2358	3670	5256
Median Trial	2426	4002	5940
75th Percentile	2587	4298	6708
90th Percentile	2778	4611	7372
Highest Trial	3065	5285	8638

* 0 to 20+ year-old horses

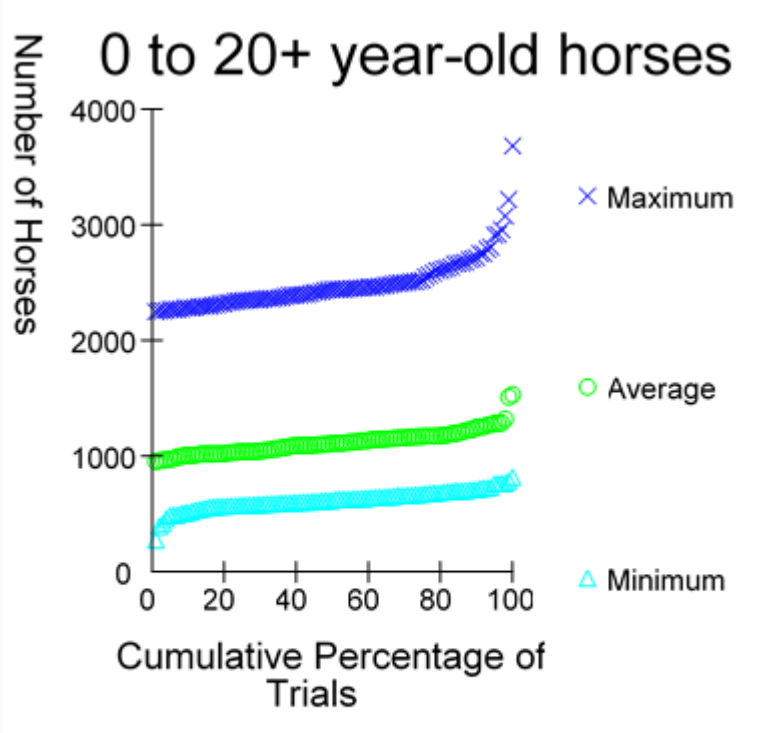
Growth Rate Modeling Graph and Table



AVERAGE GROWTH RATE IN 10 YEARS	
Lowest Trial	5.1%
10th Percentile	6.9%
25th Percentile	8.0%
Median Trial	9.1%
75th Percentile	10.2%
90th Percentile	11.2%
Highest Trial	13.1%

Alternative 2: Proposed Action:

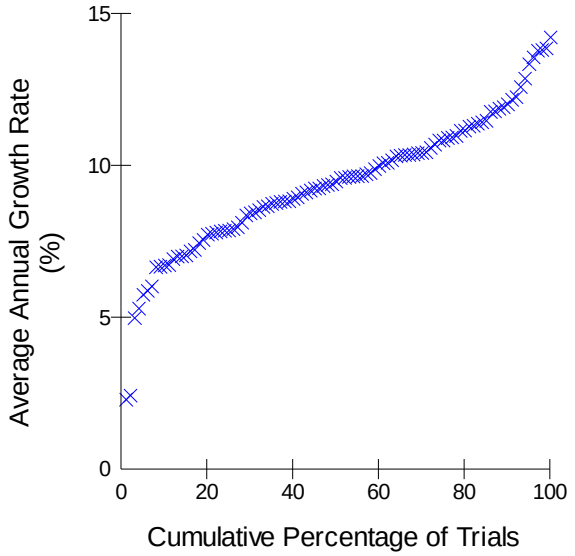
Population Size and Modeling Graph and Table (Remove to Low Limit of Management Range & Fertility Control)



POPULATION SIZES IN 11 YEARS*			
	MINIMUM	**AVERAGE**	**MAXIMUM**
Lowest Trial	275	956	2262
10th Percentile	516	1006	2293
25th Percentile	576	1038	2360
Median Trial	620	1110	2452
75th Percentile	672	1172	2548
90th Percentile	714	1251	2746
Highest Trial	820	1532	3683

* 0 to 20+ year-old horses

Growth Rate Modeling Graph and Table



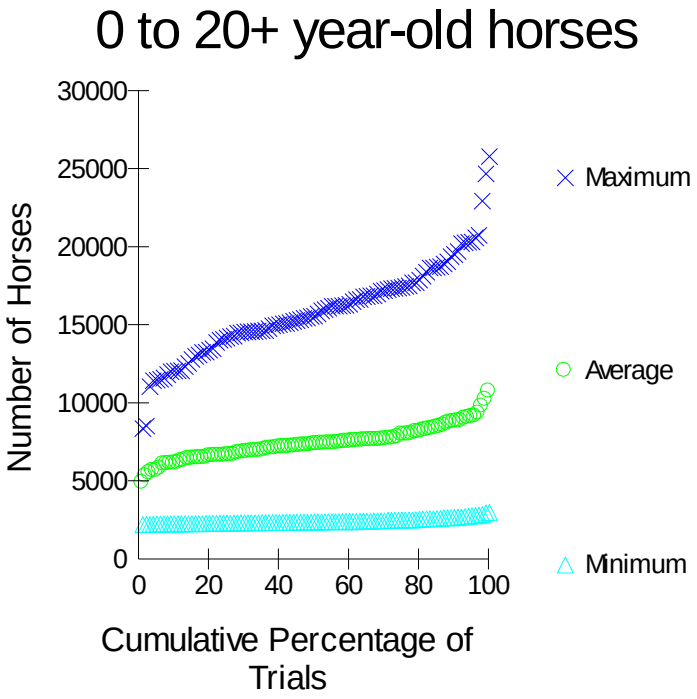
AVERAGE GROWTH RATE IN 10 YEARS	
Lowest Trial	2.3%
10th Percentile	6.7%
25th Percentile	7.9%
Median Trial	9.6%
75th Percentile	10.9%
90th Percentile	12.1%
Highest Trial	14.2%

<u>Alternative 3</u> – No Action

The changed parameters for the population modeling were:

Do not gather in 2016
Foals are not included in AML
Percent to gather: 0

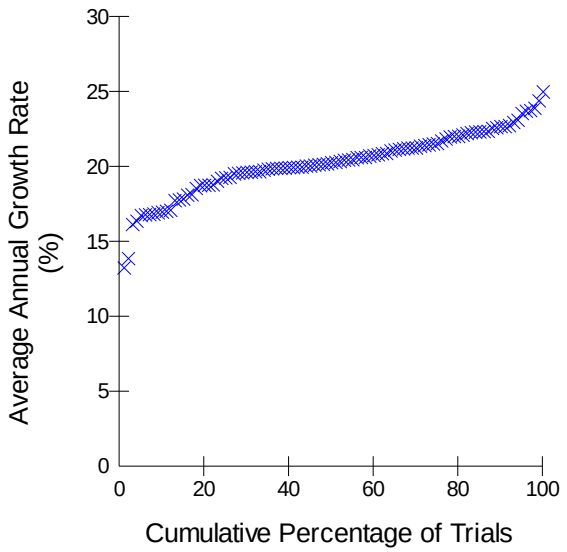
Population Size Modeling Graph and Table (No Removal & No Fertility Control)



POPULATION SIZES IN 11 YEARS*			
	MINIMUM	**AVERAGE**	**MAXIMUM**
Lowest Trial	2267	4914	8423
10th Percentile	2314	6175	12110
25th Percentile	2358	6684	14265
Median Trial	2426	7387	15697
75th Percentile	2552	8005	17486
90th Percentile	2724	8839	19663
Highest Trial	3051	10761	25839

* 0 to 20+ year-old horses

Growth Rate Modeling Graph and Table



AVERAGE GROWTH RATE IN 10 YEARS	
Lowest Trial	13.3%
10th Percentile	17.0%
25th Percentile	19.3%
Median Trial	20.3%
75th Percentile	21.7%
90th Percentile	22.7%
Highest Trial	25.0%

APPENDIX 6 Population Estimate and Methods

M E M O R A N D U M

To: Paul Griffin (BLM)
CC: Dennis Carpenter, Scott Fluer, Bryan Fuell, Ben Smith, Trent Staheli, Rubel Vigil, Tim Vosburgh, June Wendlandt, Bea Wade (BLM).
From: Bruce Lubow, IIF Data Solutions
Date: 17 July 2015
RE: Statistical analysis for 2015 survey of the Red Desert Complex horse population.

I. Summary Table

Survey areas and Dates:	April 6, 2015	Antelope Hills HMA and 'the middle'.
	April 7, 2015	Crooks Mountain HMA, Green Mountain HMA, Stewart Creek HMA and 'the middle'.
	April 9, 2015	Green Mountain HMA, Stewart Creek HMA.
	April 10, 2015	Stewart Creek HMA, Lost Creek HMA.
Type of Survey	Simultaneous Double-observer	
Aviation Company	Tony Herbie, pilot, Sky Aviation (Worland, WY)	
Agency Personnel	Ben Smith, Trent Staheli, Tim Vosburgh, Eric Collier (BLM), Paul Griffin (USGS)	

Table 1. Estimated population sizes (Estimate) are for the numbers of horses in the surveyed areas at the time of survey. For HMAs and for the complex as a whole, 90% confidence intervals are shown in terms of the lower limit (LCL) and upper limit (UCL). The coefficient of variation (CV) is a measure of precision; it is the standard error as a percentage of the estimated population. Number of horses seen (No. Seen) leads to the estimated percentage of horses that were present in the surveyed area, but that were not recorded by any observer (% Missed). The estimated number of horses associated with each HMA but located outside the HMA's boundaries is already included in the total estimate for that HMA. I also present the estimated numbers of horses in certain discrete areas outside of the HMA boundaries of interest to managers; these horses are already reflected in the HMA totals and complex total estimates, but are provided here for reference.

Area	Age Class	Estimate (No. Horses)	LCL [a]	UCL	Std Err	CV	No. Horses Seen	% Missed	Estimated # of Groups	Estimated Group Size	Foals per 100 Adults [b]	Est. No. Horses Outside HMA
Antelope	Total	208	171	253	23.8	11.5%	193	7.0%	16	12.9	7.6	112
Hills	Foals	15	9	22	3.8	25.9%						
HMA[c]	Adults	193	162	233	20.3	10.5%						
Crooks	Total	202	175	235	20.2	10.0%	187	7.6%	35	5.8	5.7	127
Mountain	Foals	11	8	14	1.7	15.9%						
HMA	Adults	191	167	222	18.7	9.7%						
Green	Total	854	803	931	44.9	5.3%	795	6.9%	99	8.6	4.2	137
Mountain	Foals	35	30	42	4.5	12.9%						
HMA	Adults	819	774	892	41.3	5.0%						
Stewart	Total	431	412	454	14.3	3.3%	421	2.4%	55	7.8	1.7	6
Creek	Foals	7	6	9	0.5	7.1%						
HMA	Adults	424	405	447	14.1	3.3%						
Lost	Total	208	163	258	28.7	13.8%	188	9.5%	18	11.4	6.9	20
Creek	Foals	13	9	18	2.3	17.0%						
HMA[c]	Adults	194	150	241	26.7	13.8%						
Complex	Total	1903	1817	2014	59.9	3.1%	1784	6.3%	224	8.5	4.4	402
Total	Foals	81	70	94	6.2	7.7%						
	Adults	1822	1739	1921	54.9	3.0%						

Table1 (continued)

Estimated numbers of horses in sub-areas; these horses are already included in the totals for the HMAs and complex, above.

"The Middle"	Total	300	277	331	16.0	5.3%	287	4.3%	33	9.0	6.3	270
	Foals	18	15	21	1.3	7.6%						
	Adults	282	260	311	14.9	5.3%						
Crooks North	Total	31	26	38	3.9	12.8%	29	5.8%	8	4.0	3.4	28
	Foals	1	1	2	0.1	11.8%						
		30	25	37	3.9	13.1%						
Green Mountain North	Total	38	23	55	7.9	20.7%	36	6.3%	3	12.1	3.0	19
	Foals	1	0	3	0.6	49.5%						
	Adults	37	23	53	7.4	19.9%						
Green Mountain South	Total	40	24	54	8.6	21.3%	36	10.6%	6	6.9	3.0	32
	Foals	1	0	3	0.4	37.5%						
	Adults	39	23	53	8.4	21.4%						

[a] 90% confidence interval based on percentiles of bootstrap simulation results. The lower 90% confidence interval limit (LCL) is actually less than the number of horses sighted during the survey for these estimates. This is a normal statistical result and reflects the fact that a confidence interval expresses what would likely happen if the survey were repeated. If repeated many times, some surveys would miss more horses and produce lower estimates, even after corrections, than were actually observed during this survey. Clearly, I conclude that there are at least as many horses as were observed during this survey, rather than using the lower confidence limit as a minimum number.

[b] The estimated ratio of foals to adults reflects what was observed during these April surveys and likely does not represent the full cohort of foals for this year.

[c] Initial counts of raw numbers of horses seen, circulated within BLM Wyoming, had 11 more animals seen in Antelope Hills HMA and 11 less animals seen in Lost Hills HMA; this discrepancy was because a group of 9 adults and 2 foals in 'the middle' were initially associated as being closer to Antelope HMA. For this analysis, though, that group of 9 adults and 2 foals was associated with Lost Creek HMA.

II. Narrative

In April of 2015, Bureau of Land Management (BLM) personnel conducted simultaneous double-count aerial surveys (Lubow and Ransom 2007) of the wild horse populations in the Red Desert complex of Wyoming. This complex includes all of the Antelope Hills HMA, Crooks Mountain HMA, Green Mountain HMA, Stewart Creek HMA, and Lost Creek HMA, as well as the lands adjacent to and nearly surrounded by (in the middle of) these five HMAs (Figure 1). In keeping with recommendations of the National Academies of Science recommendations (NAS 2013) and BLM policy (BLM 2010), these areas were surveyed together at one time, using a survey method that allows for estimating the number of horses that were present, but not seen by any observer.

I analyzed these data to estimate sighting probabilities, which I then used to correct the raw counts for systematic biases (undercounts) that are known to occur in aerial wildlife surveys, and to provide confidence intervals (which are measures of uncertainty) associated with the estimated population sizes for the HMAs and surrounding areas that were surveyed.

Population Results

The estimated total horse populations (Table 1) within these areas provided a relatively large sample size of observations (184 horse groups, Table 1, Figure 1), on which to base statistical estimates of sighting probability. Estimated sighting probabilities were high, resulting in a statistically estimated 93.7% of horses present in the surveyed areas being observed, on average, although the percentage missed was as high as 9.5% at Lost Creek HMA. The high sighting probability resulted in reasonable confidence intervals and coefficients of variation that are adequate for management purposes. Biases in the estimates could still exist due to heterogeneity of sighting probabilities that were not fully accounted for in this dataset, particularly due to the fairly large number of back seat observers used in this survey, as I discuss below.

The simultaneous double count method has not been used to estimate this population prior to the current survey, so the estimates presented here may not be comparable to those made by other methods in the past, which differed both in field technique and correction methods for missed horses. However, the correction for missed horses estimated here is similar to the assumed percentage missed in prior surveys (10%). Nevertheless, there have been very large increases in the estimated population between surveys in 2011 and 2013 and again between 2013 and 2015. In discussions with district personnel, I have identified several possible explanations for the surprisingly large increases between 2013 and 2015; however I have no information to address the changes between 2011 and 2013.

1. The prior method may have undercounted by more than the 10% assumed. This is particularly likely because only 2 observers were used in addition to the pilot, so one side was surveyed by a single individual. Comparing flight paths from earlier surveys to the current one, there were a few areas with significant vegetation that were not covered as well (wider transects) although the coverage was similar in most areas. Also, photographs of large groups were not used in the past. The observers and pilot used on earlier surveys were different and I have no information on their sighting acuity. All of these differences in methodology could have led to larger numbers of horses being missed in the past than the 10% that was assumed.
2. Foaling rates after the 2013 survey (i.e., in 2014) may have been exceptionally high. This population was treated with PZP in 2011, so it is likely that mares were especially well nourished and in good health after not foaling for the prior 2 years and could have had high pregnancy rates and produced healthy foals with unusually high survival rates.

3. Two problems may have occurred with the 2015 survey that could have inflated the estimates. First, some groups may have been observed and counted multiple times. This is a particular concern given the interruption of the survey due to weather. Observers made every effort to identify larger groups using photos and eliminate any duplicate observations from the dataset, but this effort may not have been 100% successful, especially for smaller groups for which photographs were not available. Second, it is also possible that horses not present during the prior survey found a way to immigrate into the survey area before the 2015 survey, causing an increase in the actual population present. These issues and suggested improvements are discussed further, below.

Sighting Probability Results

The front observers saw 87.9% of the groups (90.5% of the horses) seen by any observer, whereas the back seat observers saw 78.7% of all groups (82.4% of horses) seen (Table 2). These results demonstrate that simple raw counts do not fully reflect the true population without statistical corrections for missed groups, made possible by the double observer method and reported here. There were undoubtedly additional groups not seen by any observer; I address this issue in the analysis that follows.

The analysis method used for the surveyed areas was based on simultaneous double-observer data collected during these surveys. Informed by preliminary analyses and *a priori* reasoning, all models used in the double-observer analysis contained an estimated parameter for an intercept common to all observations. Ten groups were recorded on the centerline, so I also included a parameter in all models to account for the inability of back-seat observers to see this type of group. A total of 14 groups were recorded as seen spread across both sides of the flight path and visible from both sides of the helicopter. Front seat sighting probability for these groups was much higher, given their availability to all both front-seat observers, so an additional parameter was included to account for this added visibility.

I did not consider effects on detection probability of vegetation type, vegetation cover, or lighting conditions due to insufficient variation in the values of these covariates–nearly all observations were in open vegetation, 0% cover, and high contrast lighting. Only 10 observations (5 tree cover, 5 broken cover; all at Green Mountain) had any concealing vegetation recorded and all but 1 of these had ≤30%, the remaining 1 had 50% cover. These data provided an insufficient sample size to estimate the effect of vegetation. I did not attempt to estimate effects for any site (HMA) individually. Other than covariates that were recorded, sighting conditions and the range of overall topography and vegetation was similar at the sites. Furthermore, 3 of the 5 sites had ≤12 observed groups; too few to reliably estimate a unique site effect.

In preliminary analyses, I determined that there was overwhelming support for differences between the 2 front-seat observers and among the 5 back-seat observers, so I included separate additive parameters for each unique individual in all models.

In addition to the parameters included in all models, described above, I tested 6 possible effects on sighting probability by fitting models for all possible combinations of these effects, resulting in 64 alternative models. The 6 effects were: (1) an additive effect for groups located on the pilot's side of the flight path on the front-seat observers combined sighting probability due to the pilot's focus on flying and the obstructed view from the opposite side; (2) group size; (3) horse activity (moving); (4) snow and snow squared (both included if either was); (5) rugged terrain; and (6) distance of the horse group from the observers.

The effects of distance (99.5% of model weight) and snow (92.0% of model weight) were very strongly supported. Effects of group size (63.8%) and rugged terrain (47.5%) received modest support. The effects of horse movement (28.9%) and pilot-side effect (25.3%) received minimal support, so were unimportant predictors of sighting probability in this dataset.

All groups visible on both sides of the aircraft were seen by the front observers, making sighting probability 100% for these groups (Table 3). Visibility in the front for groups on the pilot's side was essentially the same as for the primary observer's side, which seems to indicate that the pilot had a good ability at spotting groups. Groups that were larger, moving, in smooth terrain, or closer to the observers were more visible, as expected. Sighting probability was lower for the average back seat observer than for either front-seat observer. Sighting probability in the front was higher for observer BS than for TS. Sighting probability varied dramatically among back-seat observers.

The estimated sighting probabilities for the combined observers ranged across horse groups from 42.5-100%. For front-seat observers, independent sighting probability ranged from 29.4-100% and for back-seat observers it was from 13.7-98.7% (excluding groups on the centerline, which were unavailable to back seat observers). Comparing actual horses seen to the estimated population size computed from the estimated sighting probabilities, I estimate that 6.3% of the horses in these combined surveys were never seen by any of the observers, with as much as 9.5% missed in Lost Creek HMA (Table 1). The high overall sighting probabilities resulted in good confidence intervals and coefficients of variation, averaging 3.1% for the complex and ranging from 2.4% to 9.5% across the individual HMAs. Even in this survey area with excellent sighting conditions characterized in most places by very open and relatively smooth terrain, adjustment to raw counts for those groups not seen by any observer are needed. This underscores the importance of using a statistical method for correcting raw counts.

Assumptions and Caveats

The results obtained from these surveys are estimates of the horses present in the areas surveyed at the time of the survey and should not be used to make inferences beyond this context.

The reliability of results from any population survey that is based on the simultaneous double-observer method rests on several important assumptions.

1. First, the method assumes that all groups of animals are flown over once during a survey period, and thus have exactly one chance to be counted by the front and back seat observers, or that groups flown over more than once are identified and considered only once in the analysis. Groups counted more than once would constitute 'double counting,' which would lead to estimates that are biased higher than the true number of groups present. Photography and the identification of 'marker' horses (e.g., horses with unusual coloration) in each group, and variation in group sizes, helped to reduce the risk of double counting during aerial surveys. This was probably not a large problem in this data set because staff from the Lander Field Office and Rawlins Field Office were meticulous about searching for and removing possible double-count observations from the data, with reference to detailed notes about horse color, photographs, and way point locations of observations (P. Griffin, pers. comm.).

   Additionally, groups that are never available to be seen (for example, due to temporary emigration from the study area, due to moving, undetected, from an unsurveyed area to one already surveyed, or due to being in such dense tree cover that they were effectively invisible to any observer) can lead to estimates that are negatively biased compared to the true population size. Although attempts were made to minimize the potential for horse movement among survey days by making use of fences, rivers, and topographic barriers, inter-day horse

movements during a multi-day survey could potentially bias results if those movements result in unintentional double counting or unavailability of groups.

Unfortunately, there was a one day break in the survey, due to a winter storm; the survey through the first 2 days had covered Antelope Hills, Crooks Mountain, and most of the areas in 'the middle' of the complex. Fences separated most of the areas surveyed up to the end of the second day from the unsurveyed areas, with the exception of within Stewart Creek. The survey staff was hopeful that the rim dividing Stewart Creek would limit movement from areas surveyed before the storm to areas surveyed after the storm.

The results presented here are based on a survey design and methods that assume that any unobserved movements were random, so combined effects of double counting and unavailable groups, if there were any, would cancel each other out.

2. Second, this method assumes that all horse groups with identical sighting covariate values have equal sighting probability. If there is additional variability in sighting probability not accounted for in the sighting models, such heterogeneity could lead to a negative bias (underestimate) of the population. However, given the relatively good sighting conditions that led to high sighting probabilities during this survey, this issue is unlikely to be important. It is possible that there could have been horse groups in heavily forested areas, for example in Green Mountain HMA, with substantially different detection probabilities that were not well represented in the observation data. If this was the case, then the estimated abundance for such areas (Table 1) would be lower than the true value. However, this potential problem is mitigated by the fact that transects over the heavily vegetated areas were generally spaced <0.5 miles apart, thereby compensating for the reduction in visibility caused by the vegetation.
3. A third assumption is that the number of horses in each group is counted accurately. In very large groups it may be common to miss a few horses unless photographs are taken and scrutinized after the flight. Relying on raw counts made from the airplane could lead to biased low estimates of population size. Using photography is in the drafted standard operating procedures for BLM double-observer aerial surveys for horses, when group size is ≥20. Group sizes ranged from 1 to 100 horses in this survey with 53 groups (15%) containing >10 horses (14 groups of those groups had >20 horses), so inaccurate counting would have been a substantial risk for some groups. Observers circled over large groups to get as accurate a count as possible and did use photography consistently to record group size of most large groups.

Given the several potential sources of bias, listed above, it is more likely that the estimates are somewhat lower, rather than higher, than the true population, unless the problem of potential double counting was not adequately avoided. However, given the high sighting probabilities and precision estimated for these surveys, the population estimates I present here provide a sound and reliable basis for management decisions.

Recommendations for Future Surveys

Several observations about the data may offer opportunities to improve future surveys.

1. There is a substantial benefit to maximizing the sighting probabilities and minimizing the number of different factors that cause variation in sighting probability. By far the most potent means to accomplish both objectives is to reduce the number of observers used in future surveys. In this survey, 2 individuals observed from the front seat and 5 from the back. One of these (EC) observed only 9 groups–less than an ideal sample size for estimating individual

acuity. There is no need to rotate observers in the front seat–a single observer should be used for the entire set of surveys, if possible, and no more than 2. It is preferable to have one observer consistently in the front seat, rather than having observers rotate from front to back seats. In a data set such as this, though, where there are a substantial number of observations from two districts, it is understandable if the district specialist sits in the front during the portion of the survey over their district. Using a single pilot is also preferred, as was done in this case. Back seat observers must be rotated, as they were, but they should be limited to as few as possible–ideally only 2 but no more than 3 or 4 unique individuals. All observers should be present long enough to accumulate >30 observations. Most important, observers should be carefully selected based on their past performance and ability to spot horses. The wide variation in acuity of the observers used in this survey suggests an opportunity to both reduce the total number of observers while retaining only those with high sighting probabilities (Table 3). It is especially important to use highly qualified observers in the front seat. These changes could improve the precision and reduce the risk of undetected biases in future results.

2. The presence of heavy vegetation cover in the Green Mountain HMA poses a challenge. It would be good to have sufficient data to estimate the effect of this vegetation cover given the tight transect spacing over it. The current dataset did not an adequate sample size. A future survey might be done when the population is larger, thereby providing a larger sample size. Or, a future survey could be pooled with the current one to obtain a larger sample size. To make this effective, it is important that future surveys be done under as similar conditions to the current one as possible. It is especially important for the observers used in the future to be primarily ones who already flew this survey.
3. I emphasize the continued importance of using photography for large horse groups (>10 is preferable, >20 is extremely important) so that group sizes recorded in flight can be validated with reference to photographs after the flight to ensure that such groups are counted accurately. Given that this population may have a tendency to form large groups, it is all the more important to have accurate counts of group size for each large group. A reliable, high-resolution camera with an adequate telephoto or zoom lens for the distance between observer and horses should continue to be used for this purpose.
4. The pilot followed predetermined transect lines (Figure 1) that were loaded into the pilot's GPS unit during most of the fight that were the same pattern of planned flight lines as was used for these surveys in 2014. The flight lines were generally spaced between 0.5-2.0 miles apart, depending on topography and vegetation. Tighter transects were flown over the mountains in the Green Mountain HMA and extending to the west beyond the boundary of that HMA (Figure 1). Slightly tighter transects over the eastern portion of the mountains in Green Mountain HMA might be desirable. Nevertheless, the high overall sighting probabilities estimated for this survey indicate that the transect layout generally provides good coverage.
5. Temporary emigration into or out of the surveyed areas was unlikely to have been a significant problem. The survey area (including the area outside of HMAs referred to as "the middle") is bounded by highways and fences along most of the north, west, and east sides. There are gaps that would permit horses to cross the study area southern boundary of Lost Creek HMA; however, this is an area of relatively low horse density. There are certainly opportunities for horses to move among some of the HMAs within the overall complex, particularly between Antelope Hills and Lost Creek. Extending future surveys outside of the

HMA boundaries in this area should be considered in areas where there may be wild horse activity.

6. The survey design and execution was adequate to minimize the possibility of horse movements within the survey area that could result in undercounting or no opportunity to observe some groups more than once, except for the unexpected interruption of the survey due to weather. If a storm is forecast that will disrupt a survey and the aircraft will continue to be available, it is better to wait to begin the survey of a given HMA or complex until the storm has passed. To the extent possible, future inventories should continue to include all the HMAs in this complex together on consecutive days.

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Lubow, B.C., and J.I. Ransom. 2007. Aerial population estimates of wild horses (*Equus caballus*) in the Adobe Town and Salt Wells Creek Herd Management Areas using an integrated simultaneous double-count and sightability bias correction technique. Open File Report 2007-1274. U.S. Geological Survey. 13 p.

National Research Council. 2013. Using Science to Improve the BLM Wild Horse and Burro Program. The National Academies Press. Washington, D.C.

Table 2. Tally of raw counts of horses and horse groups by observer (front and back) and survey year for combined HMAs. This table is based on raw counts (not statistical estimates) and, therefore does not address groups not seen by any observer.

Observer	Groups Seen (Raw Count)	Horses Seen (Raw Count)	Actual Sighting Rate[a] (Groups)	Actual Sighting Rate[a] (Horses)
Front	182	1,614	87.9%	90.5%
Back	163	1,470	78.7%	82.4%
Both	138	1,300	66.7%	72.9%
Combined (either)	207	1,784		

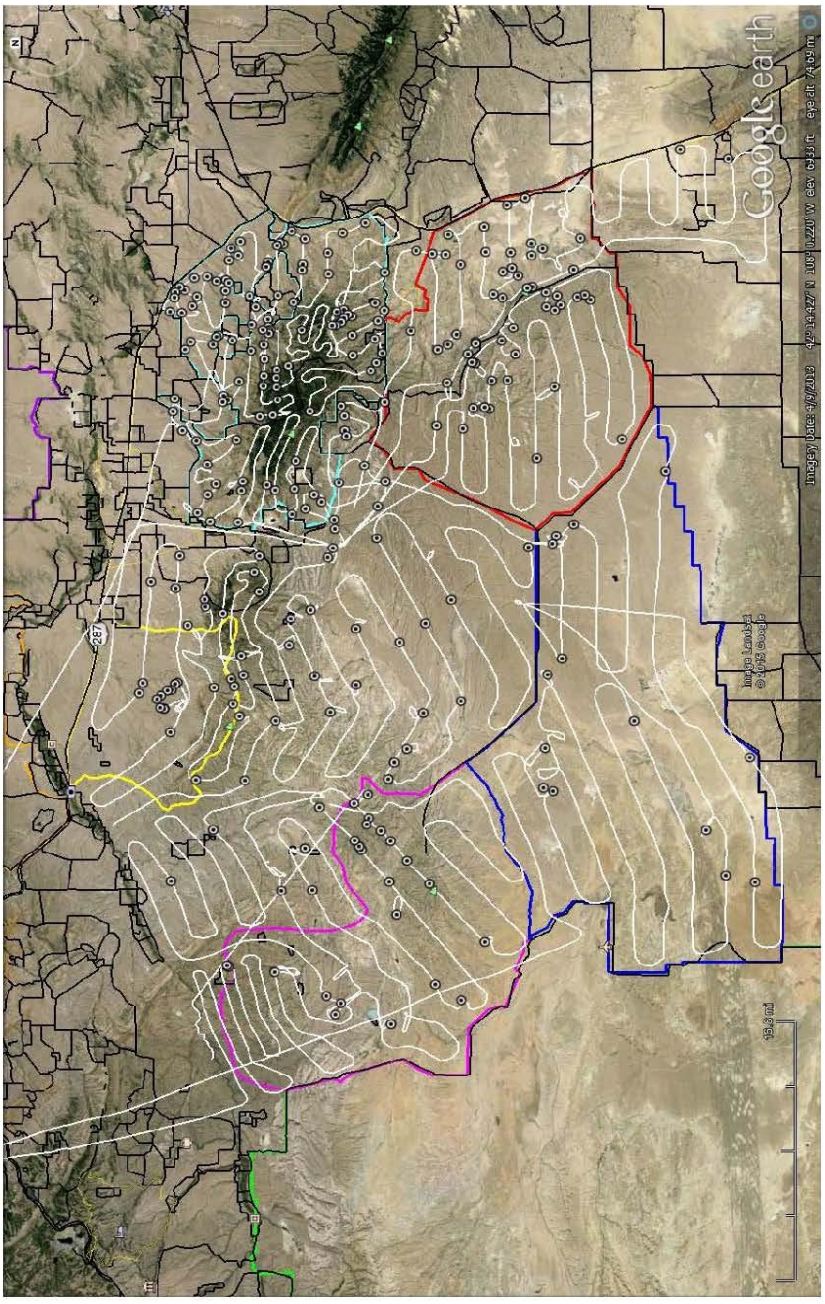
[a] Percentage of all groups/horses seen that were seen by each observer.

Table 3. Illustration of the effects of observers and sighting condition covariates on estimated sighting probability of horse groups for both front and rear observers. Baseline case (**bold**) is for observers in the indicated seat (except for horses on the pilot's side observed in the front). The baseline is for front observer TS, the average back-seat observer, a group size of 6 horse (the median value observed), horses not moving, smooth terrain, no snow cover, and the most common distance category (¼-½ mile). Other cases vary a covariate, one effect at a time, as indicated. Sighting probabilities for each row should be compared to the baseline (first row) to see the effect of the change in observer or condition. Baseline values are shown in bold wherever they occur. Sighting probabilities are calculated from weighted averaged model parameters across all 64 models.

	Sighting Probability, Front Observer	Sighting Probability, Back Observer
Baseline	**86.3%**	**78.3%**
Effect of horses on centerline	**86.3%**	0.0%
Effect of horses on both sides	100.0%	**78.3%**
Effect of Pilot's side[a]	86.9%	**78.3%**
Effect of group size (N=1)	84.5%	75.7%
Effect of group size (N=10)	87.7%	80.3%
Effect of horse movement	87.2%	79.6%
Effect of rugged terrain	79.7%	69.3%
Effect of snow cover (50%)	72.1%	59.6%
Effect of snow cover (100%)	73.5%	61.4%
Effect of distance (0-1/4 mile)	91.4%	85.9%
Effect of distance (1/2-1 mile)	74.4%	62.5%
Effect of observer BS in front	91.5%	**78.3%**
Effect of observer PG in back	**86.3%**	53.2%
Effect of observer TV in back	**86.3%**	87.0%
Effect of observer BS in back	**86.3%**	77.8%
Effect of observer TS in back	**86.3%**	95.7%
Effect of observer EC in back	**86.3%**	50.8%

[a] Sighting probability for the front observers acting as a team when the horses were on the pilot's side of the flight path, regardless of which of the front observers saw the horses first.

Figure 1 (following page)**.** Map of surveyed areas in the Red Desert complex, including Antelope Hills HMA (pink), Crooks Mountain HMA (yellow), Green Mountain HMA (light blue), Stewart Creek HMA (Stewart Creek), and Lost Creek HMA (dark blue). White lines indicate the actual path of the helicopter taken during surveys. Circles are GPS waypoints at the locations where observers saw groups of animals. Black lines depict fencing. Adjacent and nearby management areas not included in this survey are shown for reference: Divide Basin HMA (green), Dishpan Butte HMA (orange), and Muskrat Basin HMA (purple).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APPENDIX 7 Individuals, Organizations, Tribes or Agencies consulted

- Wyoming Governor's Office
- Andrea Lococo, Animal Welfare Institute
- Government and Legal Affairs, Animal Welfare Institute
- c/o Ernie Evans, Bureau of Indian Affairs
- Carbon County Commissioners
- Carl L Huhnke, Central Bank & Trust
- Congresswoman Cynthia M Lummis
- Deniz Bolbol
- Liz Clancy Lyons, Doris Day Animal League
- Double D Ranch, Dwayne and Denise Oldham; Ed Womack
- Office of the Governor, Environmental Policy Division
- Doug R Anesi, First Interstate Bank
- Douglas L Thompson; Chairman, Fremont County Commission
- Gail O'Neal
- Gerald Nelson
- Hooved Animal Humane Society
- Jack Corbett
- Wyoming Advocates for Animals, Jeannie R. Stallings
- Fremont County Cattlemen, Jim Hellyer
- Kathy Gregg
- Kevin Edinger, NRCS
- Marybeth Devlin
- Mathew Dillon
- Mike Henn, Wyoming State Land & Farm Loan Office
- Jeri Trebelcock, Popo Agie Conservation District
- Animal Protection Institute of America, Public Land Wildlife Division
- REP. Larry Meuli, MD
- REP. William "Jeb" Steward
- Rock Springs Grazing Association
- Ron Cunningham
- Scott Harnsberger
- State Planning Coordinator
- Steve Poitras, NRCS
- Tim and Heather O'Neal
- Tom Morrison
- Tyrel Nicholas
- U.S. Senator John A. Barrasso
- U.S. Senator Mike Enzi
- Lander Fish and Wildlife Conservation Office
- US Fish and Wildlife Service
- US Rep. Cynthia Lummis: ATTN: Pat Aullman
- US Rep. Cynthia Lummis; ATTN: Bonnie Cannon

- US Rep. Cynthia Lummis-Cheyenne FO
- US Senator Mike Enzi: ATTN: Reagon Green
- US Senator Mike Enzi: ATTN: Robin Bailey
- US Senator Mike Enzi: Casper Field Office
- US Senator Mike Enzi: Cheyenne Field Office
- Travis Bruner, Executive Director, Western Watersheds Project
- Jonathan B. Ratner, Director, Western Watersheds Project
- Tribal Historic Preservation Office, Wilfred Ferris
- Northern Arapahoe Tribal Historic Preservation Officer, Yufna Soldier Wolf
- Linda Serdiuk, Wind River Backcountry Horsemen Assoc.
- Wyoma D. Burris
- Jason Fearneyhough, Director, Wyoming Department of Agriculture
- Natural Resource & Policy Section, Wyoming Department of Agriculture
- Office of the Director (5), Wyoming Game & Fish Department
- Wyoming Game & Fish Department, Amy Anderson
- Wyoming Livestock Board
- Jennifer Womack
- Wyoming Livestock Roundup
- Field Director, Wyoming Outdoor Council
- Dick Loper, Wyoming State Grazing Board
- Patricia M. Fazio, Ph. D. Statewide Coordinator, Wyoming Wild Horse Coalition
- Executive Director, Wyoming Wildlife Federation
- Harold Schultz, Wyoming Wildlife Federation
- Wyoming State Historic Preservation Office (SHPO)
- Wyoming State Lands & Investments
- Wyoming Travel & Tourism
- Wyoming Planning Office
- Shoshone Business Council
- Shoshone Rose Casino
- Wyoming Business Council
- Wind River Visitors Council, c/o Paula McCormick
- Lander Chamber of Commerce
- City of Lander, c/o Mayor Mick Wolfe
- Arapahoe Business Council
- Abernathy Ranches, LLC
- David, Lyle and Colleen
- Armstrong Ranch, Inc.
- Armstrong , John D. & or William L. Bregar
- Jolley Livestock Grazing Association, LLC
- Poor Farm DTA, LP
- Anderson, Christopher and Susan
- Walking S Grazing Association, LLC
- Stewart Creek LLC
- Schiff of Wyoming, LLC. Split Rock Ranch

- Faris, Allen Guy
- Chris Anderson, ET AL.
- Quarter Circle Block, LLC
- Joshua Anderson Ranch Management, LLC
- Whitlock, Robert or Judy
- Alkali Creek Grazing Association

APPENDIX 8 Summary of Scoping and Public Comments

Comment No.	Comment or Issue	BLM's Response
1	Humane Handling and Treatment. Methods used to avoid injury and possible death to foals of the year and older horses during gather operations. Impacts that gathering and processing would have on the horses.	BLM has developed standards for the humane handling and treatment of wild horses (IM 2015-151) which would be implemented under all action alternatives. The impacts of gathering and processing horses is part of the EA. Refer to Section 3.1.2. See also Appendix 1
2	Horses relocated back in to the HMA boundaries, and remedy conditions that are allowing horses to move outside of the HMA boundaries.	In accordance with the WFRHBA, the BLM manages the HMAs to maintain a thriving natural ecological balance, as reflected in the AMLs of the approved RMPs. Relocating horses to the HMA would not address the Complex being over AML, would not maintain a thriving natural ecological balance, or meet the purpose and need. Also, past relocation efforts have shown that horses that are relocated generally return to the same area within 24 hours. Removal of horses outside the HMAs in in compliance with the WFRHBA, FLPMA, and 43 CFR 4700.
3	Increase AMLs to population levels.	Thanks for your comment. Outside the scope of this EA. Appropriate Management Levels are established through LUP decisions and are not adjusted in a gather EA.
4	Compensate ranchers for partial or full non-use or permanent retirement of grazing permits within HMAs.	Thanks for your comment. Outside the scope of this EA. BLM does not compensate permittees for taking non-use on their permits. The amount of use on a given allotment may be adjusted and is agreed upon between the BLM and the permittee.
5	Minimally intrusive gather methods that preserve herd social structure, using bait and water trapping gather methods instead of helicopter gather methods.	Gather methods that have been considered in drafting this EA include bait and water trapping. However, due to the size of the Complex, number of horses above AML, limited access to many areas, and the multitude of available water sources, this method was not carried forward in the analysis as a sole gather method. The Proposed Action was adjusted to allow this this technique if it is found to be plausible on a localized basis on an HMA-level. Helicopter gathers have been shown to be safe and humane

Comment No.	Comment or Issue	BLM's Response
		in gathering wild horses. See Section 2 for alternatives considered in the drafting of this EA.
6	Economic analysis of the cost of removing horses from the range vs. relocating them back within HMA boundaries. (The lifetime costs, estimated by BLM to be $43,000 per horse removed, should also be included in this analysis.)	Economic analysis for the removal of horses has been analyzed on a national basis. For information on the wild horse budget, visit: https://www.blm.gov/programs/wild-horse-and-burro/about-the-program/program-data
7	Analysis of surgical or chemical sterilization. Number of mares proposed to receive contraception or sterilization.	See Section 2.5.5. Sterilization of mares is not proposed and was not analyzed. The number of mares proposed to receive contraception is identified in Ch. 2 of the EA.
8	Sex ratio skewing	Sex ratio skewing is not proposed in this gather and as a result is not analyzed in this EA This has been utilized in this Complex and it has not been shown to reduce population growth, therefore was not considered because it would not meet the purpose and need.
9	PZP could be applied without the need for roundups, a comprehensive fertility control program should be developed to avoid future gathers.	PZP has been successfully applied through intensive darting programs. Such a program has not been employed, and is not plausible, in this Complex due to its size, number of horses above AML, and difficult access to horses when PZP would be most effective. However, if this technique is found to be plausible on a localized basis on an HMA-level, it may be implemented after the herd size were reduced to AML. This potential program was added to the Proposed Action.
10	The PZP administration should also be tracked because repeated administration of this drug will cause sterility in mares. Past scientific monitoring research and report data for all contraception applications including but not limited to capture and field darting and type of fertility drug, number and estimated age of each mare darted and identifying marks of each	Research has shown that some mares never reproduce after repeated application of PZP. In this complex, PZP was last applied in 2011. Using current population survey estimates shows that we are not experiencing prolonged reproduction suppression in all treated mares. Past application of PZP to mares is tracked by giving treated mares a brand. An EA is to provide an analysis to make a reasoned choice among alternatives and to determine whether or not a significant impact would occur. EA's are concise and summarize necessary data and research relevant to the direct and indirect effects

Comment No.	Comment or Issue	BLM's Response
	animal for purposes of non-removal of those mares during the proposed capture. If no identifying marks, then method of determining which mares will be given fertility control and/or removed during the upcoming capture plan. The same request for all fertility treatments of this herd for the past twenty years.	of the proposed action and reasonable alternatives, and cumulative impacts. The EA summarizes information necessary to meet that requirement. Cumulative impacts, which include the incremental impact of the action when added to other past actions, are disclosed in Section 4, and in a manner consistent with 43 CFR 46.115. Application of fertility control vaccines by darting has not occurred in the Red Desert Complex. Mares that have received fertility control vaccinations during past gather operations were given a freeze mark for future identification.
11	BLM mustang horse camping tours.	BLM does not provide camping tours. Thank you for your comment.
12	AMLs should be reevaluated to ensure genetic variability. Please provide records which show results of genetic testing for the past 20 years. Manage horses to ensure genetic diversity and prevent inbreeding.	AMLs are established through the land use planning process and will not be amended in this EA. It is however recognized that individually these HMAs populations are near the threshold for decreased genetic variability. However when considered as a complex population with interchange between each, genetic variability is preserved. A brief description of results for genetic tests completed in 2009 for the Rawlins HMAs and 2006 for the Lander HMAs can be found in Appendix 3.
13	Boundary adjustment to include area between Stewart Creek and Green Mountain.	HMA boundary adjustments are part of the land use planning process. This is outside the scope of this EA.
14	Livestock AUM's must be reevaluated, re-prioritized, reduced, and/or eliminated if necessary to insure that forage within the HMAs is devoted principally to the welfare of wild horses in keeping with the Multiple use management concept. Accurate and comprehensive disclosure of AUMs allotted to wild horses, livestock and wildlife.	AUM allocations are outside the scope of this EA. An alternative to remove or reduce livestock, which would allow for reallocation of AUMs, was considered but not carried forward for detailed analysis because these decisions are made in the LUP process, see Section 2.5.3.
15	Any efforts to control wild horse populations should include protection of predators,	Control of wild horse populations by natural means, including predation, was considered but not carried forward for detailed analysis because

Comment No.	Comment or Issue	BLM's Response
	specifically mountain lions – the most natural and least expensive way to control populations of all wildlife.	it would be contrary to the WFRHBA, FLPMA and PRIA. BLM is required to prevent range degradation from overpopulation of wild horses. Predators of sufficient size and number to regulate horse populations do not exist within the Complex. See Section 2.5.6.
16	Varied herd growth rates and each herd should be evaluated separately.	Treatment of these HMAs as a Complex does not preclude analysis on the individual HMA basis. Gathering, removing and possible treatment would be done on an HMA basis.
17	Impacts of the roundup are disruptive and damaging to the environment and ecosystem on every level.	Gather operations do cause disruption and damage on a local scale for a short period of time, but they are conducted to minimize impacts, are not expected to result in long term effects to the environment, and relieve other long-term impacts. Gather SOP's can be found in Appendix 1.
18	Noise from helicopters is tremendously disturbing to wildlife, such as sage grouse.	Protective stipulations relating to wildlife during gather operations are part of this EA, see Gather SOP's found in Appendix 1. Thanks for your comment.
19	Equipment used for gather activities increase global warming and should not be allowed.	The use of other gather methods were considered but not carried forward for detailed analysis in this EA. These methods may or may not result in fewer emissions. Other methods of gathering may take longer and have a similar impact over time. See Section 2.5. Thank you for your comment.
20	Dust generated by gather activities can cause infections to horses, and harm wildlife.	Dust abatement measures are part of the SOP's for gather operations found in Appendix 1. Thank you for your comment.
21	Gather operations would apply stresses that would make horses more likely to consume halogeton, which causes poisoning if eaten in large amounts.	Halogeton does cause toxicity in horses if consumed in sufficient amounts. There has been no observed increase in halogeton consumption in wild horses during or post gather operations.
22	Gather activities could cause damage to riparian habitats by trampling of the area by horses being gathered and equipment used to gather and transport them.	Riparian habitats would be avoided for trap site locations. Riparian habitats may be crossed while horses are being gathered. This impact would be on a small percentage of riparian habitat and only where horse actually crossed it.

Comment No.	Comment or Issue	BLM's Response
23	Detailed map of fence boundaries, including allotments, pastures, water sources or improvements, exclosures, and range improvement projects.	Map 2 provides an overview of HMAs overlaid on allotment boundaries. Range improvements are a valuable tool for the BLM management of the public lands. However the Proposed Action and the alternatives were designed specifically to address the need to remove excess wild horses to maintain the established AMLs and a thriving natural ecological balance. Please refer to Section 1.1 for the purpose and need for this action.
24	All capture methods planned for the next ten years and the number of horses to be removed using each method.	This is unknown at this time and would be determined at the time of future gathers.
25	If bait/water trapping is to be utilized, how will the public be informed, who will decide on euthanasia and will they be disposed of, and how will the public be informed of this action.	Bait and water trapping as a sole gather-method was an alternative considered but not carried forward in this EA. Euthanasia decisions are the responsibility of the Lead COR with counsel with the onsite APHIS veterinarian on special cases. Horses would be disposed of in accordance with state regulations. Daily reports are posted to the internet summarizing activities performed each day the gather takes place. These reports include the number gathered, the number removed, the number released, and any deaths associated with the gather.
26	Request that scientific monitoring data, including data that supports the claim that horses are overpopulating the HMA land and /or causing damage to the range versus livestock and wildlife and other multiple uses.	The EA provides the data and analysis to make a reasoned choice among alternatives and to determine whether or not a significant impact would occur. EA's are concise and summarize necessary data and research. See Section 3.
27	Methods used by BLM to determine and differentiate between livestock, wild horse and wildlife usage of water resources on the HMA within the past ten years and include the research data and reports. A proposed EA concerning any wild horse gather management must include all of the uses in	BLM does not manage water usage.

Comment No.	Comment or Issue	BLM's Response
	the district that use any water and any land use, including surface and sub-surface	
28	Provide all scientific monitoring research and report data for all pre and post capture actions on each of the HMAs within the past 20 years, including but not limited to aerial and ground observation that verifies the post roundup census population of WH&B.	An EA is to provide an analysis to make a reasoned choice among alternatives and to determine whether or not a significant impact would occur. EA's are concise and summarize necessary data and research relevant to the direct and indirect effects of the proposed action and reasonable alternatives, and cumulative impacts. The EA summarizes information necessary to meet that requirement. Cumulative impacts, which include the incremental impact of the action when added to other past actions, are disclosed in Section 4, and in a manner consistent with 43 CFR 46.115. Past gather information can be found in Appendix 2.
29	Scientific monitoring data and reports for all previous captures that verifies the roundups contributed to range health improvement solely due to the removal of wild horses. This must include population data, and any changes in livestock and wildlife use.	An EA is to provide an analysis to make a reasoned choice among alternatives and to determine whether or not a significant impact would occur. EA's are concise and summarize necessary data and research relevant to the direct and indirect effects of the proposed action and reasonable alternatives, and cumulative impacts. The EA summarizes information necessary to meet that requirement. Cumulative impacts, which include the incremental impact of the action when added to other past actions, are disclosed in Section 4, and in a manner consistent with 43 CFR 46.115.
30	Detailed list and analysis of impact of all other "multiple uses" on the HMA.	An EA is to provide an analysis to make a reasoned choice among alternatives and to determine whether or not a significant impact would occur. EA's are concise and summarize necessary data and research. For impacts associated with the alternatives and cumulative impacts see sections 3 and 4 in the EA.
31	BLM reasoning and research and report data that wild horses are in excess on the HMA. Include reasoning behind the	Based upon all information available, the BLM determined that approximately 2,140 excess wild horses exist within the Complex (inside of HMA boundaries and outside) and would need to be

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	annual livestock usage versus wild horse allocations. Include data that supports the percentages of AUMs for private livestock versus wild horses is a legally supported authorization.	removed to maintain a thriving natural ecological balance. This assessment is based on the following factors including, but not limited to: • Wild horse population double observer population survey estimates and distribution; • Range trend monitoring and results; and • The Standards and Guidelines Rangeland Health Assessments (2013b and 2003). Allocation of AUM's was completed during the land use planning process. According to the Rawlins and Lander RMPs, livestock grazing is an authorized use in wild horse HMAs.
32	Include details of plan to maintain or recover the short and long term genetic diversity and health of each of the proposed remaining herds.	Genetic testing of horses gathered in the Complex is included in 2 Alternatives in the EA to ensure that genetic viability is maintained.
33	Total number and age of mares, stallions and foals that were returned to the range after each previous capture in the last twenty years and the general area that they were released and reasoning of why they were released there.	An EA is to provide an analysis to make a reasoned choice among alternatives and to determine whether or not a significant impact would occur. EA's are concise and summarize necessary data and research relevant to the direct and indirect effects of the proposed action and reasonable alternatives, and cumulative impacts. The EA summarizes information necessary to meet that requirement. Cumulative impacts, which include the incremental impact of the action when added to other past actions, are disclosed in Section 4, and in a manner consistent with 43 CFR 46.115.
34	Environmental damage caused by other uses to the wild horse population for the last twenty years.	An EA is to provide an analysis to make a reasoned choice among alternatives and to determine whether or not a significant impact would occur. EA's are concise and summarize necessary data and research relevant to the direct and indirect effects of the proposed action and reasonable alternatives, and cumulative impacts. The EA summarizes information necessary to meet that requirement. Cumulative impacts, which include the incremental impact of the action when added to other past actions, are disclosed in Section 4, and in a manner consistent with 43 CFR 46.115.

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35	Remove all BLM (grazing or other source) interior fencing to allow for free roaming behavior, and protect horses and other animals from wire; disclose fencing.	HMAs in this complex have limited number of fences inside the HMA. Some fences have been identified to be removed seasonally or let down to improve wild horse/wildlife movements, see Section 3.6.
36	Replace, remove or retrofit cattle guards within HMA boundaries with safety features so that horses could cross them safely.	Cattle guards are sometimes used on HMA boundaries fences only, where major roads and fences intersect. Wild horse have rarely been caught in cattle guards in this Complex. The use of cattle guards within an HMA is limited as the risk to animals, not just wild horses, is high.
37	Disclose and identify all beneficial range restorations, water enhancements and protections of spring heads to maximize habitat for wild horses and encourage utilization of entire range.	Range improvements are a valuable tool for the BLM management of the public lands. However the Proposed Action and the alternatives were designed specifically to address the need to remove excess wild horses to maintain the established AMLs and a thriving natural ecological balance. Please refer to Section 1.1 for the purpose and need for this action. Also, see Section 3.3, 3.4, and 3.6 for discussion on rangeland improvement discussions.
38	Fully disclose all data on the wild horse population for each HMA within the complex, including demographic information and migratory patterns and seasons. Conduct accurate census.	An EA is to provide an analysis to make a reasoned choice among alternatives and to determine whether or not a significant impact would occur. EA's are concise and summarize necessary data and research relevant to the direct and indirect effects of the proposed action and reasonable alternatives, and cumulative impacts. The EA summarizes information necessary to meet that requirement. Population survey completed in April 2015. See Appendix 6 for analysis memo.
39	Alternative for emergency situations including but not limited to temporary water hauling	An emergency situation does not currently exist within the complex.
40	Repatriate any wild horses removed to zeroed out HMAs.	Moving wild horses gathered in the Red Desert to another area not designated for long term wild horse management would be contrary to land use planning decisions and is outside the scope of this EA.

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41	Ensure that BLM is in compliance with Section 106 of the National Historic Preservation Act, and that it is done in consultation with local tribes.	Consultation with the Wyoming State Historic Preservation Office was accomplished according to the Wyoming State Protocol agreement of the BLM National Cultural Resources Programmatic Agreement, which states inventory may not be required for "Animal traps and corrals in use for three days or less" (SHPO Protocol Appendix B-21).

APPENDIX 9 Summary of Public Comments on Revised May 2017 EA Document

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1	The Revised EA indicates that BLM made no substantive changes to its previous plan, nor did it consider any additional alternatives to comply with the Court's order and applicable land use plans (p. 1).	EA DOI-BLM-WY-030-EA15-63 is a revised EA that addresses a March 20, 2017 order of the U.S. District Court, District of Wyoming, in Friends of Animals v. BLM, No. 16-CV-0199-NDF. In that case, the court remanded the original EA, Decision Record, and Finding of No Significant Impact (FONSI), with instructions that: "…BLM should analyze whether selective removal/retention criteria should be utilized during the gather to increase the recognized occurrence of the breed(s), and/or whether additional genetic analysis, monitoring and/or management practices should be implemented to help assure a sufficient prevalence of the breed(s), and/or whether the removal and fertility control program affecting horses in herds in the Lost Creek and/or Antelope Hills HMAs should be revised." Accordingly, EA # DOI-BLM-WY-030-EA15-63 was revised to specifically address the impacts of the alternatives on horses in the Complex which possess the New World Iberian genotype. Changes were also made to the alternatives themselves. Language clarifying the preferential retention of individual horses that appear to have phenotypic characteristics associated with horses descended from New World Iberian breed types was added in the May 2017 version. Additionally, the current version, in Section 2.3, gives examples of such traits, and specifies a citation that will be referred to in identifying such individuals. The court order did not specifically require the development of additional alternatives, and no additional alternatives that meet the purpose and need for this action were identified during the review process.
2	The EA's analysis is not "full", "adequate", or "comprehensive" in relation to various subjects.	The EA provided the data and analysis necessary to make a reasoned choice among alternatives and to determine whether a significant impact

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		would occur. While providing complete information, EAs are also intended to be concise. Below, we respond to the specific comments. One comment claims that NEPA, WFRHBA and BLM policy "…require a more comprehensive analysis based on current information." That paragraph includes a request that BLM circulate another Environmental Assessment that contains additional analysis of the impact of proposed actions on the genetic affinity between Red Desert horses and New World Iberian breed types. The revisions to the May 2017 EA represent additional disclosure of analyses leading to the conclusion that the proposed actions would be consistent with the Rawlins RMP, with respect to genetic diversity concerns. The information presented in the updated Appendix 3 is more comprehensive, insofar as it presents a more complete summary of Dr. Cothran's analyses of the lack of genetic change in the sampled Lost Creek HMA horses from 2001 through 2009 and New World Iberian breed types, with respect to other major breed types. A related comment claims that the "…revised EA fails to fully analyze how the proposed actions could impact wild horses in the Red Desert Complex with genetic markers that link them to historically significant Iberian breeds, and how it would impact the unique genotype and associated phenotypes." The draft revised EA of May 2017 did provide enough information for the BLM to make the relevant decision with respect to the similarity of sampled genetic individuals to the New World Iberian breed type. The updated Appendix 3 demonstrates that, since 2001, there has been no statistically significant change in the relative similarity of sampled Lost Creek horses to the New World Iberian breed types, relative to other breed types. The conclusion is that the historical management actions from 2001 to 2009 did not lead to any measurable degradation of the similarity of Lost Creek HMA horses to the New World Iberian breed types, with respect to their similarity to

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		other breed types. The revised EA of May 2017 clearly stated the intention to preferentially retain horses that displayed phenotypic characteristics that have been popularly associated with the New World Iberian breed types. The May 2017 EA did not specify which phenotypic traits would be used to discriminate between horses and, thus, to attempt to increase the relative prevalence of New World Iberian associated phenotypes in the herd. This revised EA does include more specific language about examples of phenotypic traits would be used to make that discrimination (see Section 2.3). The May 2017 EA also noted that BLM would be collecting hair samples from horses turned back to the range due to their exhibition of such phenotypic traits in order that the BLM may learn whether the phenotypic traits used to distinguish putative descendants of New World Iberian breed types truly are, or are not, reliable indicators of a genetic similarity to New World Iberian breed types. In the context of the same claim about the adequacy of BLM's analysis, BLM also notes that, although 43 CFR 4700.0-6(a) does require that wild horses and burros be managed as self-sustaining populations, the spatial scale of those populations is not specified to be at the level of a single HMA. In the context of the Complex, it is clear that animals in these various HMAs interact both demographically and genetically.
3	BLM should circulate another Environmental Assessment (EA) or Environment Impact Statement (EIS) that contains additional analyses on the impact of the proposed actions on the Red Desert horses' Iberian genotype and phenotype.	As noted in response to comment #2 above, the current EA includes additional analyses leading to the conclusion that the proposed actions would be consistent with the Rawlins RMP, with respect to genetic diversity concerns. Dr. Cothran's (2006) report noted that, "Using the DNA data from 2001 and from 2006, the results of the comparison with domestic breeds was almost identical… In both cases the Lost Creek herd paired with the Morgan Horse but this pairing occupied a position in the tree that grouped outside the cluster of North American and Iberian breeds. Again this supports genetic

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		contribution from both groups. When both samples were included in the analysis…the results were essentially the same. The two samples were more similar to each other than to any domestic breed." These statements from Dr. Cothran (2006) support the conclusion that there had not been a notable change in the genetic makeup of the breed based on available monitoring data, up to that time. Other summarized results in Appendix 3 suggest that there was no significant change from 2006 to 2009, when Lost Creek horses were last sampled for genetic monitoring.
4	BLM should discuss the potential benefits of the no-action alternative.	As noted in Section 2.4, Alternative 3 (No Action Alternative) would not achieve the purpose and need for the decision, and would not be consistent with existing laws and policy. Nonetheless, expected results of Alternative 3 have already been included in the EA Section: 3.1.2., 3.2.2, 3.3.2, 3.4.2, 3.5.2, 3.6.2, 3.7.2, 4.1, 4.3, and 6.0. Value judgements about whether such anticipated results would be seen as 'benefits' or 'detriments' might depend on one's point of view. The commenter asks the BLM to discuss potential benefits of the No Action Alternative, but fails to identify any specific benefits that the BLM has omitted. Several benefits are implied but not expressly stated. These include higher wild horse abundance into the foreseeable future and preservation of the Iberian genotype. While preservation of the Iberian genotype would likely be a result of the No Action Alternative, based on the analysis of this EA, and, as clearly documented in previous and subsequent comments, the relative prevalence of Iberian genes is not likely to be negatively affected under any of the alternatives.
5	Create an alternative that seeks to preserve the wild horses' unique genotype.	As noted in Section 2.3, the Rawlins RMP specifically seeks to increase the recognized occurrence of the New World Iberian genotype and associated phenotype, especially in the Lost Creek HMA. Alternative 2 has the potential to increase the frequency of genes associated with the New World Iberian breed type.

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		It is unclear to what degree those phenotypic traits actually do correlate with alleles that have been identified as coming from New World Iberian breed type ancestry. To clarify this question, BLM will collect genetic samples from individuals that demonstrate such phenotypic traits and which are turned back to the range (as noted in Section 2.3). Therefore, Alternative 2 is expected to accomplish two things that could increase the prevalence of genetic traits associated with the New World Iberian breed type ancestry. First, by preferentially turning back to the range those individuals with identifiable phenotypic traits that are associated with New World Iberian breed type ancestry, those individuals would be expected to become a larger fraction of the breeding adults on the Complex. Second, by testing whether or not those visually identifiable traits are or are not reliable indicators of New World Iberian breed type ancestry, BLM would improve its ability to undertake such management of genetic traits into the future. Alternatives 1 and 3 would most likely maintain the prevalence of genes associated with the New World Iberian breed type at the current frequency. Alternatives 1 and 2 were developed to be responsive to the purpose and need identified in Section 1.1; many other alternatives were not analyzed, as noted in Section 2.5.
6	This analysis fails to consider whether the Iberian genotype may have a higher prevalence in some individual horses, and how BLM's actions could impact these horses. BLM also fails to consider additional analysis or sampling on the horses to assess the proposed impact of its actions.	Alternative 2 is premised on the assumption that certain horses may have greater or lesser phenotypic similarity to horse that have been identified as being of New World Iberian breed type ancestry. That alternative includes BLM actions that could increase the frequency of such horses in the wild, and also includes specific planning to sample such horses to test whether or not the phenotypic association is correlated with genetic markers that are associated with New World Iberian breed type ancestry. While it is true that some individual horses may possess more or fewer alleles that have descended from New World Iberian ancestors

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		than do other individual horses, there is no way to conclusively identify these horses without doing genetic testing. That is a process that requires sampling genetic material from individuals, sending the samples for analysis, and awaiting results. At present, that process can take many weeks, to months. Impacts of alternatives in this EA are considered with respect to the long term, population-level impacts on wild horses in the Complex and/or in individual HMAs. BLM is not generally required to manage with respect to individual animals. BLM has concluded that any action to capture horses, take samples for genetic analysis, wait weeks or months for results of the genetic analysis, and then make decisions about which horses to turn back to the wild would not constitute management "at the minimum feasible level." For that reason, this alternative was not analyzed in depth, but it is now included in the list of alternatives considered but eliminated from further analysis (Section 2.5.7). Alternatives 1 and 2 include sampling and genetic testing of retained horses in each of the HMAs within the Complex in conjunction with the proposed gather. Analysis of the samples collected in the proposed gather will inform BLM about the current status of genetic diversity in the sampled herds, whether or not there is a strong correlation between identified phenotypic traits and genetic markers that are known to be associated with New World Iberian breed type ancestry. Subsequent, future genetic monitoring after the proposed gather is beyond the scope of this document.
7	BLM does not account for the fact that its management actions of repeatedly removing large portions of the population "at random," including horses with greater evidence of Iberian ancestry, may be the cause of the diluted genotype).	See responses to #2 and #6 above. This comment appears to be based on an inaccurate premise, namely that the "New World Iberian genotype" has been "diluted" since 2001 when genetic testing first used genetic markers in the Red Desert Complex, or perhaps since the time when BLM assumed management of wild horses in the area. By "diluted," BLM understands the commenter to be asserting that the relative

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		frequency of alleles that are uniquely associated with New World Iberian breed type ancestry has declined over some unspecified time frame. The comment implies that past management actions, specifically the removals of "large portions of the population" have caused a decrease in the prevalence of those alleles. In terms of the time frame from 2001 to the present, BLM has examined data related to the similarity of sampled horses to New World Iberian breed types, relative to their similarity to other breed types, to determine whether that relative similarity has changed over time. As detailed in Appendix 3, BLM finds that there has not been a general decline in the similarity to New World Iberian breed types, relative to other breed types. In terms of a longer timeframe, it is not possible to make quantitative conclusions over time periods for which no data are available. The conclusion that removing horses from the population at random somehow caused a dilution of New World Iberian-associated alleles is not supported by available data. Available data indicate that there has not been a decline in the relative similarity of sampled Lost Creek horses to the New World Iberian breed types, with respect to other breed types where similarity was also measured. The commenter did not provide any quantitative evidence to the contrary, and BLM is not aware of any such evidence. It is the BLM's experience that the Red Desert herd is a robust and rapidly growing population from which horses need to be gathered regularly, removed, and sometimes treated with population growth suppression to maintain the herds at the appropriate management level and to ensure a thriving natural ecological balance. As far as BLM is aware, at no time since its designation has the Red Desert Complex dropped below the identified appropriate management level. Whereas past management removals have been random relative to phenotypic traits associated with the New World Iberian breed type ancestry,

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		Alternative 2 includes management actions that would be expected to increase the relative prevalence of individuals with those phenotypic traits. In this respect, Alternative 2 is responsive to the March 20, 2017 order of the U.S. District Court, District of Wyoming, in Friends of Animals v. BLM, No. 16-CV-0199-NDF which directs the BLM to analyze management alternatives that would increase the frequency of such phenotypes.
8	A change occurred in the genetic composition of the Lost Creek herd between 2001 and 2009. This alleged change was caused by a low AML and is the result of removing excess horses.	See response to #2 and #7 above, and Appendix 3. There were changes in the similarity coefficients to major breed types between 2001 and 2009, but this was largely a result of changes in the choice of genetic markers that were used for the analysis, with blood and biochemical polymorphic markers used in 2001 and DNA microsatellite markers used in 2009. Despite the resulting changes in the absolute value of similarity to New World Iberian breed types, the relative ratio of similarities to New World Iberian breed types and other breed types remained, for the most part, unchanged.
9	BLM has not provided a public analysis of how its management actions have impacted the genetic makeup of the herd.	Additional summary of Dr. Cothran's reports and analyses has been added to Appendix 3.
10	BLM has not engaged in any meaningful retrospective analysis at all.	The draft revised EA published in May 2017 made clear reference to the available reports by Dr. Cothran, who conducted genetic analyses of sampled individuals. Dr. Cothran's analyses formed the basis for BLM's considerations about genetic diversity, and BLM's conclusions in that document about similarity between Red Desert horses and the New World Iberian breed type. The majority of Appendix 3, which addressed Dr. Cothran's past reports, focused on his recommendations and conclusions. Prior to publication of the May 2017 draft revised EA, BLM evaluated Dr. Cothran's genetic reports, as noted in Section 2.6. Appendix 3 has been revised to now include additional discussion of those reports, with special attention paid to the measures of genetic similarity between sampled

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		horses and various breed types, including the New World Iberian breed types.
11	Rather than taking the time to analyze the impact of its actions on the decline of the Iberian genotype, BLM instead sought to discredit portions of its own data.	Due to formatting constraints, it was not possible to fit a response into this table format. For a response to comment 11, see attachment below comment Table.
12	BLM claims that a recent re-evaluation of 2001 reports by Dr. Paul Griffin (BLM Research Coordinator) indicates that previous statements based on blood samples of wild horses in Red Desert do not reflect current information or understanding of the genetics of the Red Desert Complex HMAs, which BLM claims is neither genetically unique or predominately of New World Iberian ancestry. Revised EA at 14. However, BLM did not explain the re-evaluation or include it.	See response to #2, #6, #7, and #11 above, and new text added to Appendix 3.
13	If there is any record of the "re-evaluation," it should be made publicly available for comment.	Appendix 3 contains a summary of the 2001 report for Lost Creek HMA and for Antelope Hills HMA. The "re-evaluation" is a study of Dr. Cothran's analysis by Dr. Griffin. All pertinent findings from this "re-evaluation" are presented in Appendix 3. Any draft renderings that went into writing the appendix are available upon request, but Appendix 3 is the final and most complete record of BLM's "re-evaluation".
14	BLM makes improper comparisons of genetic testing methods, specifically, blood samples vs hair follicle samples.	BLM appreciates the distinction between these two types of genetic markers, and has changed the text of Appendix 3 accordingly. That does not, however, change the interpretation that genetic diversity as measured by heterozygosity apparently increased from 2001 to 2006 at Lost Creek HMA. This comment refers to a portion of Appendix 3 where BLM had noted that the measure of genetic variation (heterozygosity, Ho) increased

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		from 2001 to 2006 in the Lost Creek HMA. In his 2006 report, Dr. Cothran noted that the 2001 analysis was based on blood typing genetic markers, noted that it was not clear why variation increased, and suggested that it may have been a result of sampling. This comment has caused BLM to revise that text. Newly added portions are listed here: "As measured with respect to feral herd averages, it appears that variation as measured by heterozygosity increased between the 2001 and 2006 sampling occasions, despite a short-term reduction in the number of horses living in the area, to 25% of its 2001 size." This newly added text highlights that the measure of genetic diversity is made with respect to the feral herd average and, thus, should not depend on the particular type of genetic marker being used to make the comparison. More specifically, the estimated Ho value for Lost Creek in 2001 was 0.330 based on blood typing markers, and the feral herd average for those markers was a Ho value of 0.360. Then, in 2006, when Dr. Cothran was using microsatellite DNA markers, the estimated Ho value for Lost Creek was 0.767, while the feral herd average for that type of marker was 0.719. So, taking into consideration the effect of genetic marker type, the 2001 Ho value was lower than the feral herd average, the 2006 Ho value was greater than the feral herd average.
15	BLM's conclusions assume that the datasets can be directly compared, and that the strong Iberian heritage detected in the 2001 blood data can be dismissed by subsequent findings, the 2013 National Academy of Sciences Report suggested otherwise when it listed the Lost Creek herd as one of only five HMAs where there is evidence of strong associations with Spanish bloodlines.	"Strong" is a not a word used by Dr. Cothran (2001) or by NAS (2013) to describe observable similarities between sampled horses from the Lost Creek HMA and Spanish / New World Iberian breed types. See also comment #11. Neither the narratives from Dr. Cothran about Lost Creek HMA (2001, 2006, 2010) nor the measures of genetic similarity to horse breed types have ever supported the idea that the Red Desert horses are of predominately Spanish origins. What the genetic analysis of all the HMAs in the Red Desert does show are herds of

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		mixed origins. Newly added text in Appendix 3 makes clear that, for the Lost Creek HMA, sampled horses were not predominantly similar to New World Iberian breed type.
16	BLM is not consistent in it use of allelic diversity and heterozygosity.	BLM was not intentionally avoiding discussion of heterozygosity, but values for allelic diversity were a more illustrative measure for some discussions in the EA. Levels of heterozygosity were not estimated to be below any critical value at any time for the available analyses of Antelope Hills (Cothran 2004, 2013), or Lost Creek (Cothran 2001, 2006, 2010). Even for the one report where heterozygosity levels were reported to be low, (Cothran 2001; Lost Creek HMA), the recommendation at the time was: "There is no need for immediate action. Variation should continue to be monitored. Also, the herd should be monitored for evidence of inbreeding depression, such as obvious physical defects or lowered reproductive performance. If such evidence is observed or genetic variation decreases below the critical threshold then introduction of mares from outside the HMA should take place…Variability as estimated by Ho was low for the Eagles Nest herd but not below the critical threshold of 0.31." He also was below the feral horse mean value but other measures of variation were higher than the average for feral horse populations. The positive Fis value and the pattern of variation among individuals (there was a high degree of concordance of types among individual horses) suggests some level of inbreeding, although not a high level. The Fis value is not statistically significant. However, subsequent monitoring at Lost Creek revealed that later samples of horses there showed higher levels of heterozygosity, and no levels of inbreeding that were a source for concern. In 2006, the level of Ho was estimated to be 0.767, which is greater than the mean value for either feral horses or domestic horses

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		(Cothran 2006). In 2010, the value for Ho was estimated to be 0.775 (Cothran 2010). Excerpts from the reports indicate that any degree of concern raised in the 2001 report was found to not be a factor based on later samples: "There is no evidence for inbreeding… Values for the measures of variability in 2001 were generally lower than seen in 2006 although the pattern of variation was similar. Differences in variation are not simply due to differences in sample size (about half the number of horses were sampled in 2001 than in 2006) because Ho is independent of sample size, although the other measures are influenced by sample size…The 2001 sample also was tested using blood typing genetic markers. This analysis indicated low variation of the herd and the DNA variation in 2001 does show values lower than the means for feral herds." (2006) "Genetic variation, as indicated by heterozygosity, in the Lost Creek HMA herd is well above the feral mean for both Ho and He. Ho is slightly lower than He but not at a level that would be indicative of inbreeding." (2010) The comment also implies that values for allelic diversity have declined at Lost Creek HMA to a level that should raise alarm. To the contrary, Dr. Cothran (2010) noted about Lost creek HMA that, "…all values related to allelic diversity and heterozygosity are high." BLM regards a 2% change in the estimated effective number of alleles (Ae) from 5.015 in 2006 to 4.9 in 2009 as not biologically meaningful, probably is not statistically significant one, and possibly a result of the particular sample of horses in those years. Similarly, Dr. Cothran's comments about heterozygosity and diversity for Antelope Hills indicate no cause for concern: "Genetic variation in the Antelope Hills herd is essentially the average for feral herds. Ho is higher than He. This indicates no current level

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		of inbreeding. Allelic diversity, as indicated by Ae, is relatively high." (Cothran 2004) And: "Allelic diversity as represented by Ae also is well above the average for feral herds…Observed heterozygosity in the Antelope Hills HMA herd is well above the feral mean as is He. Ho is slightly higher than He."(Cothran 2013)
17	BLM's discussion of genetic diversity and viability misstates the facts and is intentionally misleading.	BLM did not intentionally misstate facts or mislead. Specific critiques by the commenters are listed as comments #14 and #16. Additions to Appendix 3 have not changed BLM's underlying conclusion that genetic diversity is adequate in the Complex, based on available genetic monitoring data, either in terms of heterozygosity or allelic diversity.
18	BLM fails to analyze how removals will impact future genetic makeup of the Red Desert herd.	As mentioned in the EA and in responses to other comments here, BLM monitors genetic diversity in managed wild horse herds through analysis of sampled individuals. Typically these sampling occasions take place during a gather, as has taken place in Red Desert periodically in the past. Alternative 2 explicitly addresses a management action that would be intended to increase the frequency of phenotypes that are associated with a New World Iberian breed type ancestry. Alternatives 1 and 3 do not have any selective removal criteria, and Sections 2.2 and 2.4 of the EA now note that, as a result, the genetic composition of the herds would continue to evolve naturally under those alternatives.
19	The BLM does not indicate that it will take any genetic samples before deciding which horses will be permanently removed and which horses, if any, will be retained. Thus, BLM's proposed actions are likely to further reduce the presence of the Iberian genotype, and BLM must analyze this impact.	See responses to questions 6 and 7 above. In short the cost and time required to get genetic results back on several thousand horses make this alternative infeasible; See Section 2.5.7, as an alternative considered but eliminated from further analysis. The clause, "if any," of this comment implies that no horses will be retained. On the contrary, specific aspects of Alternatives 1 and 2 clearly indicate that fewer horses would be removed than gathered.

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		The second part of this comment asserts that, "BLM's proposed actions are likely to further reduce the presence of the Iberian genotype." That conclusion is not supported by the apparent lack of change in the relative similarity of sampled Lost Hills HMA horses to New World Iberian breed types, with respect to their similarity to other breed types (See Appendix 3 and response to comment #2), despite past removals of horses from this Complex. Also, Alternative 2 includes selective retention actions designed to increase the frequency of horses with identifiable phenotypic traits that have been associated with the New World Iberian breed types (see Section 2.3).
20	BLM does not include any recent analysis of the horses' genetic makeup for the majority of HMAs.	BLM used the most current data and genetic analysis available. This includes genetic monitoring analyses from Lost Creek HMA samples collected in 2009 (Cothran 2010) and from Antelope Hills HMA samples collected in 2012 (Cothran 2013). All of this information is publicly available. Standard practice is for BLM to conduct genetic monitoring by collecting hair and follicle samples during the course of gathers.
21	Since the last DNA samples were taken, BLM has further reduced the herds in the Red Desert HMAs.	The last gather and removal for the Complex was in 2012. Samples were not collected from horses from all HMAs at that time. BLM policy does not require DNA samples to be collected at every gather (BLM Instruction Memorandum No. 2009-062). This policy gives further guidance that "Unless there is a previously recognized concern regarding low genetic diversity in a particular herd, it is not necessary to collect genetic information at every gather." BLM has paid attention to analyses of genetic monitoring data, as reported by Dr. Cothran. Those analyses indicate that, at the time of the most recently available reports, measures of genetic diversity were all favorable in the complex, whether in terms of heterozygosity, allelic diversity, or similarity to various breed types. Any local or temporary reductions in herd sizes since the most recently available genetic monitoring analyses is not expected to have caused a substantial loss of

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		genetic diversity. Indeed, the purpose and need (EA Section 1.1) identifies that an overpopulation of wild horses with respect to AML is the reason for a decision needing to be made. Excessive wild horse populations are unlikely to have been associated with any loss of genetic diversity. As noted in response to comment #6, it is not practical or feasible to make decisions about which animals to retain based on laboratory analyses, because of the wait time required for the report.
22	BLM completely failed to include any analysis of the cumulative impacts of its proposed action on the unique Iberian genotype of wild horses in the Red Desert Complex when considered in combination with other past and reasonably foreseeable future actions. Such an analysis is critical because the cumulative impact of this roundup along with past and reasonably foreseeable future actions may jeopardize the continued existence of this historically significant and unique genotype.	Appendix 3 now includes a complete summary of all genetic reports which demonstrates that past actions have not apparently caused any substantial decline in the similarity of sampled horses to the New World Iberian breed types, with respect to their similarity to other breed types. Section 3.1.2 includes analysis of the Alternatives on the genetic diversity in the Complex, including effects of PZP use.
23	BLM has an obligation under both the applicable Lander and Rawlins Resource Management Plans (RMPs) and NEPA to consider an additional alternative that assures wild horses with unique Iberian genotypes and associated phenotypes are protected.	See responses to comments 1 and 5. Among the current action alternatives considered are steps to preserve horses with Iberian heritage.
24	BLM's Revised EA does not analyze any alternatives that are designed to assure a sufficient prevalence of the historically important breeds.	See responses to comments #1, #2, #5, and #23 above. A retrospective view of available monitoring reports indicates that there has not been any substantial change in the relative

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		similarity of sampled horses at Lost Creek HMA to New World Iberian breed types (Appendix 3).
25	BLM again only considered two action alternatives – just as it did in the vacated EA.	See response to comment #1 above. BLM considered Alternatives 1, 2, and 3, and was not directed to consider additional alternatives.
26	Administering PZP to wild horses with Iberian ancestry would reduce the prevalence of the genotype. In its analysis of PZP's impact on wild horses, the National Academy of Science's Report explained that "removing females even temporarily from the breeding pool is likely to reduce the effective population size (Ne) and genetic diversity of the population."	Reduced effective population size and genetic diversity would not be expected to cause any decline in the frequency of alleles associated with New World Iberian breed type ancestry because all captured and retained mares in the Complex would be treated with PZP. There would be no preferential retention under Alternative 1, but there would be preferential retention of horses with phenotypic traits associated with those breed types under Alternative 2.
27	The Revised EA fails to disclose or analyze the potential impact of PZP on the prolonged infertility and unique genotype of wild horses in the Red Desert Complex.	The EA now includes a more extensive discussion on the expected effects of PZP in Section 3.1.2. All captured and retained horses in the Complex would be treated with PZP. The last time any mares in this Complex received PZP was in 2012. It is unlikely that any mares would be re-treated prior to three years from the time of the gather. This infrequent treatment cycle is unlikely to create prolonged or lasting infertility. If it did cause infertility in a few mares, there is no expectation that those would be mares with either more or less degree of Iberian ancestry. There is no known correlation between such ancestry and an increased or decreased reaction to immunocontraceptive vaccines such as PZP. Therefore, the relative prevalence of mares with higher percentages of Iberian genes would most likely be unchanged.
28	BLM does not describe any specific protocol to retain wild horses that demonstrate Iberian ancestry.	See Section 2.3 of the EA. "BLM wild horse specialists would retain horses from the Lost Creek HMA which display popularly recognized visual characteristics commonly attributed to the New World Iberian phenotype, such as having a dished head profile, small ears with a notch or inward point at the tips, a wide neck, and sharp

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		withers (Sponenberg and Reed, unpublished)." In general, this will be left to the expertise of BLM wild horse specialists, but the scoring system for "Colonial Spanish Type" (Sponenberg and Reed, unpublished) will be used as a reference.
29	WO-IM-2010-135 cannot serve as a sufficient source of guidance for phenotype/genotype-based selective removal criteria in this roundup.	The EA lists WO-IM-2010-135 along with the Lander and Rawlins RMPs as the general guidance for selective removal criteria. This IM will be used in conjunction with the appropriate RMP for each HMA. Additional phenotypic criteria will be used in the Lost Creek HMA, as noted in response to comment #30 and in Section 2.3 of the EA.
30	The Revised EA also states that BLM would retain horses from the Lost Creek HMA which display popularly recognized visual characteristics commonly attributed to the New World Iberian phenotype, but the Revised EA fails to provide an explanation of how this would be implemented and admits that this is insufficient to preserve the unique genotype.	See comment 28.
31	Alternative 2 in the Revised EA fails to comply with obligations in BLM's land use plans for several reasons: a. First, BLM does not plan on retaining many horses after the removal. In Lost Creek, for example, nearly 80% of the current gene pool will be removed. b. Second, those horses that are retained will be treated with PZP, preventing them from passing on their genes. c. Third, BLM does not have a clear plan, if any, for how the limited "selective	a. Removal of 80% of the horses does not equate to removal of 80% of the existing genetic diversity. The expectation, based on understandings from population genetics, is that copies of alleles that have been inherited from a small number of ancestors are shared across many descendants. The BLM would reduce the current population to the Appropriate Management Level to fulfill its legal mandates including those found in the applicable land use plans. The designation of an appropriate management level is designed to ensure a thriving natural ecological balance. Under Alternative 2, which reduces abundance to the low end of AML (480 horses), this number of individuals is expected to retain a high level of genetic diversity over long time periods.

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	retention" would be carried out. d. Fourth, BLM claims that selective retention criteria will vary by HMA and field office, and that "only in Lost Creek would horses be selected for characteristics commonly thought of as being associated with the New World Iberian phenotypes." This is particularly concerning because BLM also claims that horses travel between the HMAs and intermix. e. BLM admits that this alternative would not likely preserve the Iberian genotype because "it is impossible to select for a genotype based strictly on visual characteristics."	b. PZP is expected to be temporarily effective for most treated horses, as noted in the newly added analysis of PZP effects, in section 3.1.2. c. See responses to #28, 29, and 30. d. See responses to #28, 29, and 30. e. See #30 above.
32	Collecting hair samples from the horses that BLM rounds up and then permanently removes does little to elucidate the genetic composition and viability of the minority of horses remaining on the range and their ability to pass their genes onto future generations. BLM has made not made it clear in the Revised EA whether all 25 of the samples it takes from each HMA will come from retained horses, or whether only a portion of them will.	See section 2.3 of the EA. It was BLM's intent to take genetic samples only from retained horses. The EA has been slightly changed to clarify that intention: "DNA samples (a minimum of 25 samples per HMA) would be taken only from retained horses…"
33	Mares retained in the Lost Creek HMA who contribute samples should also not be treated with PZP, as their genes will not be contributing to the subsequent filial generations.	This fails to meet the purpose and need of this action. Furthermore, the effects of PZP are generally temporary, as noted in section 3.1.2. It is expected that treated mares would foal after the temporary effects of PZP wear off.

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34	It is imperative that preliminary strategies for preserving the Iberian genotype be developed and put in place before this roundup occurs.	See response #30 above. Such strategies are outlined in this EA.
35	BLM concedes that the Revised EA does not consider management practices with the goal of increasing desired phenotypes and genotypes as part of the current action. See Revised EA at 26 (claiming "these actions are outside the scope of this document.").	In EA Section 3.1.2, Impacts of Alternative 2, the actions referred to that "…are outside the scope of this document" are future (post gather) management actions; specifically, continued genetic monitoring and monitoring movement between HMAs. Such future actions are outside the scope of this document. Despite the fact that such future actions are not the basis for the current decision, this EA does include management actions, e.g., selective retention, that would increase desired phenotypes and DNA testing of retained horses in conjunction with photo monitoring to help guide future management decisions.
36	Manage the Red Desert like the Pryors.	The population size, herd composition, herd disposition, Complex size, Complex location, geography, and policy background of these areas are very different. Management of the Red Desert Complex is designed around these local factors, not the management of other HMAs.
37	BLM fails to consider current information on range conditions and wild horse populations. Moreover, disclosure of this information is necessary for the public to make informed comments and compare alternatives.	The most current applicable information is included in the EA and is publicly available. Due to their cost, population surveys are not done every year, but a new survey would be conducted prior to gathering and made publically available.
38	The Standard Operating Procedures for Application of Fertility Control, which BLM repeatedly commits to follow, indicate that, "[a]t a minimum, estimation of population growth rates using helicopter or fixed wing surveys will be conducted the year preceding any subsequent gather." Revised EA at 81. However, BLM has not	See response to #37. 2015 is the most recent aerial survey, and results from the analysis of those survey data are the best available information about the current abundance of wild horses on the Red Desert Complex and nearby surveyed areas. When a new survey is completed that information would be made publicly available, and estimated numbers of horses needed to be gathered from areas outside or in the HMAs would be updated accordingly.

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	yet conducted a population estimate in accordance with this procedure. The Revised EA did not update any of the population estimates or data from the previous vacated EA. Thus, all the population estimates appear to be based on April 2015 aerial population survey flights. Not only are these estimates no longer current, but also an evaluation of the 2015 survey identified problems that could have led to inflated population estimates	
39	The Revised EA does not include an analysis of: grazing utilization and distribution, trend in range ecological condition, actual use, climate (weather) data, current population inventory, WH&B located outside the Herd Management Area (HMA), or in Herd Areas (HA) not designated for their long-term maintenance, and other factors such as the results of land health assessments. This information is not only important for the decision-making process, but also to comply with the WHBA. Under the WHBA, BLM can only remove horses after it makes a determinations that horses are excess and that removal is necessary. Such determinations require the analyses identified in the instruction memorandum, as well as additional analyses identified in BLM's own guidelines and handbooks.	An EA provides the data and analysis to make a reasoned choice among alternatives and to determine whether a significant impact would occur. EA's are concise and summarize necessary data and research. This information is available in this EA to the extent necessary to inform a decision. (See Appendix 3, Pages 1-3, and Section 3.0-Affected Environment). Furthermore, the March 20, 2017 order of the U.S. District Court District of Wyoming, in Friends of Animals v. BLM, No. 16-CV-0199-NDF, page 3, noted: "…an 'overpopulation' of wild horses is considered 'excess' within the meaning of the WFRHBA, and subject to gather and removal. 16 U.S.C. § 1333(b)(2)." "'Overpopulation' exists when wild horses either exceed the AML specified in the applicable RMPs or are in areas not designated for their long term management."

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40	Throughout the Revised EA, BLM omits analysis of important information and procedures. Instead, BLM refers to outside documents. While BLM indicates that it is providing a link to these documents, many of the websites cited no longer work.	Thank you bringing this to the BLM's attention. These links have been updated.
41	In the Revised EA, BLM fails to consider what qualifies as a self-sustaining, healthy population of wild horses and how alternative actions would impact the health and sustainability of wild horses.	Inasmuch as this comment refers to adjustment or analysis of population levels it is outside the scope of this document. For the purposes of this EA the BLM uses the appropriate management level (AML) as it's measure of what qualifies as a "…self-sustaining, healthy population of wild horses." AML is set though the land use planning process, in this case the Lander and Rawlins RMPs. The second part of this comment regarding how alternative actions would impact the health and sustainability of wild horses is discussed throughout the EA.
42	Managing for 60-80 animals falls far short of a viable population number to achieve the goal of retaining genetic variability let alone rare markers.	Adjusting the AML is beyond the scope of this EA. However, AML range for the Red Desert Complex is 480-724. Because there is significant movement between HMAs in the Complex and because genetic testing shows genetic variability to be fairly high for the Lost Creek herd, the BLM considers the Complex population size to be adequate. See Appendix 3.
43	Although there may be some interchange with other herds, this has not been quantified to our knowledge and any such possible interchange is likely unable to prevent the significant and inevitable loss of rare genetics found in the Lost Creek Herd. The only prudent course of action is to allow for at least 150-200 animals in this HMA and to begin to chart the relationship of the bands and	AMLs are established through the land use planning process and will not be amended in this implementation-level EA. Individually these HMAs populations are near the threshold for decreased genetic variability. However when considered as a complex population with interchange between each HMA, genetic variability is preserved. A brief description of results for genetic tests completed in 2009 for the Rawlins HMAs and 2006 for the Lander HMAs can be found in Appendix 3. The vast area of the Complex as well as the sheer numbers of horses it contains makes charting

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	individuals within the bands. The only horses to be removed would be those that have living and reproducing relatives on the range.	herd and individual relationships infeasible when applied to the whole Red Desert population.
44	We also request that all mares returned in the entire complex receive PZP or PZP-22.	The BLM identifies this as a potential action and analyzes this action under Alternative 1 and Alternative 2.
45	Remove all wild horses outside the HMA boundaries	The BLM identifies this as a potential action and analyzes this action under Alternative 1 and Alternative 2.
46	Older animals removed (those over 5 years of age) could be sold without limitation if the President's Budget is implemented.	This is beyond the scope of this EA .
47	We implore you to only remove young horses that have an opportunity to become human partners. It is the only humane alternative.	While horses that have a high chance of being adopted are a priority for removal, in order to reach AML, it would likely be necessary to remove horses that are unlikely to be adopted. This removal process is detailed in WO IM 2010-135.
48	If a helicopter roundup is needed to capture most of the horses in the four herds, then wild horse bands should be brought in discretely, with a sorting process to keep the bands intact. We know this can be done as it has been accomplished in the past in several BLM-managed herds.	The Complex would be gathered using the guidelines laid out in BLM IM 2015-151- Comprehensive Animal Welfare Program for Wild Horse and Burro Gathers.
49	All horses returned to the HMAs will be cataloged in their bands and photographed with data entry by volunteers under the direction of the BLM team present at the roundup site. All data will be entered into *HorseBase*, a Windows	BLM proposes documenting horses that are returned to the HMA via photographs along with genetic testing in Alternative 2. BLM would consider any proposals to partner with groups to help complete this task.

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	program specifically designed to keep track of wild horses.	
50	We suggest that a plan be devised for each herd in the complex similar to the Beaty's Butte model. However, horse gentlers would be compensated as in the TIP program—i.e. after the successful adoption of that animal.	This comment is beyond the scope of this EA. The Complex would be gathered using the guidelines laid out in BLM IM 2015-151-Comprehensive Animal Welfare Program for Wild Horse and Burro Gathers.
51	I am confident you have talented horse trainers in your region. Allowing them to halter train young mustangs and make a profit from the successful adoption of their young horses will stimulate local economies and will give the young horses a great chance to find homes, whether it be in WY, NV or back East.	This comment is beyond the scope of this EA. However; the BLM has worked with programs who are interested in doing this in the past and would consider any proposal along those lines if they were brought to us.
52	Finally, I ask that the final EA include the following information: Detailed annual census information, both actual counts and projected population numbers, including information about the data on which population projections/estimates are based. Complete breakdown of livestock grazing in the HMAs, including active and actual Animal Unit Month (AUM) allocations for each of the past five years. All monitoring data for each area, which includes data that	Answered with Comment 6, 30, 31, & 38 in previous EA

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	clearly delineates the separate impacts of livestock use versus wild horse use. Impacts on taxpayers – the full costs of this action to American taxpayers, including the costs of the roundup itself and the projected long-term costs of lifetime warehousing of horses removed in the roundup. Impacts on captured wild horses – a detailed analysis including expected injury and mortality rates during the roundup and while in holding facilities.	
53	If and when population levels start to exceed REVISED AMLs, begin a fertility control program with a goal of zero population growth.	Population levels are already well above established AML levels. With respect to population growth, BLM's goal is to decrease population growth as much as possible with the tools currently available and appropriate for the Red Desert Complex and which are analyzed in this EA. None of the alternatives analyzed would result in zero population growth.
54	BLM must also fairly allocate range resources to ensure that wildlife – including wild horses – have a fair share of the forage on our public lands, rather than giving exorbitant resources to the privately owned cattle and sheep operations. 7-11 times as much forage is allocated to privately owned livestock over wild horses. These numbers should be changed – decrease livestock grazing in these wild horse HMAs by retiring grazing leases.	Answered in previous EA under comment 14.
55	Though it is outside of the scope of this EA, we would like it stated that we are opposed to the use of helicopters during round ups for the following	Gather methods that have been considered in drafting this EA include bait and water trapping. However, due to the size of the Complex, number of horses above AML, limited access to many areas, and the multitude of available water

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	reasons: (1) Though SOP's for gathering animals with the use of helicopters have been established, there are numerous instances where those SOP's are not followed with little to no consequence to the BLM district offices or the contractor; (2) Horses are extremely stressed and fearful during helicopter round ups; (3) Mares and foals are easily separated during the fast-paced helicopter round ups. BLM is not averse to utilizing slower methods, such as water/bait trapping, to actually capture wild horses. Since this gather, or rather series of gathers, is already expected to take several gather periods and happen across several locations, we suggest slowing the entire project down so that it can be done carefully and thoroughly, with a better long-term chance of success?	sources, this method was not carried forward in the analysis as a sole gather method. The Proposed Action was adjusted to allow this technique if it is found to be plausible on a localized basis on an HMA-level. Helicopter gathers have been shown to be safe and humane in gathering wild horses. See Section 2 for alternatives considered in the drafting of this EA.
56	In listing impacts of Alternative 2: Proposed Action, Page 23 of the EA says, "*The current social structure of the wild horse population would be altered from the removal of approximately 2,096 horses, but the competition for forage and water resources would be reduced*." Where is the info to support that this has been a problem? Similarly, p. 27 says that "…*during periods of drought and lower forage production, competition for forage with other wildlife species would increase. As wild*	BLM Land Health Assessments conducted in 2003 and in 2011 have determined that wild horse use in Antelope Hills and Stewart Creek was a causal factor in failing to meet Standard #2 Riparian/Wetlands within the Rawlins Field Office. Field observations by BLM specialists and biologists have found similar issues on many riparian areas throughout the Complex. The impacts of wild horses on wildlife both in terms of behavior and habitat are well documented. Although not specifically referenced in the EA here are several references that substantiate the statements on p. 27 of the EA. Davies, K.W., Collins, G., Boyd, C.S., 2014. Effects of feral free-roaming horses on semi-arid

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	horse populations increase in the mid and long-term, competition for forage, space and water may lead to displacement of wildlife species, particularly big game, which may result in the use of less preferred habitat, lower animal condition, and lower capability to survive harsh winters." Is this all conjecture, or is there solid documented evidence to support this statement?	rangeland ecosystems: an example from the sagebrush steppe. Ecosphere 5, 1-14. Gooch, A.M., 2014. The impacts of feral horses on the use of water by pronghorn on the Sheldon National Wildlife Refuge, Nevada, Plant & Wildlife Sciences. Brigham Young University, Provo, Utah. Ostermann-Kelm, S., Atwill, E.R., Rubin, E.S., Jorgensen, M.C., Boyce, W.M., 2008. Interactions between feral horses and desert bighorn sheep at water. J. Mammal. 89, 459-466.
57	We are supportive of the fact that "Fertility control has been implemented in the past" (p. 51) in the Red Desert Complex. For fertility control to be successful, it must be implemented aggressively and immediately. Investing in a truly robust fertility program now will save millions of dollars a year	Fertility control is a component of both Alternative 1 and Alternative 2. The BLM is interested in long term fertility control plans for this Complex however, this analysis focuses on immediate actions. Long term fertility control plans are beyond the scope of this EA.
58	There is no meaningful analysis of grazing (information for Animal Unit Months (AUMs) permitted for livestock and wildlife and the actual use of AUMs by livestock for each HMA in recent years); there is no updated information about what AML levels are appropriate the National Academy of Sciences stated (in 2013) that repeated roundup and removal was as "expensive and unproductive for the BLM and the public it serves,"	Grazing allotment and AUM information is disclosed in section 3.6 of the EA. AUM allocation and AML adjustments are established in the Resource Management Plan and therefore, this analysis would be inappropriate for this EA. The BLM recognizes that roundups and removal may be relatively expensive. The BLM has proposed the use of fertility control in Alternatives 1 & 2 to reduce population growth and thereby reduce the frequency in which roundups are needed. A cost-benefit analysis is not relevant to the choice among alternatives, and is not required under NEPA, 40 CFR 1502.23.
59	After the mares reach 10 years of age there should be no need to continue treating with PZP if	Long term PZP treatment is not analyzed in this EA. A long term fertility treatment plan would

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	they have been darted for 5-7 consecutive years as mares will not return to fertility The proposal to treat mares after producing a single live foal for the remainder of their lives is extreme and not necessary to achieve zero population growth.	be analyzed in a separate EA before being implemented.
60	If, by some miracle, any wild mares older than 1 year old were to be released back to their rightful herd areas, they would be vaccinated with the dangerous pesticide PZP, which could result in permanent sterilization among other negative and risky side effects	Answered under comment 10 in previous EA.
61	As many mares as possible should be treated with PZP, AND that the PZP used should be NEWLY PURCHASED	Alternatives 1 & 2 propose the treatment of gathered mares with PZP. The administering of the PZP would follow BLM protocol and the manufacturer's label.
62	Although the goal is to achieve the low-bound of the AML, RFO/LFO states that it may take more than one such action to do so. All female horses aged 1 year and older before being released back to the range, would be injected with the pesticide-sterilant **PZP-22** (Porcine Zona Pellucida, long-acting formula). This inexact number of females is troubling because it seems to indicate that a lopsided gender-ratio	It is not possible to analyze and exact number of mares that would receive PZP because it is unknown how many horses would be gathered due to a number of variables including weather, terrain and vegetative cover. The BLM does not analyze nor are attempting to skew sex ratios within the Complex.
63	The correct action is Alternative 3: No Action -- no removals, no PZP, and no helicopters. Contrary to BLM's contention, No Action is the only alternative that does meet	Alternatives 1,2 and 3 all meet the purpose and need and would comply with all applicable laws. The proposed project would be in conformance with the Wild Free-Roaming Horses and Burros Act of 1971 (Public Law 92-195).

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	purpose and need, and does comply with the Law.	
64	BLM's assumption of a doubling of the population every four-years, and its assumption of a consistent 20-percent annual growth-rate, are shown to be false. • Inaccurate herd increase due to new foals. • 5% of adult wild horses perish annually • Herds self regulate • Herd growth rate is only 5% • Population modeling is inaccurate and overestimates population • Inventory overestimated population.	The 20% annual growth rate the BLM uses is supported by the 2013 NAS report. BLM's analysis of the HMAs populations in the original EA were upheld by the court, therefore the numbers in the revised EA were not adjusted or reanalyzed.
65	**WinEquus,** input data is ***over***-stated, but the software is programmed to consider it ***under***-stated. The results are further compromised by the limitations of the program's default settings, which are based on data from one herd in another state many years ago.	BLM's analysis of the HMAs populations in the original EA were upheld by the court, therefore the numbers in the revised EA were not adjusted or reanalyzed.
66	BLM employs aircraft to conduct inventories of wild horses and burros. However, the aerial method results in significant over-counts. BLM needs to reform the census methods.	BLM's analysis of the HMAs populations in the original EA were upheld by the court, therefore the numbers in the revised EA were not adjusted or reanalyzed.
67	BLM should research new technologies for remotely tracking wild horses and burros	This is beyond the scope of this EA.

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	and then procure the system that best serves the purpose.	
68	When horses stray outside the HMA boundry, BLM should put them back in the HMA, not remove them from the range. BLM should implement preventative measures to prevent horses from leaving HMA.	The action proposed in this comment would not meet the purpose and need of the proposed action and would not achieve a thriving natural ecological balance because the Complex is well above the AML. Implementing preventative measures restricting horses to the boundaries of the HMA's is beyond the scope of this EA. The BLM must consider other uses including wildlife migrations and sensitive habitats when developing measures that would limit horse movements.
69	AMLs for the Red Desert are set below minimum-viable population	Answered under comment 12 in the previous EA.
70	Multiple-use does not mean every-conceivable-use. Incompatible uses can be excluded	From context, the commenter is referring to livestock grazing. According to the Rawlins and Lander RMPs, livestock grazing is an authorized use in wild horse HMAs. Reallocating multiple uses is a land use planning decision, and is beyond the scope of this implementation-level analysis.
71	The draconian removals that BLM proposes would amount to "over-managing" the wild-horse population.	The proposed removals are consistent with the direction provided in the WFRHBA.
72	Further, the 2011 EA admitted that blood samples drawn during previous roundups were collected "from horses removed" -- which would no longer have been contributing to the gene-pool	Blood samples were randomly drawn so an analysis could be completed on the genetic makeup of the herds. It is assumed that since the samples are taken randomly, they represent the overall composition of the HMA.
73	The Antelope Hills herd was last tested in 2006, with Dr. Cothran noting that the AML for this herd was fairly low, as it continues to be	The analysis referred to was from samples taken back in 2004 in a report completed by Dr. Cothran in 2008. In his recommendations from that report Dr. Cothran states "This herd has reasonably high genetic variability so that no action need be taken at this time. However, the AML for this herd is fairly low so that future monitoring will be needed." The BLM is

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		committed to continuing genetic monitoring and has included that monitoring in this EA.
74	BLM needs to conduct a 100-percent evaluation of the Red Desert Complex herds' genetic health per DNA samples sent timely to the Equine Genetics Lab. BLM must then develop best management practices to restore and maintain gene-pool diversity via a robust population-level. • Sample current herd members. • Sample first, before considering any actions. • Sample large -- 100 percent. • Test samples. • Manage per test-results.	See responses to question 6 above. In short the cost and time required to get genetic results back on several thousand horses make this alternative infeasible. This alternative is now discussed in Section 2.5.7, as an alternative considered but eliminated from further analysis.
75	BLM managers are still being told -- incorrectly -- that PZP merely blocks sperm, is non-hormonal, and can be used safely for five-to-seven consecutive years without loss of fertility. All of those claims are not according to the facts. Therefore BLM is disinformed regarding PZP. PZP Causes Ovarian Dystrophy, Destroys Oocytes in Growing Follicles, Depletes Resting Follicles Females Reportedly Become Masculinized. Extends Wild-Horse Birthing-	The 2013 NAS report, "Using Science to Improve the BLM Wild Horse and Burro Program" analyzes the use of PZP in detail, both pros and cons, based on the available scientific research. Their findings and subsequent research was used to develop BLMs analysis of the use of PZP as found in this EA. If there is scientific data available that in some way refutes BLMs analysis please provide that data or a reference to that data so it can be analyzed.

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	Season to Nearly Entire Year. Delays Recovery of Fertility by 411.3 Days per Year-of-Treatment A Pesticide that Is Also a Bio-Hazard. Meta-Analysis Reveals the Risk of Sterilization from ZP Contraceptives Potential Adverse Effects of PZP on a Developing Embryo or Fetus. PZP Treatments for 3 Years, or If Started before Puberty, Can Lead to Sterility Unintended Consequences and Social Disruption Body-Condition Improvement Could Lead to Gender-Ratio Imbalance	
76	BLM needs to keep the younger wild horses if it aims to please the recreational visitors.	Not all horses would be gathered and removed or treated with PZP. There will continue to be natural reproduction within the HMAs and younger wild horses will remain in the HMAs and available for recreational viewing.
77	Disfiguring Brands - Fillies and mares that have been given PZP would be branded with the 3½-inch high-and-wide letters "HB" on their left hip. persons visiting the HMAs will have their experience spoiled by the hideous brands on the fillies and mares' coat	It is BLM policy to freeze brand horses which have received fertility control. This is beyond the scope of this EA. https://www.blm.gov/policy/im-2009-090
78	Mountain lions, wolves, and other such carnivores effectively control wild horse	Answered under comment 15 in original EA.

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	populations by targeting the weak, the sick, the young, and the old.	
79	There can be no true "thriving natural ecological balance" without predators.	The BLM does not manage predator populations and the proposed action does not propose to do so. The Wyoming Game and Fish Department is responsible for managing wildlife populations.
80	Using helicopters to round up horses is inhumane.	Answered under comment 5 in original EA.
81	Helicopter-stampedes can result in wild horses trampling riparian areas and in so doing, creating stagnant water puddles -- conditions ideal for mosquito breeding	Answered under comment 22 of the previous EA.
82	Bait-trapping is a true best management practice. Because bait-trapping has been proven effective, it should be implemented	Gather methods that have been considered in drafting this EA include bait and water trapping. However, due to the size of the Complex, number of horses above AML, limited access too many areas, and the multitude of available water sources, this method was not carried forward in the analysis as a sole gather method. The Proposed Action was adjusted to allow this technique if it is found to be plausible on a localized basis on an HMA-level. Helicopter gathers have been shown to be safe and humane in gathering wild horses. See Section 2 for alternatives considered in the drafting of this EA.
83	The appropriate time to gather wild horses is in autumn -- before the snowfall season.	The timing of BLM wild horse gathers is established in a national schedule. This schedule takes into account numerous variables including but not limited to available resources, climate, horse biology, health and well-being. Anticipated start dates will be addressed in the ROD, if appropriate, depending on which alternative is selected.

Attachment to comment table for Response to Comment 11

11. Rather than taking the time to analyze the impact of its actions on the decline of the Iberian genotype, BLM instead sought to discredit portions of its own data (p. 5).

Response: The May 2017 draft revised EA does not discredit the BLM's own data. All initial analyses of genetic samples were made by Dr. Cothran, and BLM has only compared and explained those analyses. The comment apparently refers to text in Section 2.6 (on page 14 of the May 2017 EA), where BLM commented on current understanding of the apparent lack of genetic uniqueness of Red Desert herds, and the lack of a predominantly New World Iberian ancestry. This categorization of Red Desert horses' genetic diversity is not contrary to Appendix L of the 2014 Lander RMP Record of Decision. The Lander RMP refers to Cothran's 2001 analysis of horses sampled from the Antelope Hills HMA (the report is labeled 'Cyclone Rim,' which is an area within the HMA, and refers to sampled horses as being from the 'Eagles Nest herd'). Appendix L of the Lander RMP says (emphasis added here):

> "Occasionally, populations have been encountered whose genetic roots can be traced to the Spanish exploration period through the *identification of genotypes associated with the New World Iberian (Spanish Colonial) breeds*. Populations with this distinctive genotype provide a genetic resource that the majority of wild horses on public lands do not provide. The wild horses in the Lander Field Office's Antelope Hills HMA are such a population. In 2001, blood samples from wild horses taken from the Cyclone Rim area in the Antelope Hills HMA were provided to Dr. E. Gus Cothran of the Equine Parentage Testing and Research Laboratory at the University of Kentucky. Results from the genetic analysis of these samples identified a clear *contribution* from New World Iberian breeds. The highest average genetic association of the blood samples provided were the Spanish Colonial breeds. The next highest average genetic association was with North American Gaited breeds, most likely from the routine escape of domestic saddle stock from the surrounding areas."

The RMP language does not imply that the Red Desert Complex horses are genetically unique, nor does it imply that the horses are of predominantly New World Iberian descent. Rather, the RMP acknowledges that there is *some* contribution of New World Iberian ancestry to the current herds. Also, it is not a necessary conclusion that New World Iberian ancestry is the predominant ancestry merely because the 2001 analysis indicated that the highest average genetic association was to that breed type.

Evaluation of Dr. Cothran's reports affirms that the herds in the Red Desert are of mixed origins, with some sampled areas showing a degree of Spanish breed influence. The statement in the EA Section 2.6 saying that the "…Antelope Hills HMA is neither genetically unique nor predominately of New World Iberian ancestry…" is correct, and is not contrary to the Lander RMP, for reasons noted below and newly added to Appendix 3.

1) The National Academies of Sciences (2013) very clearly identified several HMAs where horses do reflect ancestry that is predominantly from New World Iberian reed types, but those areas were the Cerbat Mountains HMA (AZ), Pryor Mountains HMA (MT), and Sulphur HMA (UT). The Lost Creek HMA herd was mentioned in that report only as having "…some evidence of Spanish ancestry that may be indirect." In the previous sentence where NAS (2013) referred to the possible source of such indirect ancestry in the Kiger HMA herd, that source was suggested to be possibly through Quarter Horse introductions in the same area. In that report, Antelope Hills HMA was not mentioned as having any unusual component of Spanish ancestry or other genetic diversity.

2) Although Dr. Cothran's 2001 report identified that two horses out of the 27 sampled did contain blood markers associated with Spanish breeds, and even though he found the greatest value of similarity coefficient between sampled horses there and New World Iberian breed types, the report made no statements about genetic uniqueness, saying instead that "Only the PGD-D variant seen in two individuals of the Eagles Nest herd could be considered an unusual marker but this variant is seen across a wide variety of horse breeds."

3) The highest coefficient of similarity for the 2001 sample of horses was to the New World Iberian genotype, with a Rogers similarity coefficient of 0.845 and confidence interval of between 0.814 and 0.869. However, the similarity coefficient for the North American Gaited breeds was statistically indistinguishable from that, with a value of 0.840 (a difference of less than one percent) and confidence interval of 0.785 to 0.867. The overlapping confidence intervals in the figure below illustrates that the point estimates for the genetic similarity coefficients were extremely close, and not statistically different, for any of the breed types.

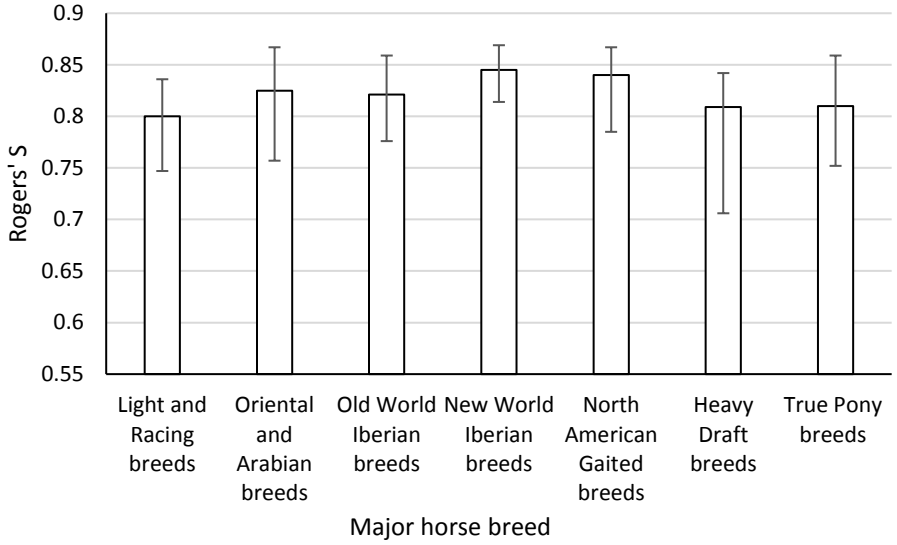

Figure: Roger's coefficient of similarity estimated in relation between sampled Antelope Hills (Cyclone Rim) horses to major groups of domestic horse breeds (Cothran, 2001). Error bars reflect confidence intervals listed in the 2001 report.

4) The genetic similarity coefficient point estimate value (0.845) that was used to identify the connection between sampled horses of the Antelope Hills HMA in 2001 was actually lower than the genetic similarity coefficient estimate value between the sampled Antelope Hills HMA horses and other wild horses in the Green Mountain HMA (0.868) or the White Mountain HMA of the Rock Springs Field Office (0.859), from Dr. Cothran's (2001) Table 4.

5) Dr. Cothran (2001) indicated that there does seem to be some Spanish influence in the sampled herd, saying:

"The highest average genetic of the Eagles Nest herd was with the New World Iberian breeds. These are breeds derived from Spanish stock that have been developed in North and South America. The highest individual breed S was with the Pantanero and Mangalarga Manchador, both Brazilian breeds. Next highest mean S was with the North American Gaited

breeds with highest individual breed similarity in this group with the Mountain Pleasure Horse, Tennessee Walker and Morgan Horse. It is certainly more likely that these later breeds directly contributed to the origins of this herd than the Brazilian breeds. However, there does appear to be some Spanish influence.

Based upon the genetic variants present there is a clear Spanish breed contribution to this herd. The Pi-V variant and Q-ac variants are clearly of Spanish origin but these variants only occur in one and two individuals, respectively. The Pi-0 variant also may represent Spanish influence. However, overall the Eagles Nest Herd docs not fit well with any breed grouping as shown in Figure 1. The Eagles Nest herd clusters on the outside of the entire tree. This is partly due to the reduced variability but also is likely due to combination of variants that do not occur in most breeds. This likely indicates mixed origins of the herd.

This population shows some evidence of Spanish origins but the low variability makes it difficult to determine the overall ancestry of the population. The RML cluster analysis indicates no close relationship to any breed group. The population probably is of mixed ancestry but there is some Spanish component."

6) Newly added text in Appendix 3 explains that, for the Lost Creek HMA, genetic analysis showed that sampled horses were not predominantly similar to New World Iberian breed type, and that the relative similarity of sampled horses to New World Iberian breed types has *not* declined, with respect to other breed types, over time.

7) Although later analyses showed that the relative similarity of sampled horses to New World Iberian breed types, with respect to other breed types, had not declined, Dr. Cothran did not continue to emphasize or note any unique connection between Antelope Hills HMA and New World Iberian breed types, nor did he lament any change in the contribution of that breed type within the Antelope Hills HMA. Dr. Cothran's 2004 analysis indicated that the Antelope Hills HMA horses sampled were of mixed origins, mainly of North American breeds, with the greatest similarity to the North American gaited breed types. Dr. Cothran's 2012 analysis indicated that the Antelope Hills HMA horses sampled were of mixed ancestry, but with possible Spanish influence, with the greatest similar to the Light Racing and Riding breed types.