U.S. Department of the Interior
Bureau of Land Management

Draft RMP Amendment and EIS for Wild Horse Management in the Rock Springs and Rawlins Field Offices, Wyoming

DOI-BLM-WY-D040-2011-0001-RMP-EIS

January 2020

Cost to Date: $310,000

Rock Springs Field Office
280 Highway 191 North
Rock Springs, Wyoming 82901

Executive Summary

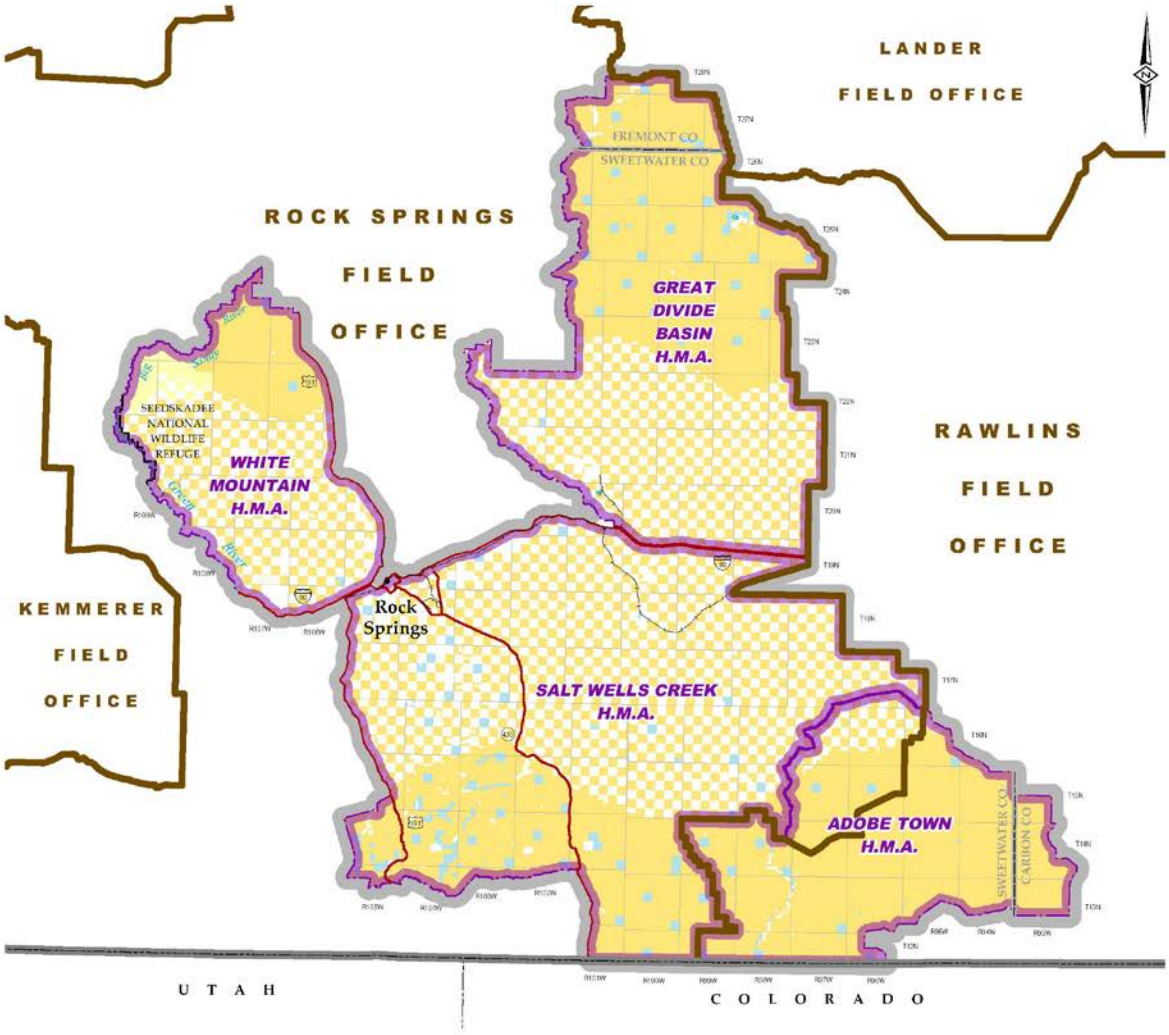
Introduction

The Federal Land Policy and Management Act (FLPMA) of 1976 directs the Department of the Interior's (DOI) Bureau of Land Management (BLM) to develop and periodically revise or amend its resource management plans (RMPs) which guide management of BLM-administered lands. The BLM has initiated a planning effort to amend the Rock Springs and Rawlins Field Offices' RMPs for the management of wild horses. In June 2011, the Rock Springs Grazing Association (RSGA) filed a lawsuit (*Rock Springs Grazing Association v. Salazar*, No. 11-CV-00263-NDF) in the United States (U.S.) District Court for Wyoming contending, in part, that the BLM had violated Section 4 of the Wild Free Roaming Horses and Burros Act, 16 U.S.C. 1334, by failing to remove strayed animals from private lands controlled by the RSGA. Historically, the RSGA had consented to allow a specific number of wild horses to utilize some of their land within the planning area. However, on October 4, 2010 the RSGA withdrew their consent and demanded BLM remove all wild horses from their private land within the planning area. In April 2013, the court approved a Consent Decree and Joint Stipulation for Dismissal (Consent Decree) that provides, in part, that the BLM will consider the environmental effects of revising the RMPs for the Rock Springs and Rawlins Field Offices by considering proposed actions that would:

- Change the Salt Wells Creek Herd Management Area (HMA) to a Herd Area (HA), which would be managed for zero wild horses, and if the BLM determines there are more than 200 wild horses within the herd area, the area would be re-gathered to zero wild horses;
- Change the Great Divide Basin HMA to a HA, which would be managed for zero wild horses, and if BLM determines there are more than 100 wild horses within the Herd Area, the area will be re-gathered to zero wild horses;
- Change the Adobe Town HMA appropriate management level (AML) to 225-450 wild horses or lower, and that gathered wild horses will not be returned to the Salt Wells Creek area; and
- Manage the White Mountain HMA as a non-reproducing herd by utilizing fertility control and sterilization methods to maintain a population of 205 wild horses and to initiate gathers if the population exceeds 205 wild horses.

The BLM is developing an environmental impact statement (EIS) for the analysis of proposed wild horse management actions to address current conditions and the BLM's obligations under the 2013 Consent Decree. If approved, management actions analyzed in this Draft EIS would amend the 1997 Green River RMP and the 2008 Rawlins RMP.

The planning area for this Draft EIS/RMP Amendment includes the Rock Springs Field Office (RSFO) and a portion of the Rawlins Field Office (RFO) depicted on Map ES-1. The planning area encompasses approximately 2,811,401acres. The BLM manages approximately 1,920,314 acres of surface estate in the planning area. Private land in the planning area totals approximately 814,086 acres.



Map ES-1: Planning Area
Draft Resource Management Plan
Amendment for Wild Horse Management

0 5 10 20
Miles

1:1,000,000

- Planning Area Boundary
- BLM Herd Management Area (H.M.A.)
- BLM Field Office Boundary
- State Boundary
- County Boundary
- Other Federal Designation
- Railroad
- Bureau of Land Management
- Bureau of Reclamation
- US Fish & Wildlife Service
- State Lands
- Private Lands
- Interstate Highway
- Secondary Highway (Federal or State)

No warranty is made by the BLM as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. The User assumes the entire risk associated with its use of these data and bears all responsibility in determining whether these data are fit for the User's intended use.

Purpose and Need for the RMP Amendment

The purpose of this planning effort is the identification and incorporation of actions for wild horse management on HMAs that encompass "checkerboard" land (alternating sections of federal and private land ownership), including establishment of AML, consistent with applicable law, in the Rock Springs Field Office and a portion of the Rawlins Field Office. The need for the plan amendment is driven by the checkerboard pattern of public and private land ownership within the HMAs, the requirements of the Wild Free-Roaming Horses and Burros Act of 1971, as amended (WFRHBA), and RSGA's withdrawal of consent to maintain wild horses on its privately-controlled lands, as embodied in the 2013 Consent Decree (see Section 1.1). The BLM will decide whether to amend the Green River and Rawlins RMPs for management of wild horses, and if so, how.

Public Participation

Scoping

The BLM initiated public scoping for the Rock Springs RMP Revision on February 1, 2011 with the publication of a Notice of Intent (NOI) in the *Federal Register*. Results of scoping for the RMP revision are available in the Rock Springs RMP Revision Scoping Report, available on the Rock Springs RMP ePlanning page. Issues identified for wild horse management during this scoping period focused on how the BLM would manage wild horse populations.

On August 16, 2013, the BLM published in the *Federal Register* a notice to extend the public scoping period for the Rock Springs RMP revision and to amend the 2008 Rawlins RMP to address management of wild horses and burros on checkerboard lands in the respective field offices. BLM allowed the public an additional 30 days to submit scoping comments on wild horse management. The results of this scoping effort are documented in the Wild Horse and Burro Consent Decree Scoping Report Addendum, available on the Rock Springs RMP ePlanning page. During the public scoping period, 15,013 individuals, agencies, and groups submitted comments on wild horse management. 734 substantive comments were identified; the bulk of commenters submitted identical form letters. Many of the comments expressed concern about wild horse reductions, over-population, conflict with other uses, the manner and method of gathers, and the viability of herds at Consent Decree AMLs. The BLM held two scoping meetings in September 2013 in Rock Springs and Rawlins, Wyoming. Identified issues included the following:

- Planning process and policy
- General comments
- Adoption/sales
- Appropriate management level (AML)
- Grazing
- Habitat management
- Herd Management Areas (HMAs)
- Population levels/population control
- Roundup/Removal

The issues to be resolved include the following:

- How will the BLM manage wild horses and meet its obligations under the 2013 Consent Decree?
- How will the BLM maintain AML in each HMA?
- How will the BLM provide for wild horse viewing opportunities for the public?

In early 2019, as a result of delays in the RMP Revision effort unrelated to wild horse management, the BLM decided to initiate a separate RMP Amendment to address wild horse management issues on the checkerboard HMAs. The 2013 scoping notice specifically included management of wild horses on checkerboard lands. Therefore, the public input about wild horse management that was received during that scoping effort was considered in the preparation of this RMP Amendment.

Cooperating Agency Involvement

Throughout this planning effort (including both the Rock Springs RMP revision and this wild horse component) the BLM has engaged with multiple federal, state, and local government agencies as well as Native American tribes. Consistent with the BLM Land Use Planning Handbook (H-1601-1) and FLPMA, cooperating agencies share knowledge and resources to achieve desired outcomes for public lands and communities within statutory and regulatory frameworks. A total of 34 agencies agreed to participate as cooperating agencies. For more information, see Chapter 5: Consultation and Coordination.

Draft EIS/RMP Amendment Alternatives

The BLM is analyzing four alternatives in this Draft EIS, including the No Action (Alternative A) and the BLM's preferred alternative (Alternative D). Summaries of the alternatives are presented below.

Alternative A (No Action)

Wild horses in the planning area are currently managed under the Green River RMP (1997) and Rawlins RMP (2008), as amended. Management under Alternative A (No Action Alternative) represents a continuation of this same management. The following HMAs are included within the planning area: Adobe Town, Great Divide Basin, Salt Wells Creek and White Mountain. Under this Alternative, the BLM would manage wild horses within these four HMAs at a total AML of 1,481 to 2,065. Water developments would be provided as necessary. Fencing would only be constructed when multiple-use values would be enhanced, and would be built to minimize restriction of wild horse movement. Fertility control would only be implemented when necessary, and opportunities for public enjoyment of wild horse herds would be provided by the development of interpretive signs, and sites, and access to herd areas.

Alternative B

Alternative B focuses on maintaining the same number of wild horses within the planning area while adjusting HMA boundaries to exclude most checkerboard lands. Under this alternative, all checkerboard lands within the Adobe Town, Great Divide Basin and Salt Wells Creek HMAs and would revert to HA status and be managed for zero wild horses. Checkerboard land would remain within the White Mountain HMA. RSGA has consented to having wild horses on private land in this area, on condition that BLM manages them as a non-reproducing herd. A total AML of 1,481 to 2,065 wild horses would be maintained among the four HMAs. Livestock grazing permits would be reduced within the four HMAs by a total of 8,100 Animal Unit Months (AUMs) to accommodate the same number of wild horses being concentrated in a smaller area. All wild horse herds would be managed as non-reproducing using various population growth suppression methods, including, but not limited to: gelding, spaying, or other mechanical, surgical, or chemical means. This would reduce the number of gathers required to maintain AML. This alternative responds, in part, to the Consent Decree's requirement that the BLM consider and analyze the possibility of managing the White Mountain HMA as non-reproducing.

Alternative C

Under Alternative C all wild horses would be removed from the planning area, and the HMAs would revert to HA status and be managed for zero wild horses. This alternative responds, in part, to requirements of the Consent Decree (i.e. analysis of converting the Salt Wells Creek and Great Divide

Basin HMAs to HAs and managing for zero wild horses in those HMAs, and managing the Adobe Town HMA at 450 wild horses or less).

Alternative D (Preferred Alternative)

Under this alternative, all checkerboard land would be removed from the HMAs and would revert to HA status, being managed for zero wild horses. As a result, the following would occur:

- The RSFO portion of the Adobe Town HMA would revert to HA status and be managed for zero wild horses. For the RFO portion of the HMA, all checkerboard land and the portion of the HMA north of the existing Corson Springs southern allotment boundary fence (see Map 2-3) would revert to HA status and be managed for zero wild horses. The remainder of the HMA would be retained and managed with an AML of 259 – 536.
- The entire Great Divide Basin HMA would revert to HA status and be managed for zero wild horses.
- The entire Salt Wells Creek HMA would revert to HA status and be managed for zero wild horses.
- The entire White Mountain HMA would revert to HA status and be managed for zero wild horses.

Total AML under this alternative would be 259 to 536 wild horses. This alternative also would establish a process by which AML may be adjusted based on an in-depth evaluation of HMA conditions and monitoring data. AUMs previously allocated to wild horse use may be reallocated to wildlife, livestock or other ecosystem functions, following an in-depth review of intensive monitoring data. Population management tools would be used to help manage wild horse populations and reduce the frequency of gathers. Population management tools could include gelding, spaying, sex ratio skewing or other population growth suppression methods. Wild horses may be relocated from other HMAs to the remaining HMAs to help maintain genetic diversity, as needed. This alternative responds, in part, to the requirements of the Consent Decree by analyzing an alternative where the Salt Wells Creek and Great Divide Basin HMAs revert to Herd Areas and are managed for zero wild horses.

Environmental Impacts of the Preferred Alternative

Impacts of the preferred alternative on wild horses as well as other resources are described in detail in Chapter 4: Environmental Consequences and are summarized in Table 2-2, Summary of Impacts. Impacts to wild horses include the direct and indirect impacts associated with gathers, transportation, and holding areas, as well as the effects associated with various methods of population growth suppression. Managing wild horses to AML on the remaining HMA would result in improved forage, water quality, and soil quality and would also result in fewer conflicts between wildlife and wild horses. Overall, under the Preferred Alternative the number of wild horses within the planning area would be reduced by approximately 74%. Members of the public seeking wild horse viewing opportunities would still be able to view wild horses within the planning area; however, there would be fewer wild horses overall, and opportunities to view wild horses would be reduced. Under this alternative, there would no longer be any wild horses in the area of the Wild Horse Scenic Loop, a popular place for viewing wild horses. The lower number of wild horses in the planning area is expected to have positive impacts to wildlife, soils, vegetation, livestock and water resources.

Contents

Chapter 1 – Introduction

1.1 Introduction

The Bureau of Land Management (BLM) Rock Springs Field Office has initiated a planning effort to prepare a Resource Management Plan (RMP) amendment and associated environmental impact statement (EIS) for wild horse management on Herd Management Areas (HMAs) that contain checkerboard land within the Rock Springs and Rawlins Field Offices. In June 2011, the Rock Springs Grazing Association (RSGA) filed a lawsuit against the BLM (*Rock Springs Grazing Association v. Salazar,* No. 11-CV-00263-NDF) in the United States District Court for Wyoming. The RSGA contended, in part, that the BLM violated Section 4 of the Wild Free Roaming Horses and Burros Act (WFRHBA), 16 U.S.C. 1334, by failing to remove strayed animals from private lands controlled by the RSGA. The RSGA-controlled lands are within the Wyoming checkerboard pattern of mixed public and private land ownership, and include lands within the BLM's Rock Springs and Rawlins management areas. These private lands are also within and adjacent to the Adobe Town, Great Divide Basin, Salt Wells Creek, and White Mountain Herd Management Areas (HMAs). The BLM and RSGA negotiated an agreement to settle the lawsuit and in April 2013, the court approved a Consent Decree and Joint Stipulation for Dismissal (Consent Decree) resolving the case. The Consent Decree provides, in part, that the BLM will consider the environmental effects of revising the respective RMPs for the Rock Springs and Rawlins Field Offices by considering actions that would:

- Change the Salt Wells Creek HMA to a Herd Area, which would be managed for zero wild horses, and if the BLM determines there are more than 200 wild horses within the herd area, the area would be re-gathered to zero wild horses;
- Change the Great Divide Basin HMA to a Herd Area, which would be managed for zero wild horses, and if BLM determines there are more than 100 wild horses within the Herd Area, the area will be re-gathered to zero wild horses;
- Change the Adobe Town HMA appropriate management level (AML) to 225-450 wild horses or lower, and that gathered wild horses will not be returned to the Salt Wells Creek area; and
- Manage the White Mountain HMA as a non-reproducing herd by utilizing fertility control and sterilization methods to maintain a population of 205 wild horses and to initiate gathers if the population exceeds 205 wild horses.

The Consent Decree requires that BLM consider these actions, but does not require that the BLM implement any specific action. The BLM has met the requirements of the Consent Decree by considering each of these actions as elements of various alternatives in this EIS, though no single alternative considers all of them together.

The RSGA owns private sections of the checkerboard land within the Adobe Town, Salt Wells Creek, Great Divide Basin, and White Mountain HMAs. Section 4 of the WFRHBA requires 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 Marshall or agent of the Secretary, who shall arrange to have the animals removed. Historically, the RSGA had agreed to allow up to 500 wild horses on the checkerboard portion of the planning area as a result of a 1979 agreement with wild horse advocacy groups (Borzea 1979, Hay 1979).

In 2010 the RSGA revoked consent to allow wild horses to utilize private land within the checkerboard. Management of a wild horse herd in the checkerboard portion of the planning area has become more challenging due to the private land conflict. In the recent *American Wild Horse Preservation Campaign v Jewell*, 847 F.3d 1174, the Tenth Circuit Court of Appeals noted the tension between Sections 3 and 4 of the WFRHBA, and the extreme difficulty for BLM in simultaneously meeting its obligations under both statutory provisions in the checkerboard. This tension arises because, under Section 3 of the WFRHBA, BLM is directed to protect and manage wild horse populations in a manner that promotes a thriving natural ecological balance. BLM does not typically reduce wild horse populations below low AML levels except in emergency situations (such as extreme drought). On the other hand, Section 4 of the WFRHBA requires BLM to remove wild horses from private land, when requested to do so. This dual mandate is difficult to implement in the checkerboard where every other section of land is private, and wild horses constantly drift between private and public land. Removing all wild horses that are on private land, or have the potential to stray onto private land, could cause the wild horse population to fall below low AML.

To resolve the issues associated with managing wild horses on checkerboard land, the BLM is considering alternatives that include managing for zero wild horses within the checkerboard portions of the HMAs within the planning area. Under these alternatives, wild horses will be managed on "solid block" land, that is, areas where BLM managed lands are concentrated in larger blocks, as opposed to the checkerboard where BLM only manages every other section of land.

The BLM has decided to prepare an EIS to analyze an RMP amendment for management of wild horses independent of the ongoing revision of the 1997 Green River RMP to address current conditions and fulfill the BLM's obligations under the Consent Decree. If approved before the RMP revision is complete, management actions analyzed in this Draft EIS would amend the 1997 Green River RMP, and would be carried forward as part of the No Action Alternative in the ongoing Rock Springs RMP revision. The approved management action would also amend the 2008 Rawlins RMP for management of wild horses in the Rawlins Field Office portion of the Adobe Town HMA.

For this RMP Amendment, the planning area includes the land encompassed by the four wild horse HMAs that include checkerboard land: Adobe Town, Great Divide Basin, Salt Wells Creek and White Mountain (see Map ES-1). The planning area totals 2,811,401 acres. Within the Rock Spring Field Office area, an additional HMA, Little Colorado, is located immediately north of the White Mountain HMA. The Little Colorado HMA is not included in the Planning Area because it does not contain any checkerboard land.

1.2 Purpose and Need for the Plan Amendment

The purpose of this planning effort is to identify and select, consistent with applicable law, a plan for wild horse management, including AML, on HMAs that include checkerboard land, in the Rock Springs Field Office and a portion of the Rawlins Field Office. The need for the plan amendment is driven by the checkerboard pattern of public and private land ownership within the HMAs, the requirements of the WFRHBA, and RSGA's withdrawal of consent to maintain wild horses on privately-owned lands, as embodied in the 2013 Consent Decree (see Section 1.1). The BLM will decide whether to amend the Green River and Rawlins RMPs for management of wild horses, and if so, how.

1.3 Scoping and Issues

Planning issues are disputes or controversies about existing and potential land and resource allocations, levels of resource use, production, and related management practices. Issues include resource use, development, and protection opportunities for consideration in the preparation of the RMP Amendment.

Issues are generally identified during the public scoping period. The BLM initiated public scoping for the Rock Springs RMP Revision on February 1, 2011 with the publication of a Notice of Intent (NOI) in the *Federal Register* (76 FR 5607 (2011)). Results of scoping for the RMP revision are available in the Rock Springs RMP Revision Scoping Report, available on the Rock Springs RMP ePlanning page.

On August 16, 2013 (78 FR 50090 (2013)), the BLM published in the *Federal Register* a notice to extend the public scoping period for the Rock Springs RMP revision and to amend the 2008 Rawlins RMP to address wild horse management in the respective field offices. The BLM allowed the public an additional 30 days in which to submit scoping comments on wild horse management. The results of this scoping effort are documented in the Wild Horse and Burro Consent Decree Scoping Report Addendum, available on the Rock Springs RMP ePlanning page.

During the public scoping period, 15,013 individuals, agencies, and groups submitted comments on wild horse management. The bulk of these commenters submitted identical form letters. The BLM identified 734 substantive comments. Many of the comments expressed concern about wild horse reductions, over-population, conflict with other uses, the manner and method of gathers, and the viability of herds at Consent Decree AMLs. The BLM held two scoping meetings in September 2013 in Rock Springs and Rawlins, Wyoming. Issues identified during scoping fell into the categories identified in Table 1-1.

Table 1-1. General scoping comment categories summary.

Comment Category	Number of Substantive Comments*
Planning Process and Policy	39
General Comments	119
Adoption/Sales	13
Appropriate Management Level (AML)	32
Grazing	68
Habitat Management	40
Herd Management Areas (HMAs)	19
Population Levels/Population Control	60
Roundup/Removal	344
Total Comments	**734**

*Identical comments in form letters were counted as a single comment.

1.3.1 Scoping Issues Addressed

The following issues were identified during scoping and will be addressed in this Draft EIS/RMP Amendment:

- How will rangelands and wild horses be managed?
- How will wild horse populations be managed?
- How will the BLM control HMA herd numbers?

1.3.2 Scoping Issues Not Addressed

The CEQ regulations state: "NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail." The CEQ regulations also state that the agency should "identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review." Non-significant issues are identified as "non-significant" because they are: 1) outside the scope of the Proposed Action; 2) already decided by law, regulation, or other higher level decision; 3) unrelated to the decision to be made; or are 4) conjectural

and not supported by scientific or factual evidence." Table 1-2 identifies these issues and explains why they were not considered further.

Table 1-2. Issues not carried forward for detailed analysis.

Issue Raised	Justification for Dismissal	Reason
BLM has illegally elevated the interests of livestock grazing over the interests of wild horses, in violation of FLPMA's multiple-use mandate and the Wild Free Roaming Horses and Burros Act.	The assertion is not an issue for land use planning analysis but is instead a legal conclusion.	To the extent the comment refers to the Consent Decree, that settlement is consistent with applicable law. The Consent Decree itself provides for compliance with applicable law The U.S. District Court for the District of Wyoming found the settlement was 'fair, reasonable, equitable, and adequate'. Moreover, the planning criteria for this planning effort (Section 1.4) provide for compliance with both FLPMA and the WFRHBA as well as other applicable law.
How will funding of wild horse removals be addressed?	The issue raised is not germane to the planning process because it involves a matter normally addressed in plan implementation.	Funding to implement decisions contained in the RMP is not part of the planning process but is managed through congressional budget decisions, followed by BLM state and local field office budget planning.
Can the BLM overrule or ignore the court's decision?	The issue raised is not germane because it is beyond the scope of this planning effort.	The Consent Decree is the result of settlement discussions between the RSGA and the BLM to dismiss the lawsuit brought by RSGA to remove all wild horses from private lands within the checkerboard pattern of mixed land ownership. RSGA may seek to enforce the Consent Decree in court. The U.S. District Court incorporated, approved, granted and expressly made the provisions of the Consent Decree an order of the Court, and retains jurisdiction consistent with the Consent Decree.
To what extent will wild horse removals be monitored after completion of Consent Decree actions?	The issues raised is addressed through law, regulation, or other policy or administrative action.	Monitoring will be in accordance with BLM strategy and policy for implementation actions associated with the decisions in the RMP.

1.4 Planning Criteria

Planning criteria are constraints or ground rules developed to guide and direct the planning effort. Planning criteria are based on laws and regulations; BLM guidance and policy; results of consultation and coordination with the public, agencies, and other stakeholders; and analysis of information pertinent to the planning area. Additional planning criteria may be identified as the planning process progresses. Planning criteria for this effort include:

- In accordance with the terms of the Consent Decree, the BLM will consider certain actions to amend or revise the Rock Springs and Rawlins RMPs..
- This RMP Amendment will comply with FLPMA, the Wild Free-Roaming Horses and Burros Act, and all other applicable laws, regulations, and policies.
- Impacts from the management alternatives considered in the EIS will be analyzed in accordance with land use planning regulations at 43 CFR 1610 and NEPA regulations at 40 CFR 1500.
- This planning process applies to BLM-administered public surface estate within four Herd Management Areas: Great Divide Basin, Salt Wells Creek, Adobe Town and White Mountain.
- Broad-based public participation will be an integral part of the planning and NEPA processes.
- The planning document will be consistent with other Federal agency, state, and local plans to the maximum extent consistent with Federal law and FLPMA provisions (43 CFR 1610.3-2(b)).
- The BLM will work cooperatively and collaboratively with cooperating agencies and all other interested groups, agencies, and individuals.
- Geographic Information System (GIS) and metadata information will meet Federal Geographic Data Committee (FDGC) standards. All other applicable BLM data standards will also be followed.
- All proposed management actions will be based on current scientific information, research, technology, and existing inventory and monitoring information. Where practicable and timely for the planning effort, additional scientific information, research, and new technologies will be considered.

1.5 Planning Process

FLPMA directs the BLM to plan for and manage the public lands it administers. The process for developing, approving, maintaining, and amending or revising RMPs is authorized by FLMPA Section 202(a). The BLM's regulations under 43 CFR 1610 set forth the BLM's process for preparing a plan, in accordance with FLPMA and NEPA, so that the management decisions are based on appropriate information and public involvement. RMPs prescribe land use allocations and future management direction. Once finalized, this RMP amendment will identify actions for management of wild horses in the Rock Springs Field Office and a portion of the Rawlins Field Office.

This planning process for wild horse management in the planning area began in 2011 (see Section 1.3 for information about the public scoping process). The notice of publication of this Draft EIS/RMP Amendment will initiate a 90-day public comment period. The Final EIS/Proposed RMP Amendment will take into consideration comments received on the Draft EIS/RMP Amendment. Publication of the Final EIS/Proposed RMP Amendment will initiate a 30-day protest period and a 60-day Governor's Consistency Review period. Following the resolution of any protests and any identified inconsistencies, the BLM will publish a Record of Decision and Approved RMP Amendment.

1.6 Cooperating Agencies

Throughout this planning effort (including both the Rock Springs RMP revision and this wild horse component) the BLM has engaged with multiple federal, state, and local government agencies as well as Native American tribes. Consistent with the BLM Land Use Planning Handbook (H-1601-1) and FLPMA, cooperating agencies share knowledge and resources to achieve desired outcomes for public lands and communities within statutory and regulatory frameworks. A total of 34 agencies agreed to participate as cooperating agencies. For more information, see Chapter 5: Consultation and Coordination.

1.7 Relevant Statutes, Limitations, and Guidelines

The FLPMA is the primary authority for BLM administration of public lands and provides the overarching policy by which the BLM administers public lands. FLPMA Sections 201 and 202 establish BLM land use planning requirements, and the BLM's Land Use Planning Handbook (H-1601-1) provides guidance for implementing BLM land use planning requirements and the land use planning regulations at 43 CFR 1600.

NEPA, together with the Council on Environmental Quality's regulations (409 CFR Parts 1500-1508), the NEPA Regulations of the Department of the Interior (43 CFR Part 46), and the BLM's NEPA Handbook (H-1709-1), establish a public, interdisciplinary framework for Federal decision-making, and ensure that agencies consider the environmental impacts of any federal actions, and involve the public in decision-making.

The Public Rangelands Improvement Act of 1978 provides for the improvement of range conditions on public rangelands, research on wild horse and burro population dynamics, and other range management practices. The WFRHBA provides for the management, protection, and control of wild horses and burros on public lands and authorizes the adoption and sale of wild horses and burros by private individuals. Among other requirements, it directs the Secretary of the Interior, through the BLM, to consider wild horses as a component of the public lands, manage wild horses in a manner to be designed to achieve a thriving natural ecological balance on the public lands, and arrange for the removal of strayed wild horses on private lands upon written request of a private landowner. Regulations applicable to wild horse and burro management on BLM-administered lands are provided in 43 CFR 4700.

1.8 Relationship to Other Plans

BLM land use plans shall be consistent with other Federal agency, state, and local plans to the extent consistent with the purposes, policies, and programs of Federal laws and regulations applicable to the public lands. The table below outlines the local, state, and federal management plans that may pertain to the planning area.

Table 1-3. List of Other Plans.

Plan Type	Plan Name
City Plans	Rock Springs Master Plan, 2012
	Green River Comprehensive Master Plan, 2012
County Plans	Fremont County Land Use Plan, 2004
	Lincoln County Comprehensive Plan, 2006
	Sublette County Federal and State Land Use Policy, 2009
	Sweetwater County Comprehensive Plan, 2002
	Uinta County Comprehensive Plan, 2011

County Conservation Districts	Lincoln Conservation District Land Use and Natural Resource Management Long Range Plan, 2010
	Popo Agie Conservation District Long Range Plan, 2013
	Sublette County Conservation District Land Use and Natural Resource Management Long Range Plan, 2010
	Sweetwater County Conservation District Land and Resource Use Plan, 2005
	Uinta County Conservation District Long Range Plan, 2010
State of Wyoming	Wyoming Department of Agriculture Strategic Plan, 2005
	Wyoming Department of Game and Fish Strategic Habitat Plan, 2015
	Wyoming Water Development Office, Green River Basin Water Plan, 2010

Chapter 2 – Alternatives

2.1 Introduction

This chapter describes the alternatives considered by the BLM for the management of wild horses in the Rock Springs Field Office and a portion of the Rawlins Field Office. These alternatives are analyzed in Chapter 4 of this EIS, were developed based on input from the public via scoping as well as discussions with cooperating agencies, and include the elements of the 2013 Consent Decree discussed in Section 1.1. These alternatives include actions that would amend both the Rock Springs and Rawlins RMPs for wild horse management.

2.2 Description of Alternatives

2.2.1 Alternative A (No Action)

Wild horses in the planning area are currently managed under the Green River RMP (1997) and Rawlins RMP (2008), as amended. Management under Alternative A (No Action Alternative) represents a continuation of this same management. The following HMAs are included within the planning area: Adobe Town, Great Divide Basin, Salt Wells Creek and White Mountain. Under this Alternative, the BLM would manage wild horses within these four HMAs at a total AML of 1,481 to 2,065. Water developments would be provided as necessary. Fencing would only be constructed when multiple-use values would be enhanced, and would be built to minimize restriction of wild horse movement. Fertility control would only be implemented when necessary, and opportunities for public enjoyment of wild horse herds would be provided by the development of interpretive signs, and sites, and access to herd areas. Current management of wild horses within checkerboard lands has presented significant challenges due to private land conflicts.

2.2.2 Alternative B

Alternative B focuses on maintaining the same number of wild horses within the planning area while adjusting HMA boundaries to exclude most checkerboard lands. Under this alternative, all checkerboard lands within the Adobe Town, Great Divide Basin and Salt Wells Creek HMAs would revert to HA status and be managed for zero wild horses. Checkerboard land would remain within the White Mountain

HMA. RSGA has consented to having wild horses on private land in this area, on condition that BLM manages them as a non-reproducing herd. A total AML of 1,481 to 2,065 wild horses would be maintained among the four HMAs. Livestock grazing permits would be reduced within the four HMAs by a total of 8,100 Animal Unit Months (AUMs) to accommodate the existing number of wild horses (2,065 at high AML) being concentrated in smaller HMAs (see Appendix A for how this AUM value was calculated). **Section 4.2.10** provides a breakdown of the reduction in livestock AUMs within each HMA under this alternative. All wild horse herds would be managed as non-reproducing, using various population growth suppression methods, including, but not limited to: gelding, spaying, or other mechanical, surgical, or chemical means. This would reduce the number of gathers required to maintain AML. This alternative responds, in part, to the Consent Decree's requirement that the BLM consider and analyze the possibility of managing the White Mountain HMA as non-reproducing.

2.2.3 Alternative C

Under Alternative C all wild horses would be removed from the planning area, and the HMAs would revert to HA status and be managed for zero wild horses. This alternative responds, in part, to requirements of the Consent Decree (i.e. analysis of converting the Salt Wells Creek and Great Divide Basin HMAs to HAs and managing them for zero wild horses, and managing the Adobe Town HMA at 450 wild horses or less).

2.2.4 Alternative D (Preferred Alternative)

Under this alternative, all checkerboard land would be removed from the HMAs and would revert to HA status, and all other lands in three of the HMAs would revert to HA status. All HA lands would be managed for zero wild horses. The outcome for each HMA would be as follows:

- The RSFO portion of the Adobe Town HMA would revert to HA status and be managed for zero wild horses. In the RFO portion of the HMA, all checkerboard land and the portion of the HMA north of the existing Corson Springs southern allotment boundary fence (see Map 2-3) would revert to HA status and be managed for zero wild horses. The remainder of the HMA (within the RFO) would be retained and managed with an AML of 259 – 536.
- The entire Great Divide Basin HMA would revert to HA status and be managed for zero wild horses.
- The entire Salt Wells Creek HMA would revert to HA status and be managed for zero wild horses.
- The entire White Mountain HMA would revert to HA status and be managed for zero wild horses.

Under this alternative Adobe Town would be the only HMA within the planning area that would remain, in part, and all checkerboard lands would be removed from that HMA. The AML for Adobe Town under this alternative would be 259 to 536 wild horses. This initial AML was calculated by proportionally adjusting the high AML based on the reduced size of the HMA (see Appendix A). The BLM considered other resource data, such as the current status of rangeland health in this area (as compared with BLM's rangeland health standards), in determining that a proportional adjustment was appropriate for this HMA. This AML would be evaluated and adjusted in the future when detailed, site specific data are available (approximately 5 years after successful implementation of this alternative). Following that, AML may be adjusted as needed when site specific data demonstrates a change in AML is appropriate. To evaluate and potentially adjust AML, the BLM would conduct and document the multi-tiered analysis process outlined in the Wild Horses and Burros Management Handbook (H-4700-1, Appendix 3). This analysis would include an in-depth review of intensive monitoring data including: grazing utilization, use patterns,

Standards for Healthy Rangelands, trend monitoring, actual use, and climate data. A site specific environmental analysis will be prepared, including opportunities for public comment. AML would not be evaluated each time a wild horse gather is proposed, but rather if monitoring data demonstrates there is a substantial increase or decrease in available forage, or long term conditions within the HMA have changed as a result of prolonged drought, wildfires, noxious weed infestations, or changes in livestock management.

AUMs previously allocated to wild horse use may be allocated to wildlife, livestock or other ecosystem functions. The BLM will determine how to allocate these AUMs after conducting an in-depth review of intensive monitoring data including: grazing utilization, use patterns, Standards for Healthy Rangelands, trend monitoring, actual use and climate data.

Under this alternative, population management tools would be used to help manage wild horse populations and reduce the frequency of gathers. Population management tools could include gelding, spaying, sex ratio skewing or other population growth control methods. Wild horses may be relocated from other HMAs to the remaining HMA to help maintain genetic diversity, as needed. When relocating wild horses, care would be taken to ensure the health of the horses being introduced to the HMA. Potential animals for relocation would have a good body condition, absence of obvious defects or abnormalities and an absence of diseases. Typical relocation activities would involve introducing approximately 5 mares from an outside HMA into the subject HMA. BLM would ensure this introduction would not cause the wild horse population within the HMA to exceed AML.

This alternative responds, in part, to the requirements of the Consent Decree by analyzing an alternative where the Salt Wells Creek and Great Divide Basin HMAs revert to Herd Areas and are managed for zero wild horses.

2.3 Rationale for the Preferred Alternative (Alternative D)

Following is a detailed description of the rationale for the Preferred Alternative by HMA:

Adobe Town HMA

In the Preferred Alternative, the RSFO portion of the Adobe Town HMA would revert to HA status and be managed for zero wild horses. Currently, 42% of the RSFO portion of this HMA lies within the checkerboard land ownership pattern. The BLM considered the possibility of allowing continuation of wild horse use on the RSFO portion of the HMA outside of the checkerboard, but determined that a combination of topography, land ownership, and available resources made this unfeasible because wild horses would constantly stray onto private land within the checkerboard land pattern.

Under this alternative the HMA boundary would be adjusted to more closely align with existing natural or man-made boundaries. There are no other natural or man-made boundaries in the area that would prevent wild horses from drifting onto checkerboard lands, so this action of aligning the revised HMA boundary with the existing infrastructure would assist in keeping wild horses off of private lands in the checkerboard.

The proposed AML for the remaining RFO portion of the Adobe Town HMA would be 259 – 536 wild horses. This AML was calculated by adjusting the historic AML of 610 – 800 in proportion to the reduced available area of the HMA under this alternative, taking into consideration climate, vegetation trend, livestock use, range suitability, wild horse genetics and populations, wildlife habitat and population objectives, carrying capacity, watershed values, disturbance and reclamation, recreation use, and dietary comparison for livestock, wildlife, and wild horses (see Appendix A for more details). The BLM

reviewed AML (as per H-4700-1) and found that there would be adequate forage, water cover and space to sustain a wild horse herd, and maintain a TNEB within the reduced HMA area, at the proposed AML (see Appendix A). The reduced AML under this alternative provides slightly more space and a lower overall stocking density than current management. Furthermore, all allotments within this portion of the HMA are currently meeting all land health standards. Since these allotments were able to meet these standards at current stocking densities, it is expected that a slightly reduced stocking density will continue to support rangeland health standards in this area, and ensure a TNEB. Based on these factors, and in particular the carrying capacity of the area (as represented by AUMs), the BLM determined that a reduced AML of 259 – 536 wild horses would be appropriate for the RFO portion of the Adobe Town HMA under this alternative, and would ensure a TNEB.

Great Divide Basin HMA

In the Preferred Alternative, the entire Great Divide Basin HMA would revert to HA status and be managed for zero wild horses. BLM has found it increasingly difficult to effectively manage wild horses in the checkerboard portion of the planning area in a manner consistent with both Section 3(b)(1) and Section 4 of the WFRHBA. Currently 48% of this HMA lies within the checkerboard pattern of land ownership, but the solid-block portion also would revert to HA status under this alternative due to the infeasibility of creating an effective barrier between checkerboard and solid-block federal lands. The BLM conducted a review of AML (as per H-4700-1, Appendix 3) and found that there was adequate forage, water, cover and space to sustain a wild horse herd in the solid-block portion of this HMA (see Appendix A); however, to prevent wild horses who had historically utilized the checkerboard lands from drifting out of the solid-block portion of this HMA, a fence or another type of barrier would be required along the entire southern border. Currently there are no other fences or natural topography that this southern barrier could intersect on the western side for at least 30 miles. A southern barrier would also fully bisect the Sublette Mule Deer Migration Corridor, and would potentially interfere with big game migration. Therefore, even though the analysis in Appendix A demonstrated that there is adequate forage, water cover and space to support a wild horse herd in the solid-block portion of the area, it would be very difficult for BLM to prevent this herd from continually returning to private lands in the checkerboard. For this reason, in the Preferred Alternative this entire HMA would revert to HA status and be managed for zero wild horses.

Salt Wells Creek HMA

In the Preferred Alternative, the entire Salt Wells Creek HMA would revert to HA status and be managed for zero wild horses. Currently 72% of this HMA lies within the checkerboard pattern of ownership but the solid-block portion also would revert to HA status under this alternative due to the infeasibility of creating an effective barrier between checkerboard and solid-block federal lands. The BLM conducted a review of AML (as per H-4700-1) and found that there would be adequate forage, water cover and space to sustain a wild horse herd, and maintain a TNEB within the solid-block portion of the HMA (see Appendix A). However, to prevent wild horses who had historically utilized the checkerboard lands, from drifting out of the solid-block portion of this HMA a fence or another type of barrier would be required along the entire northern border. Currently there are no other fences or natural topography that this northern barrier could intersect on the eastern side for at least 30 miles. Good tie-in points are lacking on the western side as well. Therefore, even though the analysis in Appendix A demonstrated that there is adequate forage, water cover and space to support a wild horse herd in the solid-block portion of this area, it would be very difficult for BLM to prevent this herd from continually returning to private lands in the checkerboard. For this reason, in the Preferred Alternative this HMA would revert to HA status and be managed for zero wild horses.

White Mountain HMA

In the Preferred Alternative the entire White Mountain HMA would revert to HA status and be managed for zero wild horses. Currently, 72% of this HMA lies within the checkerboard pattern of land ownership. The RSGA has consented to wild horses utilizing private land within this HMA, if BLM manages the White Mountain HMA as a non-reproducing herd. BLM has determined that it would not be feasible to manage this herd as non-reproducing, due to the potential interchange of reproducing animals from outside the HMA. If the BLM were to remove all checkerboard portions of the White Mountain HMA, approximately 110,000 acres would remain. The BLM conducted a review of AML (as per H-4700-1, Appendix 3) and found that insufficient forage and space would be available to sustain a wild horse herd after removing all checkerboard land from this HMA (see Appendix A). BLM considered managing the solid-block portion of the White Mountain HMA in conjunction with the Little Colorado HMA, but determined this would not be feasible (see Section 2.4).

2.4 Alternatives Considered but Eliminated from Detailed Analysis

The following alternatives were considered but eliminated from detailed analysis for wild horse management.

Maintain Public Land Portions of HMAs within the Checkerboard

Under this alternative the BLM would remove the private land portions of the checkerboard, and adjust the AML accordingly, but would maintain the public land portions of the HMAs. When wild horses moved onto private lands, the BLM would remove them as requested by the landowner. This alternative was eliminated from detailed analysis, because it is not technically feasible. In the checkerboard landownership pattern, where every other square mile alternates ownership, and very little fencing limits wild horse movement, wild horses constantly move on and off of private land. It would not be feasible to ensure that wild horses remain on only the BLM managed sections in this area. While courts have held that the BLM is not required to prevent wild horses from straying onto private lands (*Fallini v. Hodel*, 783 F.2d 1343 (9th Cir. 1986)), it would not be appropriate to maintain an HMA in a location where the constant straying of wild horses onto private land is expected. In *American Wild Horse Preservation Campaign v. Jewell*, 847 F.3d 1174 (10th Cir. 2016), the Tenth Circuit Court of Appeals noted the tension between Sections 3 and 4 of the WFRHBA, and the extreme difficulty for BLM in simultaneously meeting its obligations under both statutory provisions in the checkerboard. For these reasons, the BLM has determined that this alternative is not technically feasible, and has eliminated it from detailed analysis in this document.

Manage the Solid-block portion of the White Mountain HMA in Conjunction with the Little Colorado HMA

Under this alternative, the BLM would retain the solid-block portion of the White Mountain HMA and manage it in conjunction with the Little Colorado HMA. This alternative was eliminated from detailed analysis, because it is not technically feasible. Wild horses within this HMA have historically moved back and forth between the checkerboard and solid-block portions of the HMA. In order to prevent wild horses from straying onto private land within the checkerboard, a fence, or some other type of barrier, would need to be constructed on the southern border. However, there is no existing fence or other natural barrier that would connect with such a barrier on the western side. Therefore, this alternative was determined to be infeasible.

2.5 Table of Alternatives

Table 2-1, below, presents a table comparing the alternatives considered in this EIS.

Table 2-1.Detailed comparison of the alternatives.

Management Action #	Goal/Objective	Alternative A (No Action)	Alternative B	Alternative C	Alternative D (Preferred)
	Goals and Objectives: Wild Horse (WH) 1: Manage wild horses in the planning area at Appropriate Management Levels (AMLs). WH 2: Provide adequate habitat for free-roaming wild horses through management consistent with the principles of multiple use. WH 3: Provide opportunities for the public to view wild horses.				
Management Action (MA)001	WH 2	Manage wild horses adhering to all applicable laws, agreements, court orders, and decisions for each HMA and consider private property rights.			
MA002	WH 1	Specific habitat objectives for HMAs would be established through the development and implementation of HMA plans for each HMA or Complex. Consideration will be given to desired plant communities, wildlife habitat, watershed, livestock grazing, and other resource needs.			
MA003	WH 2, 3	Wild horses would be managed within four wild horse HMAs. These are the White Mountain, Great Divide Basin, Adobe Town and Salt Wells Creek wild horse HMAs (Map 2-1). (Note the Little Colorado HMA is not included in the planning area for this document).	Same as Alternative A.	The Great Divide Basin, White Mountain, Salt Wells Creek, and Adobe Town HMAs would revert to HA status, and be managed for zero wild horses.	Manage wild horses within one HMA, namely the Adobe Town HMA. (Map 2-3). Revert the other three HMAs to HA status and manage them for zero wild horses.
MA004	WH 1, 2	No similar action	Revert all checkerboard portions of the Salt Wells Creek HMA to HA status and manage for zero wild horses. Manage AML on	Revert the entire Salt Wells Creek HMA to HA status and manage for zero wild horses.	Same as Alternative C.

Management Action #	Goal/Objective	Alternative A (No Action)	Alternative B	Alternative C	Alternative D (Preferred)
			the adjusted HMA in accordance with MA009.		
MA005	WH 1, 2	No similar action	Retain the White Mountain HMA and manage AML in accordance with MA009.	Revert the entire White Mountain HMA to HA status and manage for zero wild horses.	Same as Alternative C.
MA006	WH 1, 2	No similar action	Revert the checkerboard portion of the Adobe Town HMA within the RSFO to HA status and manage for zero wild horses. Retain the remainder of this HMA within the RSFO and manage AML in accordance with MA009.	Revert the entire RSFO portion of the Adobe Town HMA to HA status and manage for zero wild horses.	Same as Alternative C.
MA007	WH 1, 2	No similar action	Revert the checkerboard portion of the Adobe Town HMA within the RFO to HA status and manage for zero wild horses. Retain the remainder of this HMA within the RFO and manage AML in accordance with MA009.	Revert the entire RFO portion of the Adobe Town HMA to HA status and manage for zero wild horses.	Revert the checkerboard portion of the Adobe Town HMA within the RFO to HA status and manage for zero wild horses. Revert the portion of the HMA north of the existing Corson Springs southern allotment boundary fence to HA status and manage for zero wild horses. Retain the remainder of this HMA within the RFO and manage AML in accordance with MA009.

Management Action #	Goal/Objective	Alternative A (No Action)	Alternative B	Alternative C	Alternative D (Preferred)
MA008	WH 1, 2, 3	In the Jack Morrow Hills (JMH) planning area, wild horse populations would be managed within the Great Divide Basin HMA at an AML of 415-600 horses. The Great Divide Basin HMA boundaries would remain unchanged from those identified in the Green River RMP (1997).	Revert the checkerboard portion of the Great Divide Basin HMA to HA status and manage for zero wild horses. Retain the remainder of this HMA and manage AML in accordance with MA009.	Revert the entire Great Divide Basin HMA to HA status and manage for zero wild horses.	Same as Alternative C.
MA009	WH 1	Maintain an AML of 1,481 to 2,065 wild horses among the four checkerboard HMAs. Adobe Town (RSFO): • Acres: 102,854 (BLM: 79,924) • AML: 165-235 • AUMs: 1,980-2,820 Adobe Town (RFO): • Acres: 374,132 (BLM: 362,504) • AML: 445-565 • AUMs: 5,340-6,780 Great Divide Basin: • Acres: 776,189 (BLM: 559,398) • AML: 415-600 • AUMs: 4,980-7,200 Salt Wells Creek:	Maintain an AML of 1,481 to 2,065 wild horses among four HMAs. Allocate 24,780 AUMs to wild horses to support high AML. Adobe Town (RSFO): • Acres: 66,285 (BLM: 59,007) • AML: 165-235 • AUMs: 1,980-2,820 Adobe Town (RFO): • Acres: 365,731 (BLM: 361,149) • AML: 445-565 • AUMs: 5,340-6,780 Great Divide Basin: • Acres: 397,936 (BLM: 374,697) • AML: 415-600	Manage the Great Divide Basin, White Mountain, Salt Wells Creek, and Adobe Town HMAs at an AML of zero. All wild horses would be permanently removed from the planning area.	Maintain an AML of 259 to 536 wild horses on one HMA. Allocate 6,432 AUMs to wild horses to support high AML. Adobe Town (RFO): • Acres: 355,094 (BLM: 345,277) • AML: 259-536 • AUMs: 3,108 -6,432 Manage the Great Divide Basin, Salt Wells Creek and White Mountain HMAs for zero wild horses. Manage the RSFO portion of the Adobe Town HMA for zero wild horses. Manage the checkerboard portion

Management Action #	Goal/Objective	Alternative A (No Action)	Alternative B	Alternative C	Alternative D (Preferred)
		• Acres: 1,169,288 (BLM: 689,511) • AML: 251-365 • AUMs: 3,012-4,380 White Mountain: • Acres: 388,488 (BLM: 207,350) • AML: 205-300 • AUMs: 2,460-3,600	• AUMs: 4,980-7,200 Salt Wells Creek: • Acres: 319,556 (BLM: 287,203) • AML: 251-365 • AUMs: 3,012-4,380 White Mountain: • Acres: 388,488 (BLM: 207,350) • AML: 205-300 • AUMs: 2,460-3,600		of the Adobe Town HMA within the RFO for zero wild horses. All wild horses would be permanently removed from these areas.
MA010	WH 1,2	No similar action.	Reduce livestock grazing permits within the four HMAs by a total of 8,100 AUMs as follows: • Great Divide Basin: Reduce 3,612 AUMs • Salt Wells Creek: Reduce 3,264 AUMs • Adobe Town (RSFO): Reduce 1,176 AUMs • Adobe Town (RFO): Reduce 48 AUMs • White Mountain: Reduce 0 AUMs Each grazing permit would be reduced in proportion to their relative contribution to the total livestock AUMs permitted within the HMAs.	No similar action.	AUMs previously allocated to wild horse use may be allocated to wildlife, livestock or other ecosystem functions. Determine how to allocate these AUMs after conducting an in-depth review of intensive monitoring data including: grazing utilization, use patterns, Standards for Healthy Rangelands, trend monitoring, actual use and climate data.

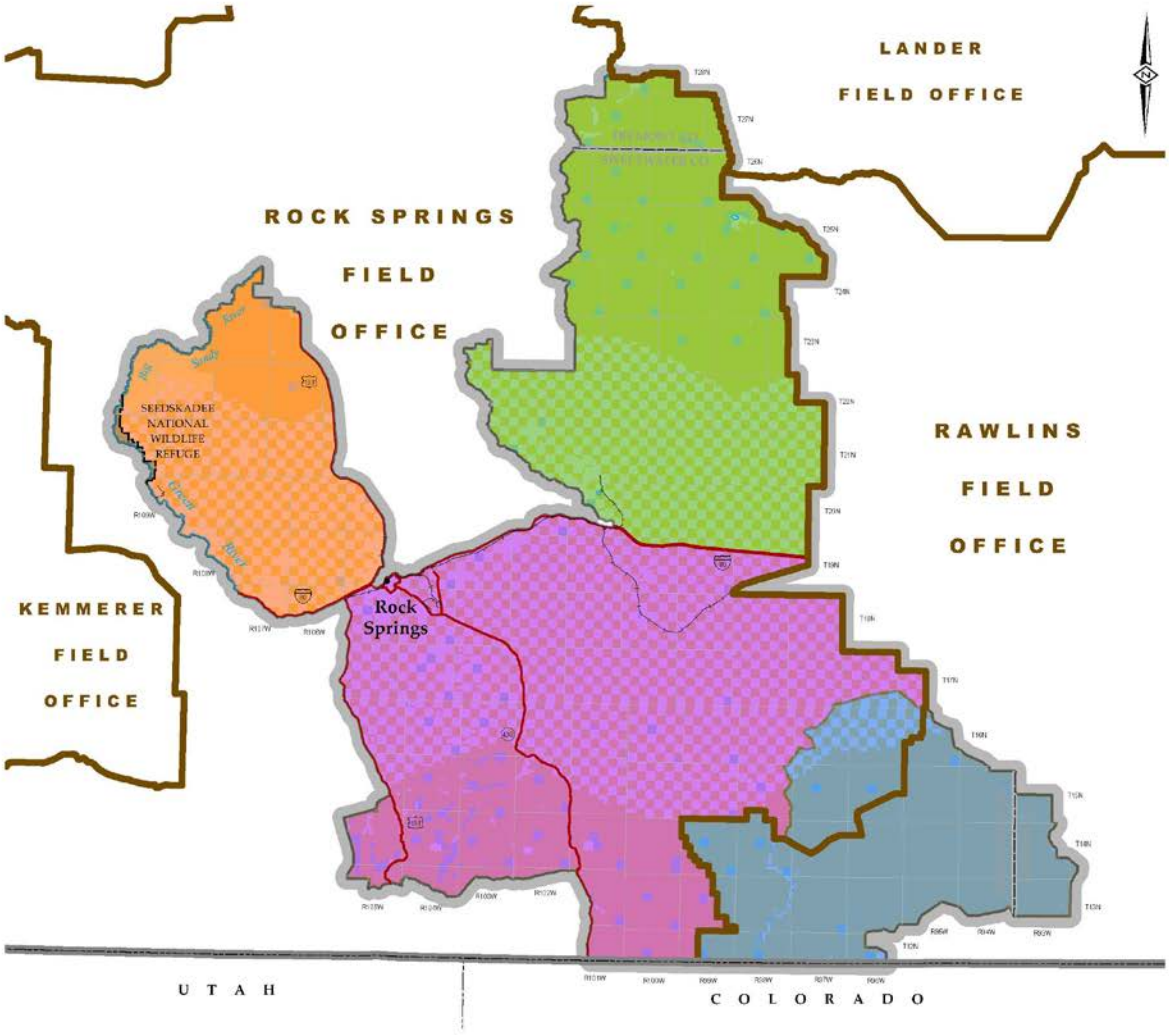
Management Action #	Goal/Objective	Alternative A (No Action)	Alternative B	Alternative C	Alternative D (Preferred)
MA011	WH 2	In the JMH planning area, water developments would be provided as needed to improve wild horse herd distribution and manage forage utilization. Water developments within sensitive wildlife habitats would be considered only if wildlife habitat and resource conditions would be improved or maintained. Compatibility with special status plant species would be required. Water developments on crucial winter ranges could be allowed if they conform to wildlife objectives and do not result in adverse impacts to the crucial winter range. Water developments would be provided if necessary to improve herd distribution and manage forage utilization. The feasibility of water development on the checkerboard land portion of the herd areas to better distribute wild horses would be determined. Any water developments	Provide water developments for wild horses where necessary to improve wild horse herd distribution and manage forage utilization. Allow water developments for wild horses on crucial winter ranges if they conform to wildlife objectives and do not result in adverse impacts to the crucial winter range.	No similar action	Same as Alternative B.

Management Action #	Goal/Objective	Alternative A (No Action)	Alternative B	Alternative C	Alternative D (Preferred)
		proposed in the Rock Springs Allotment would primarily enhance management of wild horses.			
MA012	WH 1	Fertility control would be initiated only if necessary.	Manage all HMAs as non-reproducing herds utilizing a variety of tools such as gelding, spaying, or other sterilization methods (mechanical, surgical, and chemical). Following natural attrition, sterilized wild horses from other HMAs would be introduced as needed to maintain the AML for the HMA. Gelded stallions, spayed mares, or other equivalent sterilized animals would make up the non-reproducing portion of the managed population within the HMAs. Implementation of any of these population growth suppression methods would be through a site-specific activity plan.	No similar action	Utilize a variety of population growth suppression tools to help manage wild horse populations. These tools could include gelding, spaying, sex ratio skewing or other population growth control methods (mechanical, surgical, or chemical). Implementation of any of these population growth suppression tools would be through a site-specific activity plan. Periodically supplement any herds with potential low genetic diversity with additional wild horses from other HMAs to maintain the genetic diversity of the herd.

Management Action #	Goal/Objective	Alternative A (No Action)	Alternative B	Alternative C	Alternative D (Preferred)
MA013	WH 1	Selective gathering programs would be implemented in each of the wild horse HMAs. Gathering plans would be prepared for removal of excess horses from inside and outside the wild horse HMAs. Gathering cycles would vary by plan objectives, resource conditions, and needs. These actions would aid in stabilizing populations, managing for conditions and special characteristics, and supply an adoptable population (young horses). In the JMH planning area, a gather plan incorporating the national selective removal policy would be developed and implemented to remove excess horses from inside and outside the HMA to maintain the existing AMLs. The scheduling of gathers would vary according to the HMA objectives, resource conditions, and need. Fertility control would be initiated only if deemed	Prepare gather plans for removal of excess wild horses from inside and outside the wild horse HMAs.	Same as Alternative B.	Same as Alternative B.

Management Action #	Goal/Objective	Alternative A (No Action)	Alternative B	Alternative C	Alternative D (Preferred)
		appropriate by a site-specific analysis.			
MA014	WH 2	Fencing in wild horse HMAs would be restricted to those situations where multiple-use values would be enhanced. All fences would be constructed to minimize restriction of wild horse movement.	Restrict new fencing in wild horse HMAs to opportunities that would directly benefit wild horses or other resource values.	No similar action.	Allow new fencing in wild horse HMAs on a case-by-case basis that does not impede or endanger wild horse management and supports other resource values.
MA015	WH 3	Opportunity for public education and enjoyment of wild horse herds would be provided by placing interpretive signs, providing interpretive sites, and providing access to herd areas. In the JMH planning area, public education and enjoyment of wild horse herds is an important component of the National Wild Horse and Burro Program. Portions of this program would be implemented in the Great Divide Basin HMA by providing interpretive signs and access sites for viewing horses.	Provide opportunity for public education and enjoyment of wild horse herds by placing interpretive signs, providing interpretive sites, and providing viewing access to the herd management areas.	No similar action.	Same as Alternative B.
MA016		Gathering cycles would vary by plan objectives, resource conditions, and	No similar action.	No similar action.	No similar action.

Management Action #	Goal/Objective	Alternative A (No Action)	Alternative B	Alternative C	Alternative D (Preferred)
		needs. Fertility control would be initiated only if necessary. These actions would aid in stabilizing populations, managing for conditions and special characteristics, and supply and adoptable population (young horses).			
MA016	WH 1, 2	No similar action.	No similar action.	No similar action.	AML may be adjusted as needed when site specific data demonstrates a change in AML is appropriate. To adjust AML the BLM will conduct and document the multi-tiered analysis process outlined in the Wild Horses and Burros Management Handbook (H-4700-1, Appendix 3). This analysis will include an in-depth review of intensive monitoring data.



Map 2-1: Alternative A (No Action)
Draft Resource Management Plan
Amendment for Wild Horse Management

0 5 10 20
Miles

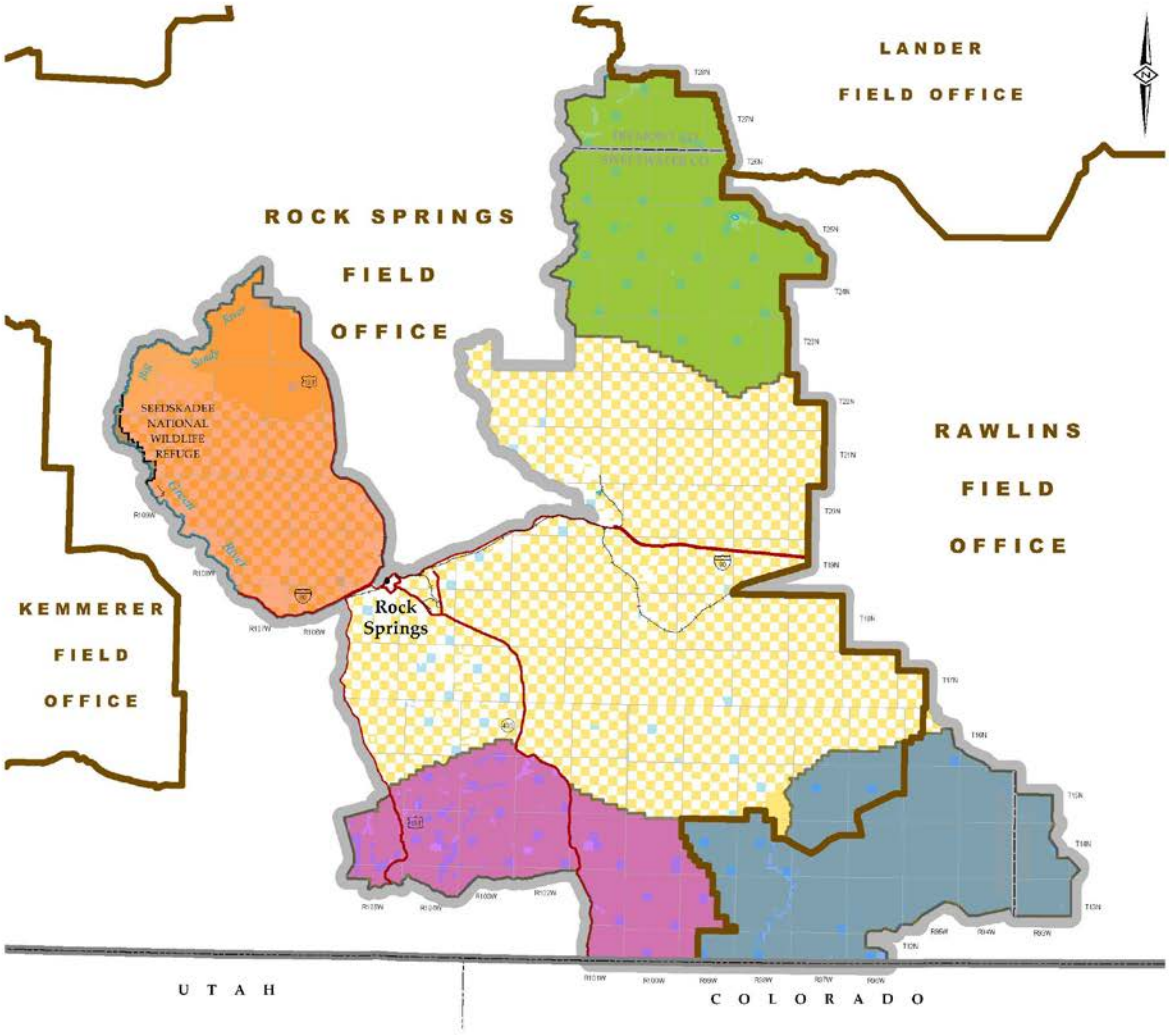
1:1,000,000

BLM Wild Horse Herd Management Areas

- Adobe Town
- Great Divide Basin
- Salt Wells Creek
- White Mountain

- Planning Area Boundary
- BLM Field Office Boundary
- State Boundary
- County Boundary
- Other Federal Designation
- Bureau of Land Management
- Bureau of Reclamation
- US Fish & Wildlife Service
- State Lands
- Private Lands

No warranty is made by the BLM as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. The User assumes the entire risk associated with its use of these data and bears all responsibility in determining whether these data are fit for the User's intended use.



Map 2-2: Alternative B
Draft Resource Management Plan
Amendment for Wild Horse Management

0 5 10 20
Miles

1:1,000,000

BLM Wild Horse Herd Management Areas

- Adobe Town
- Great Divide Basin
- Salt Wells Creek
- White Mountain

- Planning Area Boundary
- BLM Field Office Boundary
- State Boundary
- County Boundary
- Other Federal Designation
- Bureau of Land Management
- Bureau of Reclamation
- US Fish & Wildlife Service
- State Lands
- Private Lands

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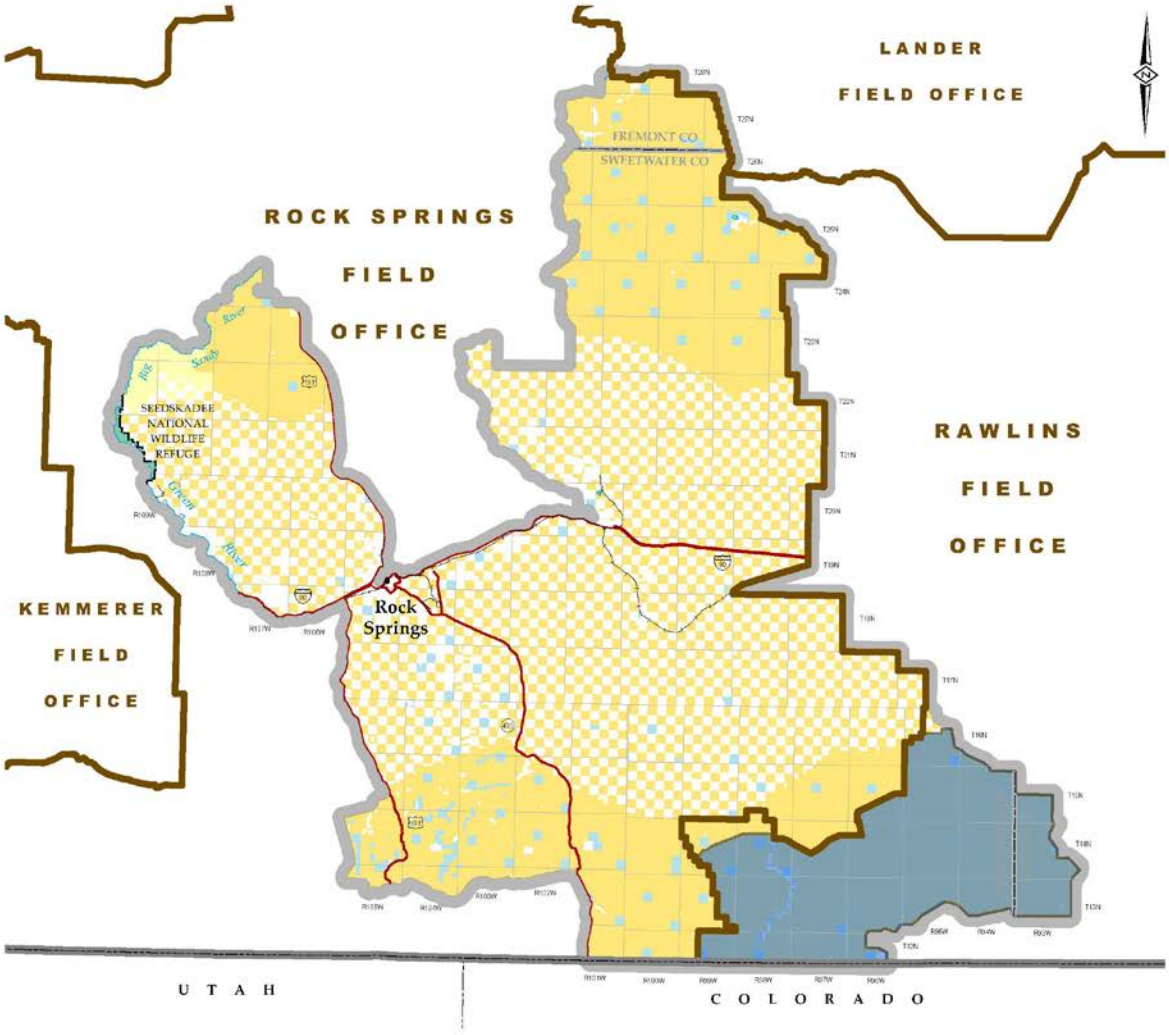

Map 2-3: Alternative D
Draft Resource Management Plan
Amendment for Wild Horse Management

0 5 10 20
Miles

1:1,000,000

BLM Wild Horse Herd Management Areas

- Adobe Town

- Planning Area Boundary
- BLM Field Office Boundary
- State Boundary
- County Boundary
- Other Federal Designation
- Bureau of Land Management
- Bureau of Reclamation
- US Fish & Wildlife Service
- State Lands
- Private Lands

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Table 2-2. Summary of Impacts

Alternative A (No Action)	Alternative B	Alternative C	Alternative D (Preferred)
Wild Horses			
Management of wild horses would support the habitat and health of the wild horse populations within the HMAs in the planning area. Impacts from gathers and limited population control would continue to occur. Management challenges related to the checkerboard lands would remain unresolved.	Conversion of all checkerboard lands from HMA to HA status would remove wild horse populations from these areas. Managing for non-reproducing herds would allow wild horses to remain in HMAs without the stress of periodic gathers. Reallocation of forage from livestock use to wild horse use would provide adequate forage for wild horses while maintaining a TNEB in the HMAs that are reduced in size. Impacts of population control would occur.	All wild horses would be removed from all HMAs. These wild horses would be transported to holding facilities and prepared for adoption, sale or long-term holding. A large, multi-step and likely multi-year effort to gather all the wild horses in the planning area would be required.	One HMA would be managed with a reduced number of wild horses and three HMAs would be reverted to HA status. Overall, there would be 1,529 fewer wild horses (at high AML) within the planning area under this alternative. Forage, habitat, and water resources would improve for those wild horses that remain on the range, as a result of reduced competition for these resources. Impacts from gathers and population control would continue to occur. Use of population management tools could reduce gather frequencies and thereby reduce the impacts to wild horses related to gathers.
Soil Resources			
Wild horses can cause soil compaction and erosion as a result of hoof action. Maintenance of AML would help mitigate potential impacts to soils especially in the vicinity of springs and other water sources. Impacts to soils as a result of gather operations include	Under this alternative the same number of wild horses would be concentrated in a smaller area due to the removal of checkerboard lands from the Great Divide Basin, Adobe Town and Salt Wells Creek HMAs. The potential for additional impacts to soils from the increased	Removal of all wild horses would require a large gather which would directly affect soils at gather locations from vehicles and hoof action. These impacts would be localized and temporary. The removal of all wild horses from the planning area would benefit soils in the	Under this alternative there would be 1,529 fewer wild horses (at high AML) within the planning area. This would result in reduced soil impacts associated with wild horse activities within the planning area. Soil resources would be impacted by gather operations similar to those

disturbance to soils from vehicles and hoof action; impacts from gathers would be localized and temporary.	concentration of wild horses would be somewhat offset by the reduction of 8,100 permitted livestock AUMs. Some impacts to soil resources would occur as a result of gathering all wild horses from the checkerboard lands, similar to those described in Alternative A.	long term as there would be reduced impacts from wild horse activities.	impacts described under Alternative C.
Water Resources			
Wild horses can impact water resources when they concentrate near them. Impacts may include localized erosion, sediment loading and reduced water quality. Springs are especially susceptible to wild horse activities. Additional water developments for wild horses could improve the distribution of wild horses in the planning area, and reduce concentrated use of sensitive springs and riparian areas.	Under this alternative the same number of wild horses would be concentrated in a smaller area due to the removal of checkerboard lands from the Great Divide Basin, Adobe Town and Salt Wells Creek HMAs. The potential for additional impacts to water resources from the increased concentration of wild horses would be somewhat offset by the reduction of 8,100 permitted livestock AUMs.	Removal of all wild horses would provide greater localized protections to water resources by preventing surface disturbance and trampling of riparian areas caused by wild horses. In addition, sediment loads would be reduced under this alternative.	Under this alternative there would be 1,529 fewer wild horses (at high AML) within the planning area. This would result in reduced impacts to water resources associated with wild horse activity within the planning area.
Vegetation			
Potential impacts to vegetation resources associated with wild horse activities include consumption of vegetation (grazing), trampling and the potential to spread invasive species. At high AML, wild horses would consume an estimated 24,780 AUMs of forage. Vegetation may also be impacted by vehicle traffic, and	Under this alternative the same number of wild horses would be concentrated in a smaller area due to the removal of checkerboard lands from the Great Divide Basin, Adobe Town and Salt Wells Creek HMAs. The potential for additional impacts to vegetation resources from the increased concentration of wild horses would be somewhat offset	Following some localized and temporary impacts to vegetation resources associated with gathering all wild horses from the planning area, there would be no impacts to vegetation from wild horse activities under this alternative. The impacts associated with wild horse activities as described under Alternative A would not occur.	Under this alternative there would be 1,529 fewer wild horses (at high AML) within the planning area. This would reduce overall grazing pressure within the planning area by an estimated 18,348 AUMs. This would result in reduced impacts to vegetation resources associated with wild horse activities within the planning area.

concentrated wild horse activities during a gather. Gather related impacts would be localized and temporary. Managing wild horses at AML helps prevent excessive impacts to vegetation resources. The construction of additional water developments for wild horses may also improve wild horse distribution and reduce overall impacts to vegetation resources.	by the reduction of 8,100 permitted livestock AUMs.		
Wildlife and Fisheries			
Wild horses can compete with wildlife (especially big game) for food and water resources. Managing wild horses at AML would limit impacts to wildlife and promote a TNEB. Water developments would support wildlife and wild horses but could also lead to increased competition at individual water sources. The HMAs also contain crucial winter range for big game species. Wild horses utilizing these areas in the winter could compete with wildlife for scarce resources such as forage and water.	Under this alternative the same number of wild horses would be concentrated in a smaller area due to the removal of checkerboard lands from the Great Divide Basin, Adobe Town and Salt Wells Creek HMAs. The potential for additional impacts to wildlife from the increased concentration of wild horses would be offset by the reduction of 8,100 permitted livestock AUMs. If any fences or other man-made barriers were needed to prevent wild horses from straying onto the private land within the checkerboard boundary, these would act as a barrier to big game movement. This can be of particular concern in designated migration corridors.	Since all wild horses would be removed from the planning area under this alternative, there would be no impacts to wildlife as a result of wild horse activities. Some localized and temporary impacts to wildlife may occur during gather operations while removing all wild horses from the planning area.	Under this alternative there would be 1,529 fewer wild horses (at high AML) within the planning area. This would result in reduced impacts to wildlife associated with wild horse activity within the planning area.

Special Status Species			
Wild horses can compete with some Special Status Species for food and water resources. They can also impact some Special Status Species habitat. Managing wild horses at AML would limit impacts to these species and promote a TNEB. Upland water developments could reduce impacts to springs and streams which contain habitat for some Special Status Species. Managing for AML would help limit potential impacts to Special Status Species. Some Special Status Species may also be temporarily disturbed during gather activities.	Under this alternative the same number of wild horses would be concentrated in a smaller area due to the removal of checkerboard lands from the Great Divide Basin, Adobe Town and Salt Wells Creek HMAs. The potential for additional impacts to Special Status Species from the higher concentration of wild horses would be somewhat offset by the reduction of 8,100 permitted livestock AUMs.	Since all wild horses would be removed from the planning area under this alternative, there would be no impacts to Special Status Species as a result of wild horse activities. Some localized and temporary impacts to Special Status Species may occur during gather operations while removing all wild horses from the planning area. Overall, habitat for Special Status Species is expected to improve under this alternative.	Under this alternative there would be 1,529 fewer wild horses (at high AML) within the planning area. This would result in reduced impacts to Special Status Species associated with wild horse activity within the planning area.
Wildland Fire			
Grazing by wild horses serves as a vegetation treatment that could reduce fuels, especially since wild horses graze primarily on grasses which are easily ignited.	Under this alternative the same number of wild horses would be concentrated in a smaller area due to the removal of checkerboard lands from the Great Divide Basin, Adobe Town and Salt Wells Creek HMAs. However, the increased concentration of wild horses would be somewhat offset by the removal of 8,100 permitted livestock AUMs. In all, impacts are expected to be similar to Alternative A.	Under this alternative there is a potential for increased wildfire risk in grassy areas. This could increase the need for other fire/fuel treatments and suppression activities.	Under this alternative there would be 1,529 fewer wild horses (at high AML) within the planning area. This would reduce overall grazing pressure within the planning area by an estimated 18,348 AUMs. This would increase the abundance of fine fuels, and could increase the potential for fire ignition.
Cultural Resources			
Grazing and trampling of vegetation by wild horses can	Under this alternative the same number of wild horses would be	Grazing and trampling would not occur once all the wild horses are	Under this alternative there would be 1,529 fewer wild horses (at

disturb the soil, which can accelerate erosion and wreathing which can lead to exposure of artifacts and sites. However, the discovery of previously unknown cultural resources could occur.	concentrated in a smaller area due to the removal of checkerboard lands from the Great Divide Basin, Adobe Town and Salt Wells Creek HMAs. The potential for additional impacts to cultural resources from the increased concentration of wild horses would be offset by the reduction of 8,100 permitted livestock AUMs.	removed from the planning area. The intensity of the gathers required to achieve this could result in localized impacts to cultural resources. Locating gather sites in locations where cultural inventories have been completed would help mitigate this concern.	high AML) within the planning area. This would result in reduced impacts to cultural resources associated with wild horse activity within the planning area.
Paleontological Resources			
Grazing and trampling of vegetation by wild horses can disturb the soil, which can accelerate erosion and wreathing which can lead to exposure of paleontological sites. However, the discovery of previously unknown paleontological resources could occur.	Under this alternative the same number of wild horses would be concentrated in a smaller area due to the removal of checkerboard lands from the Great Divide Basin, Adobe Town and Salt Wells Creek HMAs. The potential for additional impacts to paleontological resources from the increased concentration of wild horses would be somewhat offset by the reduction of 8,100 permitted livestock AUMs.	Grazing and trampling would not occur once all the wild horses are removed from the planning area. The intensity of the gathers required to achieve this could result in localized impacts to paleontological resources. Siting gather sites in locations where paleontological inventories have been completed will help mitigate this concern.	Under this alternative there would be 1,529 fewer wild horses (at high AML) within the planning area. This would result in reduced impacts to paleontological resources associated with wild horse activity within the planning area.
Livestock Grazing			
Wild horses compete with livestock for forage and water. Managing wild horses at AML allows for adequate resources for wild horses as well as livestock. Managing for AML also ensures a TNEB and helps maintain rangeland health.	Under this alternative the same number of wild horses would be concentrated in a smaller area due to the removal of checkerboard lands from the Great Divide Basin, Adobe Town and Salt Wells Creek HMAs. Because of the concentration of wild horses in these areas, grazing permits within these HMAs would be	No potential for conflicts between wild horses and livestock would occur as a result of this alternative once all the wild horses are removed from the range in the planning area.	Under this alternative there would be 1,529 fewer wild horses (at high AML) within the planning area. This would reduce overall grazing pressure within the planning area by an estimated 18,348 AUMs. This would result in reduced competition between livestock and wild horses within the planning area. These AUMs

	reduced by a total of 8,100 AUMs. Impacts due to competition between wild horses and livestock would continue to occur as described in Alternative A.		could become available for livestock use depending on the results of an in-depth review of intensive monitoring data.
Recreation			
Visitors would have the opportunity to view wild horses, visit the BLM corrals in Rock Springs, and tour along the Pilot Butte Wild Horse Scenic Loop.	Similar to Alternative A, except wild horses would be removed from checkerboard land within the Great Divide Basin, Adobe Town and Salt Wells Creek HMA. The higher concentration of wild horses within these adjusted HMAs would make it more likely for recreationists to view wild horses when they visit an HMA. Recreationists would potentially need to travel farther to view the herds. The Pilot Butte Wild Horse Scenic Loop would still provide opportunities for wild horse viewing.	The public would not have the opportunity to view wild horses in any of the HMAs in the planning area. The public could still view wild horses on the range on the Little Colorado, Lost Creek, and Antelope Hills HMAs, which are located in the same general area but are not part of this RMP Amendment. Wild horses could also be viewed at the BLM corrals as these corrals would continue to service other BLM offices and HMAs.	Similar to Alternative C, except wild horses could still be viewed by the public on the range on the Adobe Town HMA. The public would no longer be able to view wild horses along the Pilot Butte Wild Horse Scenic Loop.
Socioeconomics			
Wild horse populations would continue to support the direct and indirect social and economic values associated with wild horse herds. Other resource values that compete with wild horses would continue to be impacted by wild horse activity.	Under this alternative the same number of wild horses would be concentrated in a smaller area due to the removal of checkerboard lands from the Great Divide Basin, Adobe Town and Salt Wells Creek HMAs. Maintaining the same number of wild horses would continue to support the direct and indirect social and economic values individuals derive from the	Compared to the other alternatives, this alternative would best support the economic and social values associated with other resources since competition for range habitat, and risk of deterioration from the exceedance of AML, would be eliminated. However tourism related to wild horse viewing would likely be reduced and may result in a small	Under this alternative there would be 1,529 fewer wild horses (at high AML) within the planning area. The remaining wild horses would continue to support the direct and indirect social and economic values individuals derive from the existence and viewing of wild horses; however, there would be fewer horses to support these values. This alternative would better support

	existence and viewing of wild horses. Managing the herds as non-reproducing would adversely affect the values held by some individuals. Reducing livestock grazing permits by 8,100 AUMs would have an economic and social impact on the livestock industry in this area.	negative economic impact to that portion of the regional economy.	the economic and social values associated with other activities that compete with wild horses for resources.

Chapter 3 – Affected Environment

This chapter describes the environmental characteristics, conditions, and trends that influence the planning area or that would be affected by the management actions presented in Chapter 2. The following resources are those that would not be affected by the proposed management actions and therefore are not included in any further detail in this EIS:

- Lands with Wilderness Characteristics
- Visual resources
- Travel management
- Forests and Woodlands
- Energy and Minerals
- Lands and Realty
- Renewable energy
- Special designations
- Environmental justice

The data presented in Chapter 3 is the most up-to-date information at the time of collection and represents the description of the affected environment used for the analysis of environmental consequences.

The planning area includes the land encompassed by the four wild horse HMAs that include checkerboard land: Adobe Town, Great Divide Basin, Salt Wells Creek and White Mountain (see Map ES-1). The planning area totals 2,811,401 acres, of which 1,920,314 acres (68%) are managed by the BLM. Within the Rock Spring Field Office area there is an additional HMA, Little Colorado, that is not included in the Planning Area because it does not contain any checkerboard land. It is located immediately north of the White Mountain HMA. The planning area is located in portions of Sweetwater and Fremont counties in southwestern Wyoming. The area has predominantly high elevation plains varying from 6,000 feet to 8,000 feet.

3.1 Wild Horses

The BLM protects, manages, and controls wild horses (and burros, although BLM Wyoming does not manage any burro populations) under the authority of the WFRHBA, and one of the BLM's key responsibilities for the management of wild horses and burros is to manage for a thriving natural ecological balance (TNEB). To achieve a TNEB, the BLM establishes AMLs and works toward managing wild horses in a manner that assures significant progress is made toward achieving the Land Health Standards for upland vegetation and riparian communities, watershed function, and habitat quality for animal populations, as well as other site-specific or landscape-level objectives (please see the Wyoming Standards for Healthy Rangelands for more information, BLM 1997b).

The area utilized by wild horses in the planning area includes large unfenced acreages of private, state, BLM, and Bureau of Reclamation (BOR) lands. In addition, areas utilized by wild horses include special designations such as Wilderness Study Areas (WSAs) and Areas of Critical Environmental Concern (ACECs) managed by the BLM.

All of the HMAs within the planning area contain checkerboard land, areas where every other square mile alternates between public land and private or state lands. The RSGA owns numerous private land sections within each of these HMAs. Historically, the RSGA had given consent to the BLM for a limited

number of wild horses to utilize private land within the checkerboard. However, in 2010 the RSGA revoked this consent and requested that all wild horses be removed from private lands in this area. The removal of this consent has made it very difficult to manage wild horse herds within the checkerboard lands (see **Section 1.1** for more information). Addressing this issue is the primary purpose of this document (see **Section 1.1**).

Wild horses in the planning area have a diverse background of many domestic horse breeds and are most closely related to North American gaited breeds such as Rocky Mountain Horse, American Saddlebred, Standardbred, and Morgan. These wild horses range from 14 to 16 hands and weigh up to 1,100 pounds at mature weight. In general, wild horses in the planning area are in good health. Existing AMLs for wild horses in the planning area were established by the 1997 Green River RMP (BLM 1997a) and the 2008 Rawlins RMP (BLM 2008) and are provided in Table 3-1. For the Great Divide Basin, Salt Wells Creek, Adobe Town, and White Mountain HMAs, the AMLs established in the 1997 RMP were based on a 1979 agreement between the RSGA and a wild horse advocacy group. That agreement has since been revoked as described above and in Section 1.1 of this document.

Table 3-1. Herd Management Areas in the Planning Area and Associated AMLs

Herd Management Area	Acreage	% of HMA in Checkerboard	Current AML
Adobe Town (Rock Springs portion)	*102,854 (BLM: 79,924)*	*42%*	*165-235*
Adobe Town (Rawlins portion)	*374,132 (BLM: 362,504)*	*<1%*	*445-565*
Adobe Town (Total)	476,986 (BLM: 442,428)	9%	610-800
Great Divide Basin	776,189 (BLM: 559,398)	48%	415-600
Salt Wells Creek	1,169,739 (BLM: 689,961)	72%	251-365
White Mountain	388,488 (BLM: 228,527)	72%	205-300
Total:	**2,811,401 (BLM: 1,920,314)**	**-**	**1,481-2,065**

While the cumulative AML within the planning area is 1,481 – 2,065, actual wild horse numbers fluctuate each year based on reproductive rates, death rates, and time since the last gather/removal. Overall, wild horse populations typically increase by approximately 20% each year (though some herds exhibit higher growth rates, while others exhibit lower growth rates). When a gather is conducted, typically wild horses are removed so that the low AML number remains within the HMA. The population then grows until it exceeds the high AML. BLM regularly surveys the wild horse population within the planning area, and observes conditions on the range. When BLM determines there are excess wild horses within an HMA, it conducts a gather and excess wild horses are removed. Since BLM has limited resources nationwide to conduct gathers and place wild horses in holding facilities, not all HMAs are gathered to low AML immediately after BLM determines there are excess wild horses on the range.

Adobe Town HMA

The Adobe Town HMA is located in south-central Wyoming between Interstate 80 and the Colorado/Wyoming border. It encompasses 476,986 acres, of which 442,428 acres are BLM-administered public lands. A small portion of private lands are intermingled with the BLM managed land in this area. The Adobe Town HMA is located partially within the Rock Springs Field Office and partially within the Rawlins Field Office; approximately 42% of the RSFO portion of this HMA is within the checkerboard, while less than 1% of the RFO portion of this HMA is within the checkerboard. Both offices participate in management of the HMA. The total AML for this HMA is 610-800 wild horses, with 165-235 for the

Rock Springs portion and 445-565 for the Rawlins portion. The topography of the area is varied with everything from colorful eroded desert badlands to wooded buttes and escarpments. In between are extensive rolling to rough uplands interspersed with some desert playa and vegetated dune areas. Limited, sensitive desert riparian areas are important features of the landscape and winters are long and severe. Annual precipitation ranges from less than seven inches in the desert basins to more than 12 inches at some of the higher elevations. Elevation ranges from 6,600 feet to 7,800 feet along Kinney Rim, which forms the western boundary of the HMA. A portion of the HMA is in the Adobe Town Wilderness Study Area (WSA) and other features in the area include the Cherokee Trail, the Haystacks, and Powder Rim. The HMA is accessible to the public for opportunities for education and enjoyment along county roads and established two-track roads. Within the Rawlins portion of the HMA, the most abundant plant community is sagebrush/bunchgrass; other plant communities include desert shrub, grassland, mountain shrub, and a very few aspen woodlands.

Domestic cattle and sheep utilize the area during both summer and winter months. Vegetation in the HMA is dominated by sagebrush, salt desert shrubs and grass, with juniper and conifers interspersed. Wild horses typically use a high amount of grass species, the most favorable being needlegrass, Indian ricegrass, wheatgrass, and sedges. The area supports significant wildlife populations including elk, deer and pronghorn.

Great Divide Basin HMA

The Great Divide Basin HMA encompasses 776,189 acres, of which 559,398 acres are BLM-administered public lands; the AML for the existing HMA is 415-600 wild horses. The management area is located 40 miles east of Rock Springs, to the Rawlins/Rock Springs field office boundary, west to the Continental Divide, and north of I-80 to just south of South Pass City. The northern portion of the HMA consists primarily of consolidated public lands with state school sections and small parcels of private land making up the remaining lands. The southern portion is in the checkerboard land ownership area; approximately 48% of the HMA is within the checkerboard. Topography within the herd area is generally gently rolling hills and slopes with some streams and tall buttes. Elevations range roughly from 6,200 to 8,700 feet. Precipitation ranges 6-16 inches, predominately in the form of snow. It is common for snow in the northern portion of this HMA to reach depths of 3 to 6 ft. over the course of the winter. The HMA is accessible to the public for opportunities for education and enjoyment along county roads and established two-track roads.

Domestic cattle and sheep utilize the area lightly in summer and moderately in winter. Vegetation in the HMA is dominated by sagebrush and grass intermixed with greasewood and saltbrush. The area supports significant wildlife populations including elk, deer, and pronghorn. The Great Divide Basin is the only HMA in the RSFO that contains portions of the Sublette Mule Deer Migration Corridor. See Section 3.5 for a more detailed description of Wildlife in the Great Divide Basin HMA.

Salt Wells Creek HMA

The Salt Wells Creek HMA encompasses 1,169,739 acres, of which 689,961 acres are BLM-administered public lands; the AML for the existing HMA is 251-365 wild horses. Approximately 72% of the HMA (the northern portion) lies within the checkerboard land ownership area. Consolidated public lands with state school sections and small parcels of private land make up the majority of lands in the southern section of the HMA. Topography within the HMA is generally gently rolling hills. There are several small streams passing through the area, and some high ridges. Elevations range roughly from 6,300 to 7,900 feet. Precipitation ranges 7-10 inches in lower elevations and 15-17 inches at higher elevations,

predominately in the form of snow. The area is unfenced other than portions of boundary fence and right-of-way boundaries along I-80. The HMA is accessible to the public for opportunities for education and enjoyment along county roads and established two-track roads.

Domestic cattle and sheep utilize the area lightly in the summer and moderately in the winter. Vegetation in the HMA is dominated by sagebrush and grass, with juniper, aspen, and conifers interspersed. Wild horses typically use a high amount of grass species, the most favorable being needlegrass, Indian ricegrass, wheatgrass, and sedges. The area supports significant wildlife populations including elk, deer, and pronghorn.

White Mountain HMA

The White Mountain HMA encompasses 388,488 acres, of which 228,527 acres are BLM-administered public lands (207,350 acres directly managed by the BLM, and 27,177 acres of BOR land on which BLM manages livestock grazing and wild horse use). The AML for this HMA is 205-300 wild horses. Approximately 72% of the HMA lies within the checkerboard land ownership. Consolidated public lands with state school sections and small parcels of private land make up the remaining lands in the northeast section of the HMA. The HMA is a high plateau that overlooks the city of Rock Springs. The 24-mile Pilot Butte Wild Horse Scenic Loop is located within this HMA and currently provides wild horse viewing opportunities in close proximity to the cities of Rock Springs and Green River. Elevations range roughly from 6,300 to 7,900 feet. Precipitation ranges from 6-10 inches, predominately in the form of snow. The area is unfenced except for portions of boundary fence and right-of-way boundaries along I-80 and Highway 191 North. The HMA is accessible to the public for opportunities for education and enjoyment along county roads and established two-track roads.

Domestic cattle and sheep utilize the area lightly in the summer and moderately in the winter. Vegetation in the HMA is dominated by sagebrush and grass, with saltbrush, winterfat, and greasewood intermixed. Wild horses typically use a high amount of grass species, the most favorable being needlegrass, Indian ricegrass, wheatgrass, and sedges. The area supports significant wildlife populations including elk, deer, and pronghorn. Approximately 67% (263,500 acres) of the White Mountain HMA is sage-grouse PHMA.

AML Evaluation Process

AML is expressed in a range and applies to the number of adult wild horses (or burros, as appropriate) to be managed within the HMA, and does not include the current year's foals; the AML upper limit is the maximum number of wild horses that would result in a TNEB and avoid deterioration of the range. The AML lower limit is set to a number that would allow the population to grow to the upper limit over a 4-5 year period, with no interim gathers. When establishing or adjusting AML, a multi-tiered analysis is used:

- Tier 1: Determine whether the four essential habitat components (forage, water, cover, space) are present in sufficient amounts to sustain healthy wild horse (and burro) populations and healthy rangelands over the long term.
- Tier 2: Determine the amount of sustainable forage available for wild horse use.
- Tier 3: Determine whether or not the projected wild horse herd size is sufficient to maintain genetically diverse wild horse populations (avoid inbreeding).

If the Tier 1 analysis determines that one or more of the essential habitat components is not present in sufficient quantities to maintain a healthy wild horse population, the authorized officer should consider amending or revising the land use plan to remove the area's designation as an HMA. If sufficient forage, water, cover, and space are present in the area, and higher levels of wild horse use would not result in

deterioration of the range, then an increase in AML may be appropriate. If the Tier 1 analysis demonstrates that there is not sufficient forage, water, cover, or space, then there is no need to proceed to the next analysis tier. The analysis to establish AML includes an interdisciplinary and site-specific environmental review and should be completed whenever review of resource monitoring and population inventory data indicates that the existing AML may no longer be appropriate.

When evaluating AML, the following should be considered:

- Changes in environmental conditions that may have occurred since the AML was established. Changing environmental conditions could include drought, wildfires, noxious weed infestations, effect of varying numbers of wild horses on forage utilization or range ecological condition/trend, an increase or decrease in the available forage, changes in livestock management, etc.
- The presence of any newly listed Threatened, Endangered, or Sensitive Species.
- Any resource monitoring, population inventory or other relevant data collected since AML was established.

See Appendix A for a detailed discussion of the three-tier AML analysis for the HMAs within the planning area.

Social Structure of Wild Horses

Wild horses have three major social groups: harem groups, multiple male and female groups, and bachelor male groups. Harems are stable groups consisting of one adult male and several adult females with their offspring and can range in size; the females in the group mate almost exclusively with the harem male and offspring leave the herd once sexual maturity is reached. Typically, harem groups are composed of an adult male with 1 to 3 adult females and their immature offspring (Feist and McCullough 1976, Berger 1986, Roelle et al. 2010). In many populations subordinate 'satellite' stallions have been observed associating with the band, although the function of these males continues to be debated (see Feh 1999, and Linklater and Cameron 2000). Juvenile offspring of both sexes leave the band at sexual maturity (normally around two or three years of age (Berger 1986), but adult females may remain with the same band over a span of years. Group stability and cohesion is maintained through positive social interactions and agonistic behaviors among all members, and herding and reproductive behaviors from the stallion (Ransom and Cade 2009). Group movements and consortship of a stallion with mares is advertised to other males through the group stallion marking dung piles as they are encountered, and over-marking mare eliminations as they occur (King and Gurnell 2006).

Multiple male and female groups are characterized by multiple adult males and several adult females and offspring; these groups are typically not stable and differ from harems in mating behavior and dominance structure. One male tends to be more dominant over the others and prevents other males from interacting with the adult females.

Bachelor male groups are composed entirely of male wild horses and tend to be unstable; these horses are young males forced out of their family groups or older males who have lost membership in either their harem or multiple male/female groups.

In horses, males play a variety of roles during their lives (Deniston 1979): after dispersal from their natal band they generally live as bachelors with other young males, before associating with mares and developing their own breeding group as a harem stallion or satellite stallion. In any population of horses not all males will achieve harem stallion status, so all males do not have an equal chance of breeding (Asa 1999). Stallion behavior is thought to be related to androgen levels, with breeding stallions having higher androgen concentrations than bachelors (Angle et al. 1979, Chaudhuri and Ginsberg 1990, Khalil et al.

1998). One study observed that a bachelor with low libido had lower levels of androgens, and two year old bachelors had higher testosterone levels than two year olds with undescended testicles who remained with their natal band (Angle et al. 1979).

3.2 Soil Resources

Soils in the planning area are diverse and highly variable, are generally light colored, and textures and aggregate development vary. Some darker colored soils, with greater amounts of organic matter, are found in areas of increased moisture due to aspect, elevation, and drainage. Much of the soil within the planning area was derived from sediment that collected on the bottom of a shallow sea. The generally low rainfall in the area has resulted in a limited amount of leaching, resulting in high salinity soils that dominate the area. Soils of the planning area have formed from a wide variety of geologic material, ranging from in situ geologic parent material rock (residuum) to material transported by wind (aeolian deposits), water (alluvium), gravity (colluvium), and ice (glacial till). These parent materials, along with variable climate, topography, biota, and management, produce soils with diverse characteristics. Soil characteristics can differ over relatively short distances, reflecting differences in parent material, position on the landscape, elevation, aspect, biota such as bacteria, fungi, biological crusts, vegetation, soil, animals and humans, and climatic variables, such as precipitation and temperature. Varying amounts of soluble salts occur in most of the soils in the planning area, which can affect management of soils due to toxicity, reduced infiltration rates, limits on nutrient availability, and reduction of water available to plants. A portion of the planning area is located within the Colorado River Basin, where salinity threatens municipal and industrial needs as well as irrigation within the watershed. Moderately saline soils are generally found along the major drainages, and over 50 percent of the total salt yield in the planning area is derived from slightly saline soils. Position on the landscape, slope length and gradient, chemical and physical properties, surface texture and structure, plant cover, and erosion control practices contribute to susceptibility of soils to wind and water erosion. Wind erosion is common in the planning area, as is water erosion; susceptibility to water erosion is typically a function of raindrop intensity and runoff rates, slope gradient and length, water infiltration rates, soil depth to bedrock, and vegetative cover.

Most soils in the planning area are dependent on vegetation cover for the prevention of erosion; vegetation also acts as a buffer between the soil surface and surroundings. The soils in the planning area possess several limitations that reduce the potential for establishing vegetation following a disturbance. Soils with limitations include highly erodible soils, saline, sodic, and sandy soils, soils with biological crusts, soils with slopes greater than 25%, frozen soil, 2:1 shrink-swell clays, badlands, and soils with potential archaeological or paleontological concerns.

Surface disturbing activities, such as mineral exploration and development, recreation, livestock grazing, wild horse use, and timber harvest have direct and indirect effects on soils as a result of loosening the topsoil and removing the vegetation and/or other ground cover. This type of disturbance can result in accelerated erosion. Soils particularly susceptible to surface disturbing activities include unstable, sandy, and erosive soils.

3.3 Water Resources

The majority of the planning area is located within the Colorado River Basin and the Great Divide Basin. A small portion of the planning area is located within the North Platte Drainage Basin. Within the Colorado River Basin, salinity is a concern (as discussed above in Section 3.2, Soils.) The Great Divide Basin is internally drained, with no surface water leaving the watershed. Stream flow in the area is dominated by high magnitude-low frequency flows due to thunderstorms and snowmelt. The occasional perennial or intermittent water sources tend to be dominated by riparian and wetland vegetation.

Ephemeral channels tend to be dominated by upland vegetation. Channel stability in the area varies from good to poor depending on historic and existing impacts, substrate, and vegetative conditions.

Water bodies in Wyoming are classified for water quality regulation according to beneficial uses by the Wyoming Department of Environmental Quality (WDEQ). Class 1 waters are defined as "outstanding waters" and are those surface waters in which no further water quality degradation by point source discharges, other than from dams, will be allowed. There are no Class 1 waters within the planning area; however, Class 2, 3, and 4 waters are present. Class 2, and 3 waters are those with specific water quality standards that must be maintained for aquatic life. Class 4 waters do not have aquatic life criteria (WDEQ 2013).

The State of Wyoming manages water quality within its borders. Within the portion of the Colorado River Basin addressed in this document, Bitter Creek (which closely parallels the Northern border of the Salt Wells Creek HMA) and Killpecker Creek (which closely parallels the eastern border of the White Mountain HMA) are listed as being impaired by fecal coliform. To address the levels of fecal bacteria in these waterbodies, WDEQ established Total Maximum Daily Loads (TMDLs) for these streams in 2018, in an effort to improve water quality. The same stretch of Bitter Creek is also impaired by high chloride concentrations. Additional information can be found in WDEQ's *Wyoming's 2016/2018 Integrated 305(b) and 303(d) Report* (WDEQ 2016/2018).

Roads, changes in climate, recreational use, bank alterations, industrial development, vegetation removal by grazing animals, and other human caused disturbances may affect stream conditions and water quality in the planning area.

3.4 Vegetation

Vegetative resources within the planning area are diverse and unique as a result of the precipitation, elevation, and temperature extremes, combined with soil and geologic variability. The desert areas provide habitat for a variety of hearty plants tolerant of low precipitation, temperature extremes, and saline soils. High elevation areas support plants adapted to very low temperatures, an extremely short growing season, and high snow accumulation. Vegetation types are susceptible to fire occurrence as a result of fuel loading or as a natural condition of the environment. The high-elevation, cold-desert vegetation of the project area is composed predominately of Wyoming big sagebrush/grass and Gardner saltbush vegetation communities. Other plant communities present include desert shrub, grassland, mountain shrub, juniper woodlands, and a very few aspen woodlands. Needle-and-thread, Indian ricegrass, bluebunch wheatgrass, western wheatgrass, junegrass, basin wild rye, sandhill muhly, Canby and little bluegrass, and threadleaf sedge are the predominant grasses and grass-like species. Wyoming big sagebrush, black sagebrush, bud sage, birdsfoot sage, Gardner's saltbush, spiny hopsage, four-wing salt bush, greasewood, bitterbrush, winterfat, horsebrush, Douglas and rubber rabbitbrush, and true mountain mahogany are important shrub species for wildlife. Forbs are common and variable depending on the range site and precipitation zone.

The vegetative resources in the planning area are divided into three main areas: Rangelands/Uplands, Riparian, and Forests and Woodlands. Each of these main areas is made up of various vegetation communities or associations; more detail on rangelands and riparian areas are presented below. Forests and woodlands are not considered further in this document as they are not considered part of the affected environment regarding wild horse management (see the introduction to Chapter 3). Wild horses generally prefer perennial grass species as forage when available; shrubs are more important during the fall and winter and during drought years. Needle-and-thread and Indian ricegrass are the most important during the winter and spring; wheatgrasses are more important during the summer and fall.

Rangelands/Uplands

Rangeland/Uplands within the planning area mainly consist of grassland, salt desert shrub and sagebrush communities. Grasslands cover approximately 292,792 acres. Patches of grasslands are found scattered throughout low and high-density sagebrush communities. These grassland communities provide important habitat and forage for wildlife. Grass species dominate these communities, but shrubs, subshrubs, and cushion plants are also common.

Salt Desert Shrub communities cover approximately 259,140 acres. These communities include species that are highly resilient to salty soils and dry conditions. These vegetation communities play an important role in protecting soils form erosion, while providing forage and habitat for wildlife.

Sagebrush communities are the most extensive plant cover type in the planning area as well as in the surrounding Wyoming Basin area and intermountain region. Sagebrush communities cover approximately 1,713,154 acres within the planning area. Adaptations to different habitat characteristics (e.g., soil type, climate, and elevation) have resulted in a variety of sagebrush species in the western United States (Monsen and Shaw 2000). Sagebrush communities in the planning area are dominated by two subspecies of big sagebrush (Wyoming big sagebrush and big basin sagebrush), with a well-established grass and forb component.

No widespread invasions involving exotic weedy species that dominate the native plant communities have been observed. Wildfires in sagebrush communities have increased in number and intensity compared with historical levels in some parts of the West, but that has not been a particular issue in the planning area. Many grasslands and rangelands in the planning area have been influenced by livestock grazing, fire, fire suppression, and surface-disturbing activities.

Riparian

Wetlands and riparian areas occur throughout the planning area and are most frequently located on the lands adjacent to surface waters but may also be located in lands with a high water table that is not expressed on the surface. They occupy approximately 61,089 acres within the planning area. They are dominated by vegetation that is adapted to a consistent water supply and can withstand soil saturation, and periodic flooding. Many plant and wildlife species are found only in riparian areas or use them as a preferred habitat. These small, but important, ecosystems serve as a biological oasis and represent a vegetation structure, soil, and hydrology unique relative to the vast expanses of sagebrush and prairie grass that dominate the landscape of the region. They are some of the most productive resources found on public and private lands. They comprise less than 2% of the land mass in the State of Wyoming, yet are prized for their fish and wildlife habitat, water supply, cultural, and historic and recreational values as well as for their economic values which stem from use in livestock production, forest management, and mineral extraction. Wild horses utilize riparian areas as water sources.

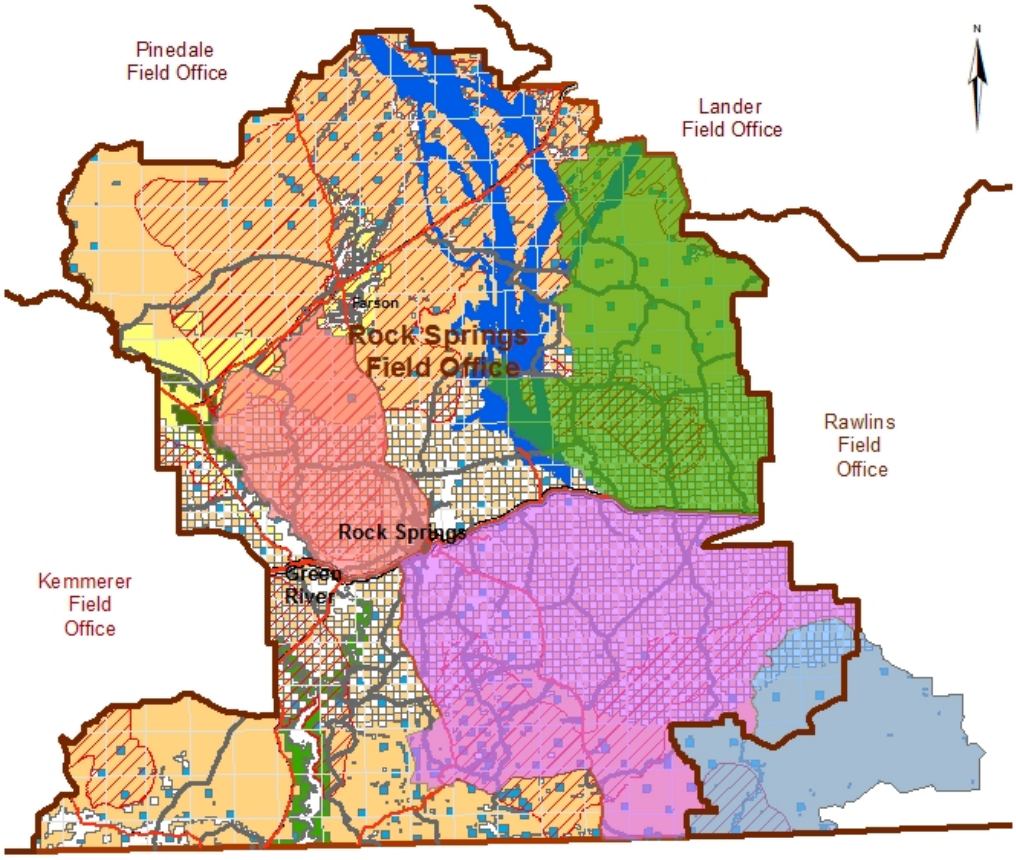
3.5 Wildlife and Fisheries

Over 350 species of wildlife are found on a variety of habitats in the planning area. Activities such as oil and gas, mining, recreation, and grazing may affect wildlife habitat. The distribution and abundance of wildlife in the planning area are primarily functions of habitat conditions, and habitat is best characterized by the various vegetation types found in the planning area. The predominant habitat in the planning area is sagebrush steppe, and various areas of mountain shrub, willow and cottonwood communities occur along rivers, and badlands, saltbush and cushion plant communities, grasslands, and pine, aspen or spruce/fir forests are present in the higher elevations. Varieties of migratory birds utilize the different habitats within the planning area for nesting, foraging and as stop-over areas during migration.

Populations of big game in the area include moose, elk, mule deer, white-tailed deer, and pronghorn antelope; over 55 percent of the planning area is considered crucial big game habitat. All of the HMAs in the planning area contain designated Crucial Winter Range (CWR) Habitat for big game species. The White Mountain HMA contains approximately 217,000 acres of pronghorn CWR, 35,500 acres of elk CWR and does not contain mule deer CWR. The Salt Wells HMA contains approximately 123,000 acres of pronghorn CWR, 8,800 acres of elk CWR and 122,000 acres of mule deer CWR. The Great Divide Basin HMA contains approximately 137,500 acres of pronghorn CWR, 91,800 acres of elk CWR and 254,000 acres of mule deer CWR. The Adobe Town HMA contains approximately 56,000 acres of pronghorn CWR, 2,400 acres of elk CWR and 59,000 acres of mule deer CWR. There is overlap of the different species crucial habitats within each HMA.

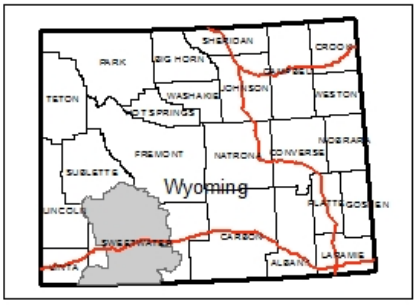
The Sublette Mule deer Migration Corridor, designated by the Wyoming Game and Fish Department in 2016, stretches approximately 150 miles from the Hoback River Drainage to Interstate 80, just east of Rock Springs (see Map 3-1). The lower approximately 70 miles lies within the Rock Springs Field Office, and accounts for approximately 275,800 acres of the overall Corridor. The Great Divide Basin HMA overlaps approximately 54,700 acres of the Corridor area. No other HMAs within the planning area overlap the Sublette Mule deer Migration Corridor.

There are approximately 600 miles of perennial or intermittent stream on public lands within the planning area. Inventories and studies indicate that fish inhabit many of the perennial streams. However, even those perennial streams that have very low flow, or flow intermittently, and may not contain fish populations, do contribute to the condition of those streams that are populated. There are 25 species of fish known to occur in the waters of the planning area, eight of which are native to the area. The mountain sucker is the most common and widespread species, with flannelmouth sucker, speckled dace, mottled sculpin, and fathead minnow also being common. Colorado River cutthroat trout and mountain whitefish are the only native sport fish in the area and the other six native fish in the planning area are nongame species. Over time, seven non-native sport fish have been intentionally introduced to waters in southwest Wyoming to provide recreational sport fishing opportunities for anglers. These sport fish include five species of trout, kokanee salmon, channel catfish and smallmouth bass. In addition, burbot (ling) a sport fish on the east side of the Continental Divide, were illegally introduced to the drainage and now have established widespread reproducing populations throughout the planning area. The remaining eight fish species are non-native non-game fish that have, over time, been introduced either accidently or intentionally by bait bucket or other vectors.



Map 3-1: Existing Herd Management Areas
Greater Sage-Grouse PHMA and
Migration Corridor
Draft Resource Management Plan
Amendement For Wild Horse Managment

10 5 0 10 Miles



Surface Management Agency

- Bureau of Land Management
- Bureau of Reclamation
- Fish & Wildlife Service
- Forest Service
- Private
- State
- Field Office Boundaries
- RSFO PHMA
- Sublette Mule Deer Migration Corridor

RSFO Herd Management Areas

- Adobe Town
- Divide Basin
- Salt Wells Creek
- White Mountain

3.6 Special Status Species

Special Status Species are those listed as threatened or endangered, are proposed for listing, or are candidates for listing under the provisions of the Endangered Species Act (ESA); or those designated by the BLM State Director as sensitive. The BLM has developed a sensitive species list for public lands in Wyoming. The objective of the designation is to ensure that these species are considered when undertaking actions on public land and that those actions do not contribute to the need to list the species under the provisions of the ESA. The USFWS provides regulatory oversight for all plant, fish, and wildlife species listed as threatened or endangered, proposed for listing, or that are candidates for listing under the ESA. Section 7 of the ESA requires that federal agencies (such as the BLM) address impacts on species listed under the ESA through consultation with USFWS (BLM 2004b).

Federally listed wildlife in the planning area include the Yellow-billed cuckoo.

Wyoming BLM sensitive wildlife species in the planning area include:

- Fringed myotis
- Long-eared myotis
- Spotted bat
- Townsend's big-eared bat
- Wyoming pocket gopher
- Brewer's sparrow
- Ferruginous hawk
- Loggerhead shrike
- Mountain plover
- Peregrine falcon
- Sage thrasher
- White-faced ibis
- Colorado River cutthroat trout
- Roundtail chub
- Columbia spotted frog
- Northern leopard frog
- Idaho pocket gopher
- Pygmy rabbit
- Swift fox
- White-tailed prairie dog
- Bald eagle
- Burrowing owl
- Greater Sage-grouse
- Long-billed curlew
- Northern goshawk
- Sagebrush sparrow
- Trumpeter swan
- Bluehead sucker
- Flannelmouth sucker
- Boreal toad
- Great Basin spadefoot toad
- Midget-faded rattlesnake

Federally listed plant species that may occur within the planning area include:

- Blowout penstemon
- Ute ladies'-tresses

BLM Wyoming sensitive plant species that may occur within the planning area include:

- Beaver Rim phlox
- Cedar Rim thistle
- Green River greenthread
- Limber pine
- Ownbey's thistle
- Small rockcress
- Trelease's racemose milkvetch
- Uinta greenthread
- Cedar Mountain Easter daisy
- Dune wildrye
- Large-fruited bladderpod
- Meadow pussytoes
- Precocious milkvetch
- Stemless beardtongue
- Tufted twinpod
- Wyoming tansymustard

Significant populations of Greater Sage-grouse are found throughout most of the planning area. 918,400 acres of the planning area are considered Priority Habitat Management Areas (PHMA)(see Map 3-1). Each of the HMAs in the planning area contains significant expanses of PHMA habitat. The Adobe Town HMA has 59,100 acres of PHMA, the Great Divide Basin HMA has 254,600 acres of PHMA, the Salt Wells Creek HMA has 341,200 acres of PHMA and the White Mountain HMA contains 263,500 acres of PHMA.

3.7 Wildland Fire

Wildfires can occur from an act of nature (e.g. lightening) or can be human caused. Fire frequency and severity vary by plant community and extensive suppression activities has resulted in the accumulation of fire fuels in some portions of the planning area. This has changed the structure and composition of some vegetation communities. Drought also affects fire behavior, such as by reducing the amount of fine fuels and reducing fuel moisture content. Based on data collected between 1984 and 2010, in any given year the planning area is likely to experience between 34 and 50 unplanned ignitions, resulting in approximately 1,800 to 2,200 burned acres. An examination of the available historical record and experience indicate that the typical wildfire in the planning area is a natural caused single tree (juniper) fire of less than one acre. However, occasionally, larger unplanned events skew the average acreage per fire. Only five wildfires larger than 3,000 acres have occurred in the planning area since 1984; these include Wildhorse Basin 07/2000 (36,700 acres), Sheep Mountain 08/2000 (36,360 acres), Pepper 07/2002 (13,200 acres), Black Butte 07/2018 (3,558 acres) and Laney Rim 07/2018 (13,198 acres).

The majority of fires occur south of Rock Springs along a lightning belt extending from Utah (high Uintas) east along the state line. This occurrence pattern likely exists because the best opportunity for a sustained ignition is where lightning can strike standing trees. Prior to fire suppression activities and modern civilization, large fires occurred over cyclic periods (depending on fuel system, i.e., sagebrush/grass, juniper/sage, or conifer forest) involving entire drainages. In addition to natural occurrence, historic livestock operations often burned range lands in the fall. With increased grazing, the abundance of fine fire fuels has been reduced, thus causing a drop in annual fire occurrence. Studies of the transition zones indicate large fire occurrence to be common over the last 300 years. As a result of fire suppression over the last 100 years, brush and tree invasion is common on the edges of the basin area particularly in the sagebrush/juniper and aspen/conifer communities. When burned, sagebrush/grass system is generally reduced to perennial grasses.

A number of fire/fuels treatments have occurred, or are ongoing throughout the planning area. These include chemical treatment of cheatgrass, sagebrush thinning, removing juniper that is encroaching on sagebrush communities, treatment of conifer that is encroaching on aspen communities, and wildland urban interface fuels breaks. Since 1992 there have been approximately 70,000 acres treated for fuels reduction or habitat improvement.

3.8 Cultural Resources

The planning area straddles a section of Wyoming with possibly the highest densities of archaeological sites and districts in the state. A Class I inventory was completed for the Rock Springs Field Office in 2013 and for the Rawlins Field Office in 2010. Known cultural resources number in the tens of thousands despite the low percentage of lands which have been inventoried to a Class III level. Historic sites, prehistoric sites, and traditional cultural properties (TCP) are widespread throughout the planning area. The area also contains National Historic Trails, National Historic Trail candidates, and historical wagon roads. Tribes have identified a host of important cultural sites and landscapes important to their cultures and life ways.

Cultural resources include prehistoric and historic archaeological and architectural structures, features and objects, as well as Native American traditional cultural and religious properties. Prehistoric properties include lithic scatters, temporary camp sites, occupation sites, hunting/kill/butchering sites, processing areas, rock shelters, rock art, cairns, trails, and corrals. Historic properties include historic trails, stage stations, homesteads/farmsteads, roads, irrigation ditches, reservoirs, mining sites, corrals, cairns, campsites, rock art/inscriptions, and trash scatters. Together these properties represent human use of the area by Native American and Euro-American cultures, covering a time from the Paleo-Indian period (12,000 BP) through the present.

The BLM primarily consults with Native American tribes over impacts to sacred sites, TCPs, or other sites known to be of importance to tribes, although tribal concerns can go beyond site specific impacts. The BLM primarily initiates consultation in order to identify cultural and archeological resources that may be of importance to the tribes. Tribes have expressed that sacred sites are not necessarily archeological in nature and may be more properly associated with specific geographic features, plant communities, or locations associated with significant people or events in tribal history. Tribal concerns are documented and incorporated into decisions. The majority of cultural resources in the planning area are identified, evaluated, and managed as a result of compliance with the NHPA, although there are numerous other authorities under which BLM manages cultural resources on the public lands (e.g. FLPMA, ARPA, and Wyoming State Protocol). The purpose of the four-step process required by the NHPA and its implementing regulations is to identify "historic properties" in the undertaking's area of potential effects (APE), assess effects, and to seek ways to avoid, minimize, or mitigate any adverse effects on historic properties through consultation among the agencies and other parties that may have interests in the affected properties (36 CFR 800). A "historic property" is defined as any cultural resource eligible for listing in the National Register of Historic Places (NRHP). The BLM evaluates the significance of historic properties in consultation with the Wyoming State Historic Preservation Officer (SHPO), and sometimes Native American tribes and consulting parties, to determine if the resources are eligible for inclusion in the NRHP. The NRHP specifies that a historic property must meet at least one of four criteria and some of the seven aspects of integrity to be deemed 'eligible' for listing in the NRHP (36 CFR 60.4).

3.9 Paleontological Resources

Fossils are defined as the remains, imprints, and traces of once living organisms that have been preserved in the Earth's crust. Fossils can be remains of plants or animals (the body or imprints of remains), or their reflected actions (trace fossils). Fossils are typically preserved in sedimentary rocks, or in a few unique situations, in volcanic igneous and some meta-sedimentary rocks. They can range from microscopic in size, (radiolarians, foraminifera, bacteria and algae, vertebrates, and pollen) to macroscopic (flowers, leaves, petrified wood, shells or invertebrate animals, and the bones, teeth tracks, feeding traces, coprolites and burrows of vertebrates). The BLM manages paleontological resources on the public lands under the Paleontological Resources Protection Act.

In the planning area, there are fossils of numerous kinds of plants, animals and other organisms, including leaves and tree trunks, reptiles, fish, primates, and avian species. Fossils are important for the information that they can provide about the development of life on earth, the environments of deposition and the physical changes in the earth itself. They provide an outdoor laboratory and classroom to a myriad of important and intriguing questions from dinosaur extinction to the studies of plate tectonics.

Geologic units in the planning area are described according to the Potential Fossil Yield Classification (PFYC), usually at the formation or member level, according to the probability of yielding resources of concern to land managers, primarily all vertebrate fossils and significant plant and invertebrate fossils.

There are five Classes of PFYC with Class 1 being Very Low Potential, and Class 5 being Very High Potential for vertebrate or scientifically significant paleontological resources. Although granite, lava beds, and other igneous or metamorphic rock types are usually considered to be void of any fossils, outcrops of these rocks may have fissure fillings, cave-like structures, sinkholes, and other features that may preserve significant paleontological resources or information, so the potential is not zero; therefore Class 1 is applied to these rock types usually considered not to contain fossil resources.

3.10 Livestock Grazing

There are 28 livestock grazing allotments that at least partially intersect the planning area. Table 3-2 lists all allotments within each HMA, their corresponding permitted AUM allocations and the percent of the allotment within the HMA.

Table 3-2. Grazing allotments within HMAs and their corresponding permitted AUM allocations.

HMA	Allotment	Permitted Active AUMs on Allotment	% of Allotment Within HMA
Adobe Town (RSFO)	Rock Springs	107,991	5%
	Total:	**107,991**	
Adobe Town (RFO)	Adobe Town	1,820	100%
	Continental	2,830	100%
	Corson Springs	1,189	97%
	Cow Creek	709	100%
	Crooked Wash	5,602	67%
	Espitalier	2,775	100%
	Grindstone Springs	413	100%
	Little Powder Mountain	1,534	100%
	Powder Mountain	1,304	100%
	Red Creek	2,612	100%
	Rotten Springs	1,423	100%
	Sand Creek	2,839	100%
	Willow Creek	1,680	100%
	Total:	**26,730**	
Great Divide Basin	Bush Rim	3,277	55%
	Continental Peak	5,769	100%
	Red Desert	9,758	100%
	Rock Springs	107,991	17%
	Total:	**126,795**	
Salt Wells Creek	Alkali Creek	2,283	100%
	Circle Springs	946	100%
	Crooked Wash	5,602	100%
	Horseshoe Wash	3,103	35%
	Mellor Mountain	6,101	99%
	Pine Mountain	7,763	5%
	Rife	508	100%
	Rock Springs	107,991	36%

HMA	Allotment	Permitted Active AUMs on Allotment	% of Allotment Within HMA
	Salt Wells	2,618	99%
	Vermillion Creek	5,298	100%
	Total:	**142,213**	
White Mountain	Highway-Gasson	5,208	95%
	Lombard	6,643	6%
	Rock Springs	107,991	13%
	Total:	**119,842**	

Annual fluctuations in the authorized AUMs are common and are the result of user demands, climatic conditions, and/or an effort to preserve or improve rangeland health. Some livestock users within the planning area have reduced their use levels in recent years as a result of wild horse populations exceeding AML, which can negatively impact livestock operations. Livestock grazing on specific allotments is authorized during established seasons of use. Most of the allotments in the planning area are operated under grazing strategies incorporating rest, seasonal rotations, deferment, and prescribed use levels that provide for adequate plant recovery time to enhance rangeland health. The majority of the allotments in the planning area are considered lower-elevation allotments, and livestock turnout in these allotments typically occurs from March to May. Some livestock operators (especially sheep operators) move their livestock to USFS-administered allotments from July to October. There are several BLM-administered allotments at higher elevations where grazing does not begin until June. Typically, the season of use for these allotments is four to six months.

Numerous range improvements (such as fences or water developments) have been installed within the planning area to help manage livestock distribution and season of use, while protecting sensitive riparian habitat. Many of these range improvements benefit multiple resource values, including wild horses and wildlife.

3.11 Recreation

Federal lands within the planning area provide a broad spectrum of outdoor opportunities. The BLM provides opportunities for outdoor recreation and nature-based tourism under the concept of multiple-use management. Recreational activities occurring on public lands are multi-faceted, generally considered as non-consumptive and typically requires minimal regulatory constraints.

Dispersed recreation consists of activities of an unstructured type that are not confined to specific locations or dependent on developed recreation sites. Dispersed recreation occurs throughout the planning area over a wide range of ecosystem types. Occurring in combination with other resource activities, dispersed recreation includes but is not limited to sight-seeing, touring, backpacking, horseback riding, geocaching, hiking, OHV use, photography, wildlife viewing, fishing, other water related activities, hunting, and camping. These recreational opportunities are offered to the public on all BLM-administered lands within the planning area as long as legal access is available.

The Rock Springs Field Office manages many developed recreation sites scattered throughout the Rock Springs Field Office, consisting of day use/picnic areas, campgrounds, interpretive sites, and historic site tourism. Developed recreation sites provide excellent opportunities and starting points for activities such as camping, hiking, backpacking, horseback riding, wildlife viewing, and sightseeing, OHV touring, fishing, and hunting.

The most popular wild horse viewing activity in the planning area is the Pilot Butte Wild Horse Scenic Loop, located within the White Mountain HMA. This driving tour, located within close proximity to Rock Springs and Green River, allows members of the public easy access to wild horse viewing within the HMA. In addition, the wild horse holding facility in Rock Springs is open to the public to visit the corrals and view wild horses available for adoption or sale. Other opportunities for wild horse viewing include various areas within the HMAs that are accessible by motor vehicles.

3.12 Social and economic values

Public opinions about wild horse management generally arise from the economic and social values associated with these animals. Many of the individuals and groups expressing concern for the well-being of wild horses derive satisfaction from wild horse herds by actively watching and studying them, or using them as inspiration for their artwork. All of which, stimulate economic activity in local economies. Others derive value indirectly from art and photography which depict free-roaming wild horses in western landscapes. Some individuals value the existence of wild horses without actually encountering them. This value represents a non-use or passive value commonly referred to as existence value. Existence values reflect one's willingness to pay to simply know that herds of wild horses still roam free. Some of these individuals believe that any type of capturing and active management of wild horses, including the use of fertility control and sterilization, is inhumane and derive dissatisfaction from these management actions.

Conversely, a separate group of individuals may not support the existence of wild horses on public lands because of their concerns about wild horse numbers and the adverse impacts they can have on rangeland habitats and other resources. These "other resources" include, but are not limited to, negative economic impacts that could result from reduced livestock grazing opportunities, impacts on recreational activities influenced by overpopulation of wild horses, impacts to wildlife resources, and the resulting decline in hunting opportunities. Collectively, these economic and social values reflect the importance of wild horses to people.

Chapter 4 – Environmental Consequences

4.1 Assumptions for Analysis

Assumptions for analysis are made to assist in determining the potential environmental, social, and economics impacts of the alternatives described in Chapter 2 on the affected environment (Chapter 3). Assumptions are for the purpose of analysis only, and are presumed accurate for the purpose of equitably comparing the alternatives. Assumptions do not constrain or define management; they are based on observations, historical trends, and professional judgement, and are generally made for the expected life of the RMP, unless otherwise stated.

The analysis is based on the following assumptions:

- The proposed management actions described in the alternatives apply only to BLM-administered lands, but may affect intermingled private lands.
- The planning criteria described in Chapter 1 (Section 1.4) apply to all alternatives.
- The alternatives would be implemented as described in Chapter 2.
- Implementation actions would comply with valid existing rights and all federal laws, regulations, and policies.
- Sufficient funding and personnel would be available to implement the final decisions.

- Appropriate maintenance would be carried out to maintain the functional capability of all developments (e.g. roads, fences, and other projects).
- Monitoring would be completed as indicated, along with any needed adjustments or revisions.
- Approximately five acres would be temporarily disturbed from the construction and use of wild horse traps (every three to five years when applicable).
- The number of wild horses would increase about 20% annually (with the exception of herds proposed to be non-reproducing).
- Wild horse gathers would occur about every three to five years, when applicable.
- Maintenance of wild horse populations at AMLs within existing HMAs would be accomplished through removals and selected application of other population growth suppression methods, and supplemented with sterilized horses from other HMAs.
- BLM would be able to successfully manage wild horses within AML.
- For analysis purposes (for consideration of wild horse numbers and associated AUMs) the number of wild horses at high AML is used.
- Wild horse gathers would use existing trap locations for the most part. About 30 acres have been disturbed from the development of existing traps. Disturbance from trap locations is limited in scope and temporary.
- Wild horse management would comply with the WFRHBA, applicable implementing regulations, and BLM policies.
- Data used to determine the number of wild horses within an HMA, and to ensure wild horses are managed at AMLs, will be the best available science.

4.2 Impact Analysis

4.2.1 Wild Horses

Impacts Common to All Alternatives

Herd Health

Achieving and maintaining AML and implementing resource monitoring and gather plans would serve to limit wild horse population numbers and achieve a balance among forage resources and other resource uses. Maintaining wild horse population size within the AML would reduce competition for resources and allow wild horses to use their preferred habitat. This would improve forage quantity and quality, and promote healthy populations of wild horses in a thriving natural ecological balance. Deterioration of the range associated with wild horse overpopulation could be avoided, if gathers are implemented as necessary and AML is maintained. Managing wild horse populations in balance with the available habitat and other multiple uses would lessen the potential for individual animals or the herd to be affected by drought and would avoid or minimize the need for emergency gathers, which would reduce stress to the animals and increase the success of these herds over the long term.

Wild horses removed to maintain AML would be placed in short or long term holding facilities until they are adopted. Following a gather the wild horses that remain on the HMAs would have more forage, water, and space available, which would likely improve the overall health of the herd.

Achieving AML for HMAs could help prevent or reduce excessive forage loss, introduction or spread of invasive, non-native plant species, soil compaction, erosion, sedimentation, and the influx of nutrients into riparian areas, wetlands, or streambeds, thereby protecting water quality for wild horses. Currently, wild horses are using habitat outside established HMA boundaries, and they could continue to do so. Removing or modifying fences within the HMA could allow free movement of wild horses and extend

the amount of available forage. Habitat management plans could maintain or enhance vegetation (forage) for wild horses, and prevent habitat degradation from invasive, non-native plant species.

Gathers

Individual, direct effects to wild horses include the handling stress associated with the roundup, capture, sorting, handling, and transportation of the animals. The intensity of these effects varies by individual, and is indicated by behaviors ranging from nervous agitation to physical distress. Individual, indirect effects can include miscarriages in mares, increased social displacement, and conflict in stallions, and are known to occur intermittently during gather operations.

The BLM has been gathering excess wild horses since the mid-1970s and has been using both helicopters and motorized vehicles for this purpose; both of these methods have proven to be a safe and effective means for gathering and removing excess wild horses from the range. Approximately 0.6% of the captured animals could potentially require euthanasia due to pre-existing conditions and in accordance with BLM policy (GAO 2008). The BLM has a moratorium on using helicopters to assist in the removal of wild horses, except in case of emergency, during the peak foaling period, which occurs March 1 through June 30. The BLM also uses water and/or bait trapping as a method of gathering wild horses. Both methods of gathering can be stressful, varying in intensity by individual horse.

Injuries sustained by wild horses during gathers can include nicks and scrapes to the body or face; rarely, horses may encounter barbed wire fences and receive wire cuts. Other injuries can include biting and kicking bruises; horses may strike or kick gates, panels, or the working chute while in corrals or traps which may cause injuries. These injuries are generally not fatal. Other injuries such as a broken leg are extremely rare; injuries requiring euthanasia could be anticipated to occur in 1 per 100 animals captured. Spontaneous abortion events among pregnant mares following captures is rare, however, it has happened particularly among mares with poor body condition at the time of gather.

Dependent foals would be gathered with their mares, but a few foals may be orphaned during a gather; this can happen if the mare rejects the foal, the foal becomes separated from its mother and cannot be reunited, the mare dies or must be euthanized during the gather, the foal is ill or weak and needs immediate care and removal, or the mother does not produce enough milk to support the foal.

Summer gathers can result in an increased risk of heat stress on the wild horses, however this is rare and the BLM would conduct gathers in the early morning and stop earlier in the day as well as ensuring that wild horses are brought in at slow speeds. Dehydration is a risk during summer gathers when animals may be traveling long distances between forage and water. Winter gathers may occur in less steep terrain due to high snow depth in higher elevations. Snow cover can increase fatigue and stress during winter gathers. In this situation wild horses would be moved at a slow, easy pace to help reduce fatigue.

Temporary Holding Facilities and Handling

Gathered wild horses would be transported from the trap sites to a temporary holding corral. Most injuries are sustained once the wild horses have been captured and tend to occur as a result of kicks and bites, or from the animals making contact with corral panels or gates. Injuries generally consist of superficial wounds to the rump, face, or legs. Rarely, horses may sustain a spinal injury or a fractured limb; however, serious injuries requiring euthanasia occur in less than 1 horse per every 100 captured.

Impacts on Herd Health from Gathers

Wild horses that are returned to the range following the gather may be temporarily disturbed and move into another area during the remainder of the gather operations; however, these impacts are generally temporary in nature and tend to disappear within several days of wild horses being released back to the range. No observable effects from the gather would be expected within one month of gather completion, except possibly for a heightened awareness of human presence. The primary effects to the wild horse population would be to herd population dynamics, age structure or sex ratio, and subsequently to the growth rates and population size over time.

Reducing excess wild horses would improve overall herd health for those horses left on the range. Decreased competition for forage and water resources reduces stress and promotes healthier animals, and fighting among stud horses would decrease as would injuries associated with this fighting. The reduction of excess animals as well as the reduced population growth (as a result of population growth suppression, discussed below) should result in improved health and condition of mares and foals. Reduced population growth rates would be expected to extend the time interval between gathers and reduce disturbance to individual animals as well as the herd social structure.

Increased social displacement and conflict in stallions has also been known to occur; brief skirmishes between older stallions is often the observable manifestation of this stress. Traumatic injuries are generally not a result of these conflicts and injuries normally are limited to bites and/or kicking with bruises which do not break the skin. Miscarriages of pregnant mares are also known to occur occasionally as a result of gather operations.

Impacts Common to Alternatives A, B, and D

Establishing viewing sites and providing interpretive information on wild horses would serve to educate the public on the importance of appropriately managing the wild horse program. Wild horse management actions would provide further benefits by allowing construction of water developments designed to improve herd distribution and manage forage utilization. Water developments could improve the distribution of resources across the range, could improve herd distribution, and increase available forage levels. Additional water sources would reduce impacts from wild horses congregating around water developments, which would reduce impacts from forage loss, soil compaction, erosion, and degradation of water resources.

Population Growth Suppression

Wild horse population growth suppression measures include treating with immuno-contraceptives, spaying, gelding, and other sterilization methods which may be mechanical, surgical, or chemical. The various methods used for population growth suppression are discussed in Appendix B. A National Research Council (NRC) Report (2013) noted that all fertility suppression methods may have effects on mare behavior, mostly as a result of lack of pregnancy and foaling. Any decrease in the number of breeding females in a population should lead to a direct decrease in the population's growth rate, so the implementation of any of the population growth suppression measures discussed in Appendix B would likely result in a decrease in the overall population growth rates, which would assist in the maintenance of AML. Controlling the population growth rates of wild horses through the use of population control strategies would provide for healthier herds by limiting the stress of continual pregnancy on mares; this would also be true for non-reproducing herds where geldings would not be exerting energy attempting to breed the mares. Gathers would also be scheduled further apart due to AML being met for a longer period of time, therefore resulting in less stress to the wild horses. 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. After a treated mare returns to fertility, her future foals would be expected to be healthier overall, and would benefit from improved nutritional quality in the mare's milk. This is particularly to be expected if there is an improvement in rangeland forage quality at the same time, due to reduced wild horse population size. Past application of fertility control has shown that mares' overall health and body condition can remain improved even after fertility resumes. Anecdotal, subjective observations of mares treated with an immunocontraceptive (PZP; discussed in Appendix B) in past gathers showed that many of the treated mares were larger, maintained better body condition, 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 by some a 'rebound effect.' Elevated fertility rates have been observed after wild horse gathers and removals (Kirkpatrick and Turner 1991). More research is needed to document and quantify these hypothesized effects. If repeated contraceptive treatment leads to a prolonged contraceptive effect, then that may minimize or delay the hypothesized rebound effect. Selectively applying contraception to older animals and returning them to the HMA could reduce long-term holding costs for such horses, which are difficult to adopt, and could negate the compensatory reproduction that can follow removals (Kirkpatrick and Turner 1991). Because successful fertility control would reduce foaling rates and population growth rates, another indirect effect would be to reduce the number of wild horses that have to be removed over time to achieve and maintain the established AML. Contraception would be expected to lead to a relative increase in the fraction of older animals in the herd. Reducing the numbers of wild horses that would have to be removed in future gathers could allow for removal of younger, more easily adoptable excess wild horses, and thereby could eliminate the need to send additional excess wild horses from this area to off-range corrals or pastures. Among mares in the herd that remain fertile, a high level of physical health and future reproductive success would be expected because reduced population sizes should lead to more availability of water and forage resources per capita. Reduced population growth rates and smaller population sizes could also allow for continued and increased environmental improvements to range conditions within the project area, which would have long-term benefits to wild horse habitat quality. As the local wild horse abundance nears or is maintained at the level necessary to achieve a thriving natural ecological balance, vegetation resources would be expected to recover, improving the forage available to wild horses and wildlife throughout the HMAs. With rangeland conditions more closely approaching a thriving natural ecological balance, and with a less concentrated distribution of wild horses across the HMAs, there should also be less trailing and concentrated use of water sources. Lower population density would be expected to lead to reduced competition among wild horses using the water sources, and less fighting among horses accessing water sources.

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.

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.

Impacts Common to Alternatives B and D

Alternatives B and D propose to supplement herds with additional wild horses from other HMAs to help maintain AMLs following natural attrition or to help preserve adequate genetic diversity. Translocating

horses from one HMA to another could facilitate the spread of pathogens; however, this risk would be minimized by advanced testing and monitoring so that the BLM is aware of potential pathogens prior to transfer. Since mares would be re-located without their stallions, the dissolution of the bonds between those mares once they are released into their new HMA could occur. These mares would need to be assimilated into existing harems or groups. Changes in the existing herd structure and dynamics can occur, however, because the BLM would not be translocating stallions this impact may be minor.

Impacts Unique to Alternative A

Alternative A represents the continuation of existing management as identified in the 1997 Green River RMP. Wild horses would be managed in four checkerboard HMAs at a cumulative AML of 1,481 to 2,065, and gather plans would be prepared for removal of excess wild horses both inside and outside the HMAs. Water developments would be constructed to improve herd distribution and manage forage utilization. Fertility control would be implemented only when necessary, and any fencing constructed in HMAs would be constructed to minimize restriction of wild horse movement.

Implementing population growth suppression only when necessary could result in the populations meeting and/or exceeding AML more quickly than they would if fertility control were to be implemented on a more regular basis. Managing these herds as reproducing would also result in the need for more frequent gathers as the population would grow more rapidly as compared to the other alternatives. As a result the impacts described above under **Impacts Common to All Alternatives** – *Gathers* and **Impacts Common to All Alternatives** – *Impacts on Herd Health from Gathers* would occur more frequently compared to the other alternatives. Impacts associated with population growth suppression, when it would be implemented under this alternative, would be similar to those discussed under **Impacts Common to Alternatives A, B and D** – *Population Growth Suppression*.

Alternative A does not propose any components to address the BLM's obligations under the Consent Decree since it is the No Action and represents the continuation of existing wild horse management within the planning area. The BLM has attempted to manage wild horse populations within the checkerboard portions of these HMAs under this alternative but has found this to be untenable as a result of the private land conflicts in this area. Furthermore, the AMLs established under this alternative assume the permissive use of private land, which has since been revoked. For these reasons Alternative A is not likely to be viable in the future.

Impacts Unique to Alternative B

Under Alternative B, all checkerboard lands within the Great Divide Basin, Salt Wells Creek and Adobe Town HMAs would revert to HA status and be managed for zero wild horses. Approximately 100 miles of new HMA boundary would be created adjacent to the checkerboard land pattern. Future management tools such as man-made boundaries, capture and relocation, and/or active herding of wild horses would be needed to prevent constant movement of wild horses back into the checkerboard, particularly as wild horses in these herds have historically used the checkerboard for winter range. These management tools would have considerable impact to the landscape. For example, a boundary such as 100 miles of fencing could impact wildlife movement (see **Section 4.2.5**), cultural (see **Section 4.2.8**) and paleontological sites (see **Section 4.2.9**), and National Historic Trails (see **Section 4.2.8**). These types of impacts could prevent the BLM from implementing any such management tools and wild horses would be free to move back and forth into the private lands within the checkerboard.

All remaining lands within the HMAs would be managed for non-reproducing populations. Checkerboard lands within the White Mountain HMA would remain a part of the HMA. RSGA has consented to wild horse use of private land in that area, if the herd is managed as non-reproducing.

Under this alternative AML remains the same as under Alternative A (1,481 – 2,065), however wild horses will be concentrated in a smaller area as a result of removing checkerboard lands from the HMAs. Overall, HMAs would decrease in size by 1,276,852 acres, or 55%. A proportional reduction in numbers would require the permanent removal of 675 wild horses. Since AML would remain the same under this alternative, additional forage would need to be allocated from other resources to wild horses in order to provide adequate habitat. To provide adequate forage, water, cover and space for this increased concentration of wild horses, permitted livestock AUMs would be reduced by 8,100 on the allotments within the HMAs (see **Section 4.2.10**). Maintaining the AML and implementing monitoring and gather plans would serve to limit wild horse population numbers and achieve a balance among forage resources, other resource uses, and wild horse management.

The BLM would manage all of the HMAs as non-reproducing herds utilizing a variety of tools, including gelding, spaying, or other population growth suppression tools. Managing the HMAs as non-reproducing herds would aim to maintain populations at appropriate levels to allow for ideal forage quantity and quality, habitat health, and water availability for wild horses. As a result of managing the HMAs as non-reproducing, fewer gathers would be necessary, and would result in less stress, injury, and mortality. All population growth suppression methods are likely to alter the behavior or physiology of wild horses in some way (see Appendix B). According to the NAS Report (2013), the two important considerations are bonds between animals and the stability of the social groups. The absence of young horses would alter the age structure of the population, resulting in a larger component of older animals, and could thereby affect harem dynamics. In a non-reproducing herd, the mares would be likely to display improved overall fitness due to the lack of stress incurred as a result of pregnancy and lactation; in addition, without those stressors, mares may live longer (NAS Report 2013). If any of the changes described above occur, those changes would not be contrary to the WFRHBA, as the wild horses would still retain their untamed, wild and feisty nature, and would still be free-roaming.

In addition, fewer wild horses would have to be held in either short or long term holding facilities. There would also be fewer wild horses from these HMAs available for adoption and sale. However, fertility treatments could impact behavior and cause varying levels of stress to the animals (see Appendix B). These impacts would be managed by implementing selection criteria to ensure that the animals that undergo these procedures would have a high probability of success with minimal side effects. Selection criteria would include a good body condition class, at least average size and stature, and good confirmation.

Under this alternative, once the BLM successfully establishes the herds as non-reproducing, the genetic makeup of the animals there would no longer contribute to future genetic diversity. This is because, while the animals present in the herd could represent a wide range of wild horse genotypes and phenotypes, no foals would be produced. As the herds are supplemented with additional non-reproducing animals from other HMAs, the range of phenotypes and genotypes in the herds would be expected to change.

Managing for non-reproducing herds within the planning area would likely be difficult to implement because untreated wild and feral horses from outside the HMAs (or adjacent HMAs) may drift into these HMAs and introduce breeding opportunities. There is a high likelihood that this situation would occur on all of the HMAs, as there are adjacent HMA herds in the BLM Rawlins and Lander Field Offices, and in

the BLM offices to the south in Colorado. There is also a known population of feral horses immediately west of the Green River, near the White Mountain HMA. Managing non-reproducing herds is more likely to be successful in areas where herds are isolated and interchange with other untreated animals is unlikely to occur.

Overall, the BLM's ability to manage wild horses would improve compared to Alternative A. However, in order to successfully manage wild horses under this scenario, it would be critical for the BLM to be able to implement management tools such as fencing along the border between checkerboard and solid-block BLM lands in the Salt Wells Creek, Great Divide Basin and Adobe Town HMAs. Otherwise, wild horses, which are accustomed to utilizing checkerboard lands, would be expected to drift onto these lands and establish a herd in that area. The BLM's ability to manage a tool such as fencing would be challenging, as any gates left open or any sections of the fence that were not well maintained would likely allow wild horses access to the checkerboard lands.

This alternative meets the Consent Decree requirements to consider the possibility of maintaining the White Mountain HMA as a non-reproducing herd, as all HMAs would be managed as non-reproducing under this alternative. However, as described in the above analysis, managing a non-reproducing herd on the White Mountain HMA would be difficult because of the possibility of interchange with untreated animals from outside the HMA.

Impacts Unique to Alternative C

Alternative C proposes to convert all checkerboard HMAs in the planning area to HA status, managed for zero wild horses. An estimated 2,065 wild horses would be permanently removed from the planning area. Population growth suppression tools would not be implemented, fencing would not be constructed (for the benefit of wild horses), and the public would not have the opportunity to view and experience wild horses in the planning area.

Impacts to wild horses as a result of this alternative include the impacts associated with gathers and the associated potential for injury, stress, and mortality. Gather related impacts would be greater under this alternative than other alternatives since more gather efforts may be necessary to ensure all wild horses are removed from each HMA. This impact would be more intensive but would be short in duration. A large, multi-step and likely multi-year effort would be required in order to achieve complete removal of wild horses from the planning area. In addition, all the wild horses gathered would have to be transported to and held in either short or long term holding facilities. An increased number of horses would be available for adoption or sale as a result of eliminating the HMAs in the planning area. However, the number of wild horses gathered typically far exceeds the demands for adoption and sale, and the increased number of horses available for adoption or sale would be temporary.

This alternative meets the Consent Decree requirements to consider the possibility of converting the Great Divide Basin and Salt Wells Creek HMAs to HA status and managing them for zero wild horses. It also meets the Consent Decree requirement to analyze an alternative that considers managing the Adobe Town HMA at an AML of 225-450 wild horses, or lower.

Impacts Unique to Alternative D

Under this alternative all checkerboard lands within HMAs would be converted to HA status and managed for zero wild horses. As a result of this the entire Great Divide Basin HMA, the entire Salt Wells Creek HMA, the entire White Mountain HMA and the RSFO portion of the Adobe Town HMA would revert to HA status and be managed for zero wild horses. Impacts to these HMAs would be the

same as those described under Alternative C. For the RFO portion of the Adobe Town HMA, all checkerboard land and the portion of the HMA north of the existing Corson Springs fence (see Map 2-3) would revert to HA status and be managed for zero wild horses. The remainder of the HMA would be retained and managed at a proportionally smaller AML. In all, the RFO portion of the Adobe Town HMA would be reduced by approximately 5% and the total AML for the HMA would be reduced by approximately 33%.

In all, under this alternative an estimated 1,529 wild horses would be permanently removed from the four HMAs in the planning area. This represents a 74% reduction in the total wild horse population within the four HMAs. A total of approximately 2,466,118 acres would no longer be allocated for wild horse use. This represents an 87% reduction in total acreage allocated for wild horse use. All of the gather related impacts listed under **Impacts Common to All Alternatives** – *Gathers* and **Impacts Common to All Alternatives** – *Impacts on Herd Health from Gathers* could occur. These impacts would not be as intense as under Alternative C, but would exceed the impacts expected for Alternative A, because all wild horses would have to be removed from three of the HMAs and all checkerboard lands. Forage condition for wild horses that remain on the range is expected to improve since there would be reduced competition as a result of permanently removing 1,529 wild horses from the range. This is expected to lead to improved health for these wild horses.

This alternative would allow for AML to be adjusted without requiring a Land Use Plan amendment. This approach would allow for more timely adjustments to AML in response to changing conditions within the Adobe Town HMA. By more rapidly responding to needed changes in AML this alternative would help ensure the number of wild horses present on the Adobe Town HMA are appropriate in consideration of the forage, water, cover and space available, as these conditions change. More timely adjustments to AML would also help protect resource conditions within the HMA and ensure the long term viability of the wild horse herd, while maintaining rangeland health.

Under this alternative, the BLM would utilize population growth suppression to help manage wild horse populations and reduce the frequency of gathers in the Adobe Town HMA. Impacts associated with population growth suppression efforts are described in detail under Alternative B and in Appendix B. Impacts to wild horses related to population growth suppression are expected to be reduced in this alternative compared to Alternative B, because the BLM would not manage the entire Adobe Town herd as non-reproducing, but rather would utilize population growth suppression tools to reduce population growth rates. Overall, population growth suppression methods often cause some stress to the treated animals, but are likely to result in greater overall health since reproduction related energy costs are reduced. Under this alternative, the herd as a whole would benefit from the reduced frequency of gathers and the associated stress and injuries that can occur as a result.

Population growth suppression under this alternative is not expected to adversely affect genetic diversity in the remaining Adobe Town herd. In an HMA 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 size of the Adobe Town herd, and the likelihood of interactions with other wild or feral horses would help ensure adequate genetic diversity for this herd.

In the HMAs where the entire herd is removed (Great Divide Basin, Salt Wells Creek and White Mountain), these wild horses would no longer contribute to the genetic diversity of wild horses in this

area. However, this is not expected to have impacts outside of these individual herds. The NRC (2013) recommended that managed herds of wild horses would be better viewed as components of interacting metapopulations, with the potential for interchange of individuals and genes taking place as a result of both natural and human-facilitated movements. Because of natural horse movements and a long history of human-facilitated movements between HMAs, the wild horses now living in these HMAs may be considered as all belonging to one metapopulation, the boundaries of which may be farther west, south, and north than these HMAs alone. Because of this, it is unlikely that any of the herds in a single HMA discussed in this document contain significant genetic elements that are not also represented in other herds.

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. As a result, in most HMAs, applying fertility control to a subset of mares is not expected to cause irreparable loss of genetic diversity. Improved longevity and an aging population are expected results of contraceptive treatment that can provide for lengthening generation time; this result would be expected to slow the rate of genetic diversity loss (Hailer et al., 2006). Based on a population model, Gross (2000) found that 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.

The BLM expects that wild horse family structures would continue to exist under this alternative because fertile mares, stallions, and their foals would continue to be a component of the herd. It is not expected that using population growth suppression tools on a subset of wild horses would significantly change the social structure or herd demographics (age and sex ratios) of fertile wild horses.

Cumulative Impact Analysis

The Cumulative Impact Analysis Area (CIAA) for Wild Horses is the state of Wyoming. Within this area there are a total of 16 HMAs, 4 of which occur within the planning area. Table 4-1 provides a summary of the Wyoming HMAs:

Table 4-1. Summary of Wyoming HMAs. * indicates HMAs present within the planning area.

HMA	Field Office	Low AML	High AML	Acres
*Adobe Town	Rock Springs / Rawlins	610	800	476,986
Antelope Hills	Lander / Rawlins	60	82	158,569
Conant Creek	Lander	60	100	57,707
Crooks Mountain	Lander	65	85	58,416
Dishpan Butte	Lander	50	100	99,720
Fifteen Mile	Worland	70	160	81,130
*Great Divide Basin	Rock Springs	415	600	776,189
Green Mountain	Lander	170	300	116,764
Little Colorado	Rock Springs	69	100	630,033
Lost Creek	Rawlins	60	82	251,338
McCullough Peaks	Cody	70	140	109,779
Muskrat Basin	Lander	160	250	193,328
Rock Creek	Lander	50	86	24,585
*Salt Wells Creek	Rock Springs	251	365	1,169,288

Stewart Creek	Rawlins	125	175	167,969
*White Mountain	Rock Springs	205	300	388,488
	TOTALS:	**2,490**	**3,725**	**4,760,289**

Alternative A

This alternative represents current management. Under this alternative the HMAs within the planning area would make up 59% of all Wyoming HMAs by acres, and 55% of all Wyoming HMAs by high AML.

Alternative B

Under this alternative there would be 1,272,954 fewer HMA acres within Wyoming, compared to Alternative A. This represents a 27% decrease in the acres available for wild horses within the CIAA. AML would remain the same under this alternative so there would be no changes in the total number of wild horses present within the CIAA. Overall, the HMAs within the planning area would constitute 44% of all Wyoming HMAs by acres, and 55% of all Wyoming HMAs by high AML.

Alternative C

Under this alternative all of the HMAs within the planning area would revert to HAs, managed for zero wild horses. Overall there would be 2,810,951 fewer HMA acres within the CIAA. There would also be 2,065 fewer wild horses (at high AML) within the CIAA. This represents a 59% decrease in the acres available for wild horses within the CIAA and a 45% decrease in the total number of wild horses (at high AML) within the CIAA.

Alternative D

Under this alternative there would be 2,455,858 fewer HMA acres within Wyoming, compared to Alternative A. This represents a 52% decrease in the acres available for wild horses within the CIAA. There would also be 1,529 fewer wild horses within the CIAA (at high AML). This represents a 41% decrease in the number of wild horses (at high AML) within the CIAA. Overall, the remaining HMA within the planning area would constitute 15% of all Wyoming HMAs by acres, and 24% of all Wyoming HMAs by high AML.

Mitigation Measures

In implementing the selected alternative, the BLM will follow all laws, policies, handbooks, standard operating procedures, and best management practices (such as those outlined in the BLM's Comprehensive Animal Welfare Program for Wild Horse and Burro Gathers (BLM 2015)). These measures will minimize impacts related to the management of wild horses, by maintaining appropriate conditions for wild horses on the range, and ensuring the use of proper gather procedures and appropriate removal and care practices for wild horses after they are removed from the range.

4.2.2 Soil Resources

Alternative A

Concentrated wild horse use can affect soil resources, especially in wet areas, around springs, and near salt blocks. Wild horses often use riparian and wetland areas for water and shade, and may congregate around water developments. This can result in compacted soil and trampled vegetation. A total of 24,780 AUMs would be used by wild horses (at high AML) under this alternative. Grazing from wild horses can

lead to reduced vegetative cover, reduced water infiltration rates and nutrient cycling, decreased plant litter and water quality, and increased bare ground and soil erosion. However, managing at AML would limit potential impacts to soil resources. Some trampling of vegetation and subsequent erosion could still occur, but if the gather program is successful in maintaining wild horse population levels these impacts would be limited.

In areas where range improvements are constructed, surface disturbance from the construction of water developments would remove vegetation and increase erosion caused by wind and water in localized areas. However, water developments would also improve the distribution of wild horses, reducing the magnitude of localized vegetation removal and subsequent soil erosion associated with the concentration of wild horses in these areas.

Direct impacts to soil resources associated with wild horse gathers include disturbance to soil surfaces immediately in and around temporary gather sites and holding facilities. Impacts would occur from vehicle traffic and hoof action as a result of concentrating the wild horses, and would be localized in the immediate vicinity of the gather sites and holding facilities. Generally, these sites would be small (less than one half acre in size, and any impacts would be localized and temporary. In general, gather sites are located near existing roads or other disturbances such as pullouts or water haul sites which would further serve to reduce impacts to soils from gathers.

Alternative B

Impacts to soil resources from wild horses would be similar to those described under Alternative A, except the same number of wild horses would be concentrated in a smaller area under this alternative. Higher concentrations of wild horses could lead to greater impacts to soil resources. However, some of the potential impacts to soil resources from this alternative would be offset by the removal of 8,100 permitted livestock AUMs. Some impacts to soil resources would occur as a result of gathering all wild horses from the checkerboard lands. These impacts would be similar to those described under Alternative A related to gather operations.

Alternative C

Because this alternative proposes to remove all wild horses and manage for zero wild horses, the long term impact of wild horses to soil resources would be minimal. However, the efforts that would be undertaken to gather all of the wild horses in the planning area would likely result in short term disturbance to gather sites and other temporary gather facilities. Due to the large number of wild horses that would need to be gathered, it is likely that a greater number of facilities and vehicles would need to be used. In addition, the large amount of hoof action that would occur during these gather activities would also create localized, temporary impacts to soil resources.

Alternative D

Under Alternative D, wild horse populations would be reduced by approximately 74% within the planning area. In total, these HMAs would be reduced in size by approximately 87%. Overall, fewer wild horses would impact soils in fewer places within the planning area. This would reduce the overall level of impact on soil resources (e.g., vegetation trampling, soil compaction) from the presence of wild horses in comparison to Alternative A. However, impacts would occur to soil resources as a result of gathering all wild horses from three HMAs. These impacts would be similar to those described in Alternative C.

By providing a means of adjusting AML for the Adobe Town HMA based on up-to-date information about resource conditions, this alternative will allow for more timely adjustments to AML in response to changes in resource conditions. This is expected to benefit soil resources by ensuring the AML is appropriate to current conditions on the HMA.

Cumulative Impact Analysis

The CIAA for soils is the planning area. Livestock grazing within this area can impact soils in a similar manner as wild horses (i.e. removal of protective vegetation causing potential increased erosion and soil compaction from grazing activities in areas where animals concentrate). However, livestock use is typically seasonal and actively managed to minimize these impacts, while wild horse use is typically year round, with little direct management of the herd; impacts from wild horses are primarily managed by limiting the herd size within AML.

Other activities that occur within the planning area can also impact soils, including fires, vegetation treatments, mining activities, oil and gas development, roads, structures and utility lines. The acres impacted by these activities are summarized in Table 4-2. These impacts represent approximately 3% of the planning area.

Table 4-2. Summary of acres of disturbance within the planning area.

Impact Category	Past	Present	Future	Total
Fires and Vegetation Treatments	24,910	0	0	24,910
Mining Activities	69	8,346	0	8,415
Oil and Gas	2,988	2,645	350	5,983
Transportation (roads and railways)	0	16,517	0	16,517
Structure Development (including cities)	0	12,803	0	12,803
Utilities	0	9,263	0	9,263
Totals:	**27,967**	**49,574**	**350**	**77,891**

The activities listed in Table 4-2 can lead to increased soil erosion, reduced infiltration rates and soil compaction. Impacts to soils associated with these activities are typically more pronounced than those associated with wild horse activities. All of the alternatives, except for Alternative C, allow for the construction of water developments or other range improvements to support wild horses within the HMAs. Impacts associated with these range improvements would be similar to those of the activities listed in Table 4-2, and therefore would compound those effects to varying degrees in Alternatives A, B, and D. Wild horse gather activities would not have cumulative effects to soils because these impacts are temporary and limited in scope.

Alternative A

This alternative represents current management. There are a total of 28 grazing allotments that at least partially intersect the HMAs under this alternative. These allotments permit an estimated 146,787 livestock AUMs within these HMAs. Wild horses would utilize an estimated 24,780 AUMs (at high AML). The combined use by livestock and wild horses would be an estimated 171,567 AUMs. As described above, removal of vegetation and impacts associated with grazing activities can expose more soil to erosion, and impact infiltration rates and nutrient cycling.

Wild horse related range improvements could be developed within the 2,818,132 acres covered by the four checkerboard HMAs. Impacts to soils from these developments would likely be similar to those described for the activities listed in Table 4-2.

Alternative B

Since the HMAs would exclude any checkerboard lands under this alternative, there would only be 26 grazing allotments that at least partially intersect the HMAs. These allotments would permit an estimated 78,360 livestock AUMs (after reducing permitted livestock AUMs by 8,100). Wild horses would continue to utilize an estimated 24,780 AUMs. The combined use by livestock and wild horses would be an estimated 103,140 AUMs. As described above, removal of vegetation and impacts associated with grazing activities can expose more soil to erosion, and impact infiltration rates and nutrient cycling.

Because wild horse use would be concentrated in a smaller area under this alternative, the cumulative impacts to soils on solid block land are expected to be greater, although some of these impacts would be offset by the reduction in permitted livestock AUMs noted above. Conversely, cumulative impacts on soils in the checkerboard lands would be reduced under this alternative as a result of removing wild horses from this area, though impacts to soils from livestock grazing would continue to occur.

Wild horse related range improvements would not be developed on checkerboard lands under this alternative, but could be developed on the 1,537,997 acres of solid block lands. As a result, cumulative impacts associated with the construction of range improvements would be less than Alternative A within checkerboard lands, but likely similar to Alternative A within the solid block lands.

Alternative C

Under this alternative all of the HMAs within the planning area would revert to HAs, managed for zero wild horses. Throughout the planning area there would be 24,780 fewer AUMs removed through grazing activities, and the impacts to soils associated with wild horse grazing activities would not occur. Because of this, cumulative impacts to soils would be reduced under this alternative, relative to the other alternatives. Impacts to soils from other activities (such as those described in Table 4-1) would continue to occur. Impacts to soils from gather related activities would likely be initially greater under this alternative, but because these impacts would be temporary and limited in scope they would not add to the cumulative impacts to soils within the CIAA.

Alternative D

Since only the Adobe Town HMA would remain under this alternative, there would only be 12 grazing allotments that at least partially intersect the HMA under this alternative. These allotments permit an estimated 22,955 livestock AUMs within the HMA. Wild horses would utilize an estimated 6,432 AUMs (at high AML). The combined use by livestock and wild horses would be an estimated 29,387 AUMs. As described above, removal of vegetation and impacts associated with grazing activities can expose more soil to erosion, and impact infiltration rates and nutrient cycling. Overall, cumulative impacts to soils under this alternative would be greater than under Alternative C, in which all wild horses would be removed, but reduced relative to Alternatives A and B, as the impacts associated with wild horse use would only occur on one of the HMAs. Impacts associated with wild horse use, in addition to impacts from livestock use and oil and gas development, would continue to occur within the Adobe Town HMA, and the cumulative impacts would be similar to those listed for Alternative A. Other activities would continue to impact soils in areas where wild horses are removed; however, there would no longer be any additional wild horse related impacts in these areas.

Wild horse related range improvements would not be developed on any of the HMAs that revert to HA status under this alternative, but could be developed on the 355,093 acres within the Adobe Town HMA. As a result, cumulative impacts associated with the construction of range improvements would be less than Alternative A within the HMAs that revert to HA status, but likely similar to Alternative A within the Adobe Town HMA.

4.2.3 Water Resources

Alternative A

Impacts to water resources from wild horses can occur when the animals congregate near surface waters, overgraze sensitive areas, spread plant pests, increase pathogen and nutrient loading to water bodies via surface water contact with manure, and compact or otherwise damage soil. As movements of wild horses are not directly controlled, it is possible for them to over-use some watering areas, limiting opportunities for the resources in that area to recover from grazing activities.

Achieving and maintaining the AML for wild horses within the four wild horse HMAs would reduce potential impacts to water resources. Some trampling of riparian vegetation and subsequent erosion would still occur, but this could be held to an acceptable level if the selective gather program were successful in reducing and maintaining wild horse population levels. Concentration of wild horses near water sources and along fences could increase localized erosion and sediment loads caused by trampling and overgrazing of riparian vegetation.

Disturbances associated with the gathering and transport of the animals, as discussed in the soils portion of this document, could create localized areas of water quality degradation, but would likely be limited in time and scope.

Improvements to water availability, via water developments, would benefit all rangeland users, including wild horses. There would be some impacts associated with the construction of water developments, however these impacts would be localized and limited in scope. Water developments would improve animal distribution (for wild horses, livestock and other wildlife), reducing the magnitude of focused vegetation removal, soil erosion, and nutrient loading from wild horse concentrations around natural water sources.

Alternative B

The types of impacts to water resources from wild horse management would be similar to those discussed in Alternative A. However, under this alternative the same number of wild horses would be concentrated in a smaller area. This could lead to increased impacts to surface waters in these areas. However, some of the impacts to water resources would be reduced by the removal of 8,100 permitted livestock AUMs.

Alternative C

This alternative would provide greater protections to water resources, compared to all other Alternatives. Because wild horses would be entirely removed from the planning area, all of the impacts described under Alternative A would not occur. The process of gathering all wild horses under this alternative could cause minor additions to sediment loading, but these impacts would be limited and temporary.

Alternative D

The types of impacts on water resources from managing wild horses in the Adobe Town HMA would be similar to those presented under Alternative A. These impacts would not occur within the portions of the planning area where approximately 2,446,118 acres would no longer be allocated for wild horse use. This represents an 87% reduction in total acreage allocated for wild horse use. Overall, this would reduce the

level and extent of impact on water resources (e.g., vegetation trampling, soil compaction, and subsequent surface runoff and sedimentation of water sources) from the presence of wild horses.

By providing a means of adjusting AML for the Adobe Town HMA based on up-to-date information about resource conditions, this alternative will allow for more timely adjustments to AML in response to changes in resource conditions. This is expected to benefit water resources by ensuring the AML is appropriate to current conditions on the HMA.

Cumulative Impact Analysis

The CIAA for water resources is the planning area. The activities listed in Table 4-2 can impact water resources by increasing the amount of sediment that enters surface waters as a result of increased soil erosion and decreased water infiltration rates. Livestock grazing activities can also impact water resources similar to those described for wild horses above. Range improvements, such as water developments, can have a similar impact to those activities listed in Table 4-2; however, water developments can also protect water resources by reducing the amount of time grazing animals spend near natural surface waters.

Alternative A

This alternative represents current management. The 28 grazing allotments that at least partially intersect the HMAs under this alternative permit an estimated 146,787 livestock AUMs. Wild horses would utilize an estimated 24,780 AUMs (at high AML). The combined use by livestock and wild horses would be an estimated 171,567 AUMs. As described above, wild horses and livestock tend to congregate near water sources and can impact water resources in these areas. This can decrease water quality, and decrease bank stability in these areas. The development of offsite water can reduce these potential impacts to water resources by encouraging wild horses and livestock to congregate away from natural surface waters.

Alternative B

Only 26 grazing allotments would at least partially intersect the HMAs in this alternative. These allotments would permit an estimated 78,360 livestock AUMs (after reducing permitted livestock AUMs by 8,100). Wild horses would continue to utilize an estimated 24,780 AUMs. The combined use by livestock and wild horses would be an estimated 103,140 AUMs. Because wild horse use would be concentrated in a smaller area under this alternative, the cumulative impacts to water resources on solid block land are expected to be greater than under Alternative A. However, some of these impacts would be offset by the removal of 8,100 permitted livestock AUMs in this area. Conversely, cumulative impacts on the checkerboard lands would be reduced under this alternative as a result of removing wild horses from this area, though impacts to water resources from livestock grazing would continue to occur.

As with Alternative A, developing offsite water for wild horses and livestock could reduce impacts to water resources. However, under this alternative, wild horse related water developments would only occur on solid block land, and not on checkerboard land. Water developments on checkerboard lands could continue to occur to support livestock grazing activities.

Alternative C

Under this alternative all of the HMAs within the planning area would revert to HAs, managed for zero wild horses. Throughout the planning area there would be 24,780 fewer AUMs removed, and the impacts to water resources associated with wild horse grazing activities would not occur. Cumulative impacts to

water resources therefore would be reduced under this alternative, relative to the other alternatives, as no wild horse related impacts would occur. Impacts to water resources from other activities (such as those described in Table 4-2) would continue to occur. Impacts to water resources from gather related activities would likely be initially greater under this alternative, but because these impacts would be temporary and limited in scope they would not add to the cumulative impacts to water resources within the CIAA.

Alternative D

Since only the Adobe Town HMA would remain under this alternative, there would be 12 grazing allotments that at least partially intersect the HMA under this alternative. These allotments permit an estimated 22,955 livestock AUMs within this area. Wild horses would utilize an estimated 6,432 AUMs (at high AML). The combined use by livestock and wild horses would be an estimated 29,387 AUMs. As described above, livestock and wild horses tend to congregate near water sources and can impact water quality and bank stability. Overall, cumulative impacts to water resources would be reduced under this alternative as the impacts associated with wild horse use would only occur on one of the HMAs. Impacts from wild horse use, in addition to impacts from livestock use and oil and gas development, would continue to occur within the Adobe Town HMA, and the cumulative impacts would be similar to those listed for Alternative A. Other activities would continue to impact water resources in areas where wild horses are removed; however, there would no longer be any additional wild horse related impacts in these areas.

Wild horse related range improvements would not be developed on any of the HMAs that revert to HA status under this alternative, but could be developed on the 355,093 acres within the Adobe Town HMA. As a result, cumulative impacts associated with the construction of range improvements would be less than Alternative A within the HMAs that revert to HA status, but likely similar to Alternative A within the Adobe Town HMA.

4.2.4 Vegetation

Alternative A

Direct impacts on vegetation from wild horse management includes browsing and trampling of vegetation, and compacting soil, which can alter the amount, condition, production, and vigor of vegetation in grazed areas. Riparian vegetation can be directly impacted through trampling and grazing, which reduces riparian species cover and diversity, and may result in localized areas of invasive, non-native plant dominance. Under this alternative wild horses would remove an estimated 24,780 AUMs of vegetation (at high AML).

Wild horse gathers can impact vegetation as well, through hoof action, vehicle traffic and concentration of wild horses at trap sites and holding facilities. Impacts to vegetation associated with wild horse gathers would likely be localized, predominantly occurring where temporary gather sites and other facilities are established. These impacts are expected to be limited and temporary.

Managing wild horses at AML and implementing monitoring and gather plans would serve to control wild horse population numbers and achieve a balance among forage resources, reducing impacts to existing plant communities. Managing for AML could help reduce or prevent vegetation loss, introduction, or spread of invasive, non-native plant species, soil compaction, erosion, sedimentation, and the influx of nutrients into riparian habitat. Water developments would benefit vegetative communities by reducing the congregation of wild horses around natural water sources, which could prevent over grazing or trampling of vegetation, supporting soil stability and overall habitat quality.

Alternative B

The types of impacts to vegetation from wild horse management under this alternative would be similar to those discussed in Alternative A. However, under this alternative the same number of wild horses would be concentrated within a smaller area, which could increase the impacts to vegetative resources in that area. However, some of the impacts to vegetation would be reduced by the removal of 8,100 permitted livestock AUMs within the HMAs. It is important to note that the adjustment of permitted livestock AUMs will not entirely offset potential impacts to vegetation as a result of increasing wild horse concentration in this alternative. This is a result of differing foraging behaviors between the animals, and due to the fact that wild horse use would be year-long, where most livestock grazing use is managed within an appropriate season that minimizes potential impacts to vegetation during critical growing periods.

Alternative C

The removal of all wild horses from the planning area would prevent the impacts to vegetation described in Alternative A. The 24,780 AUMs required to sustain wild horses under Alternative A would be available for other resource uses. Vegetative diversity and health could improve in areas where wild horses are removed. Perennial vegetation would experience reduced year-long grazing pressure, which would support plant health and vigor. Soil erosion and plant health could be improved around water locations with reduced year-long grazing by wild horses.

The process of removing all wild horses from the planning area would cause localized impacts to vegetation due to trampling, vehicle use and concentration of animals at trap sites and holding facilities. However, these impacts are expected to be limited and temporary.

Alternative D

The types of impacts on vegetation resources from managing wild horses within the Adobe Town HMA would be similar to those presented under Alternative A. Impacts in the portions of the planning area where , approximately 2,466,118 acres would no longer be allocated for wild horse use would be similar to Alternative C, as wild horses would be removed. This represents an 87% reduction in total acreage allocated for wild horse use. AUMs required to sustain wild horse populations (6,432) would be reduced by 18,348, compared to Alternative A, leaving that forage available for other resource uses. Overall, this would reduce the level and extent of impact on vegetation resources from the presence of wild horses.

By providing a means of adjusting AML for the Adobe Town HMA based on up-to-date information about resource conditions, this alternative will allow for more timely adjustments to AML in response to changes in resource conditions. This is expected to benefit vegetation resources by ensuring the AML is appropriate to current conditions on the HMA.

Cumulative Impact Analysis

The CIAA for vegetation is the planning area. Impacts associated with livestock grazing in this area would be similar to those described for wild horses. Other activities in this area have also impacted vegetation communities. See Table 4-2 for a list of these activities and the total acres of disturbance associated with them. Most of these activities directly impact vegetation by removing it, or altering plant communities. Some of these impacts (such as those associated with pipelines) are short term while others (such as those associated with mining activities) are long term. Some range improvements can impact vegetation in a similar fashion, namely by removing vegetation, or altering vegetation communities.

Alternative A

This alternative represents current management. A total of 28 grazing allotments at least partially intersect the HMAs under this alternative. These allotments permit an estimated 146,787 livestock AUMs within these HMAs. Wild horses would utilize an estimated 24,780 AUMs (at high AML). The combined use by livestock and wild horses would be an estimated 171,567 AUMs. As described above, livestock grazing can impact vegetation in a similar manner as wild horses.

Impacts form wild horse related range improvements would have a cumulative impact with those activities listed in Table 4-2. Water developments would concentrate both wild horses and livestock in the area around the development. This would lead to increased cumulative impacts to vegetation in these areas. However, this would also lead to better animal distribution across the range which would decrease the overall cumulative impacts to vegetation.

Alternative B

Only 26 grazing allotments would at least partially intersect the HMAs under this alternative. These allotments would permit an estimated 78,360 AUMs (after reducing permitted livestock AUMs by 8,100). Wild horses would continue to utilize an estimated 24,780 AUMs. The combined use by livestock and wild horses would be an estimated 103,140 AUMs. Because wild horse use would be concentrated in a smaller area under this alternative, the cumulative impacts to vegetation on solid block land are expected to be greater. However, some of these impacts would be offset by the removal of 8,100 permitted livestock AUMs in this area. Conversely, cumulative impacts on the checkerboard lands would be reduced under this alternative as a result of removing wild horses from this area, though impacts to vegetation from livestock grazing would continue to occur.

Wild horse related range improvements would not be developed on checkerboard lands under this alternative, but could be developed on the 1,537,997 acres of solid block lands. As a result, cumulative impacts associated with the construction of range improvements would be less than Alternative A within checkerboard lands, but likely similar to Alternative A within the solid block lands.

Alternative C

Under this alternative all of the HMAs within the planning area would revert to HAs, managed for zero wild horses. Throughout the planning area there would be 24,780 fewer AUMs removed, and the impacts to vegetation associated with wild horse grazing activities would not occur. Cumulative impacts to vegetation therefore would be reduced under this alternative relative to all other alternatives, as no wild horse related impacts would occur. Impacts to vegetation from other activities (such as those described in Table 4-2) would continue to occur. Impacts to vegetation from gather related activities would likely be initially greater under this alternative, but because these impacts would be temporary and limited in scope they would not add to the cumulative impacts to vegetation within the CIAA.

Alternative D

Only the Adobe Town HMA would remain under this alternative, and 12 grazing allotments would at least partially intersect the HMA. These allotments permit an estimated 22,955 livestock AUMs within this area. Wild horses would utilize an estimated 6,432 AUMs (at high AML). The combined use by livestock and wild horses would be an estimated 29,387 AUMs. As described above, livestock grazing can impact vegetation similar to wild horse use. Overall, cumulative impacts to vegetation would be reduced under this alternative as the impacts associated with wild horse use would only occur on one of the HMAs. Impacts associated with wild horse use, in addition to impacts from livestock use and oil and

gas development, would continue to occur within the Adobe Town HMA, and the cumulative impacts would be similar to those listed for Alternative A. Other activities would continue to impact vegetation in areas where wild horses are removed; however, there would no longer be any additional wild horse related impacts in these areas.

Wild horse related range improvements would not be developed on any of the HMAs that revert to HA status under this alternative, but could be developed on the 355,093 acres within the Adobe Town HMA. As a result, cumulative impacts associated with the construction of range improvements would be less than Alternative A within the HMAs that revert to HA status, but likely similar to Alternative A within the Adobe Town HMA.

4.2.5 Wildlife and Fisheries

Alternative A

Wild horses compete with wildlife for forage, water, and cover. As large herbivores, wild horses can consume large quantities of vegetation and water and can impact riparian habitat. The HMAs contain crucial winter range for big game species. Wild horses utilizing these areas in the winter could compete with wildlife for scarce resources such as forage and water. Managing wild horses at AML would reduce impacts to wildlife related to competition with wild horses. However, gathers can cause short-term stress and displacement of some species, resulting in the disruption of life-cycle behaviors. Winter gathers could impact big game and other wildlife by causing additional stress when food resources are scarce and weather conditions are poor. Properly timing gathers to reduce disruption of wildlife within the planned gather area can reduce those impacts on most species. If new fences were added to support wild horse management they could create travel barriers, alter distribution patterns, increase stress and energy loss, and could cause injury or death from entanglement or collisions with fence wires. Water developments could support wildlife by providing additional sources of water, however, they may also lead to increased competition at the water development sites.

Wild horses can impact riparian areas, adding additional sediment, widening stream channels and adding bacteria to the water. Approximately 906 miles of stream would be present within HMAs under this alternative. These can impact the quality of habitat for fish species that inhabit some of the streams within the planning area. These impacts can be reduced by managing wild horses at AML and providing upland water developments to limit wild horse use of riparian areas.

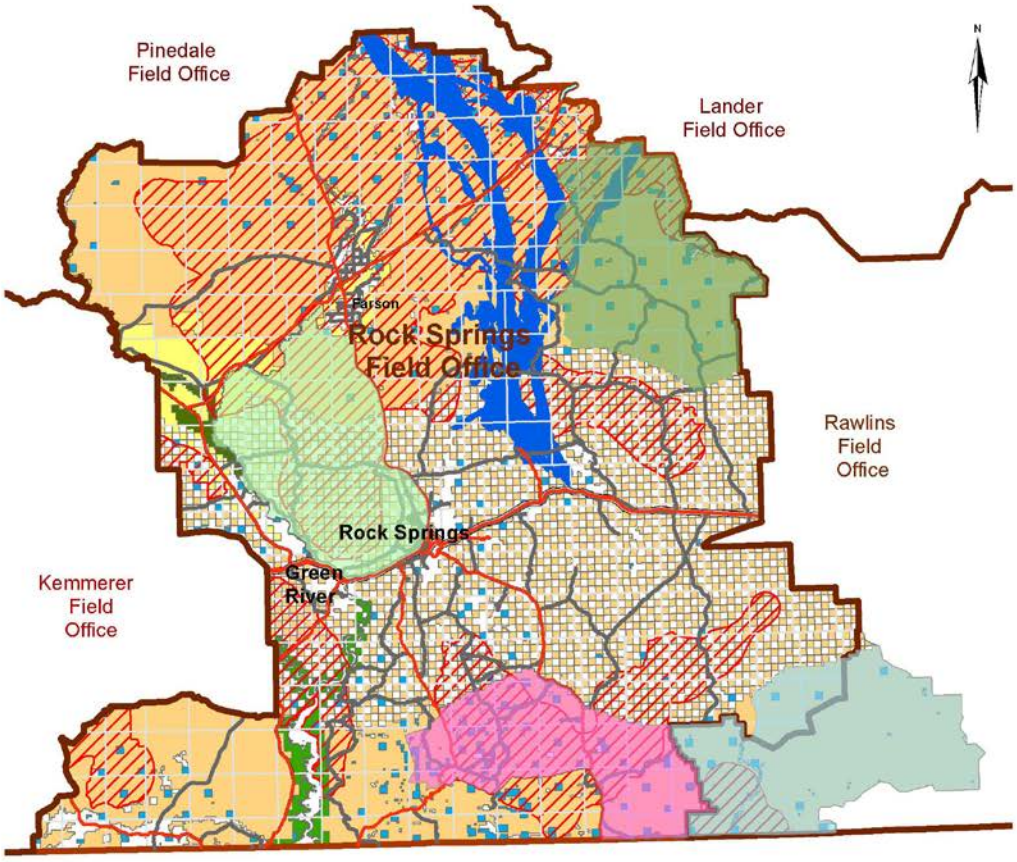
Alternative B

The types of impacts to wildlife from wild horse management under this alternative would be similar to those discussed in Alternative A. However, under this alternative the same number of wild horses would be concentrated in a smaller area within the planning area (see Map 4-1). Increased concentration and yearlong use by wild horses could lead to increased competition with wildlife especially during times when forage is limited (i.e. winter or drought). Depending on the level of competition, wildlife species could be forced to relocate to other habitats in search of adequate food or cover resources. Relocation, especially during critical life cycles, such as nesting, parturition, or in winter, could put undue stress on wildlife and lead to diminished health and/or increased mortality. However, some of the impacts to wildlife would be reduced by the removal of 8,100 permitted livestock AUMs within the HMAs.

The amounts of crucial habitat for big game that may be impacted by conflicts with wild horses would be reduced under this alternative. The amount of CWR in the White Mountain HMA would remain the same, however the Salt Wells HMA would contain 96,900 acres (21% reduction in overlap) of pronghorn CWR, 835 acres (91% reduction in overlap) of elk CWR, and 24,600 acres (38% reduction in overlap) of

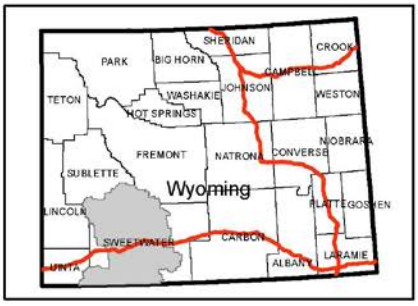
mule deer CWR. The reduction of size for the HMAs in this alternative would increase the amount of CWR that is outside of existing HMAs, and reduce wild horse impacts to CWR in those areas; however, having the same number of horses in a smaller area may impact crucial wildlife habitats within the remaining HMAs by increased disturbance to those habitats. Within the Great Divide Basin HMA under this alternative, only 19,600 acres (65% reduction in overlap) of the Sublette mule deer migration corridor would be within the HMA, which could reduce impacts to migrating wildlife from competition with horses (see Map 4-1). However, If new fences or other man-made barriers were needed to manage wild horses within these HMAs then these would impact wildlife as described in Alternative A. These impacts would be especially profound if the barriers bisect the Sublette mule deer migration corridor.

Impacts to fish species under this alternative would be similar to those described under Alternative A. However, impacts from wild horses would be more pronounced due to an increase in the concentration of wild horses in the areas they would occupy. Some of the potential impacts to fish species would be offset by the removal of 8,100 permitted livestock AUMs.



Map 4-1: Alternative B Herd Management Areas
Greater Sage-Grouse PHMA and
Migration Corridor
Draft Resource Management Plan
Amendement For Wild Horse Managment

10 5 0 10 Miles



Surface Management Agency

- Bureau of Land Management
- Bureau of Reclamation
- Fish & Wildlife Service
- Forest Service
- Private
- State
- Field Office Boundaries
- RSFO PHMA
- Sublette Mule Deer Migration Corridor

RSFO Herd Management Areas

- Adobe Town
- Divide Basin
- Salt Wells Creek
- White Mountain

Alternative C

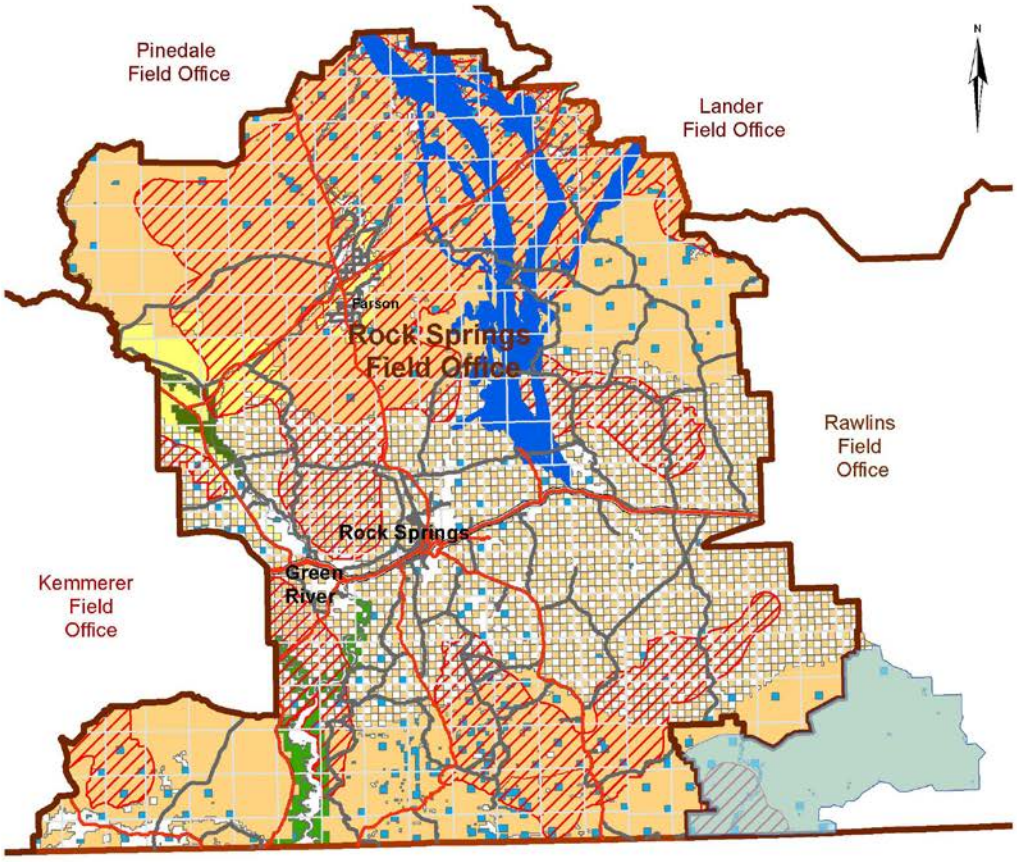
Under Alternative C, removing all wild horses from the planning area would eliminate competition between wildlife and wild horses for forage, rangeland, and water resources. This would improve habitat conditions and provide greater forage and cover for big game and other wildlife within the planning area. Removing wild horses would reduce impacts to wetland and riparian areas, which would decrease runoff, erosion, and cementation of substrates in stream channels. Reduced sediment runoff would provide preferential habitat conditions for aquatic species (such as fish) for feeding, cover, and reproduction. Less use of riparian areas and wetlands by wild horses would improve water quality, reduce the likelihood of stream bank erosion, stream channel alteration, and loss of wetland or riparian vegetation. Improvement of riparian habitat would improve habitat for many wildlife and fish species that rely on riparian areas for survival. Some impacts to wildlife would occur as a result of gather activities under this alternative, as described in Alternative A; however, these are expected to be localized and temporary.

Alternative D

The types of impacts on wildlife and fish species from managing wild horses for the Adobe Town HMA would be similar to those presented under Alternative A. These impacts would not occur in the portions of the planning area where approximately 2,466,118 acres would no longer be allocated for wild horse use (see Map 4-2). This represents an 87% reduction in total acreage allocated for wild horse use within the planning area. AUMs required to sustain wild horse populations (6,432) would be reduced by 18,348, compared to Alternative A, leaving that forage available for wildlife and other resource values. Under this alternative, only the Adobe Town HMA would continue to be managed as an HMA, and the HMA would overlap with fewer acres of crucial big game habitats, reducing potential conflicts between wild horses and wildlife in those areas. The HMA would contain 48,298 acres (65% reduction in overlap) of pronghorn CWR (Map 4-2). Overall, this would reduce the level and extent of impact on wildlife and fish species from the presence of wild horses.

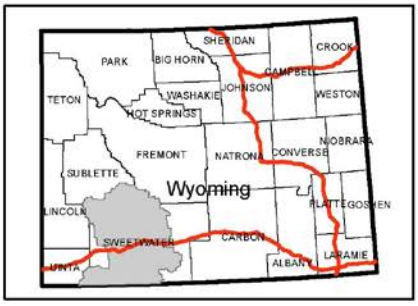
Reduced competition would improve habitat conditions, and provide greater forage and cover for big game and other wildlife within the HMAs. Removing or reducing the presence of wild horses would reduce damage to wetland and riparian areas, which would decrease runoff, erosion, and cementation of substrates in stream channels. Reduced sediment runoff would provide preferential habitat conditions for aquatic species for feeding, cover, and reproduction. Less use of riparian areas and wetlands by wild horses could improve water quality, reduce the likelihood of stream bank erosion, stream channel alteration, and loss of wetland or riparian vegetation. There would be approximately 60 miles of stream present within the remaining HMA under this alternative.

By providing a means of adjusting AML for the Adobe Town HMA based on up-to-date information about resource conditions, this alternative will allow for more timely adjustments to AML in response to changes in resource conditions. This is expected to benefit wildlife and fish species by ensuring the AML is appropriate to current conditions on the HMA.



Map 4-2: Alternative D Herd Management Areas
Greater Sage-Grouse PHMA and
Migration Corridor
Draft Resource Management Plan
Amendement For Wild Horse Managment

10 5 0 10 Miles



Surface Management Agency

- Bureau of Land Management
- Bureau of Reclamation
- Fish & Wildlife Service
- Forest Service
- Private
- State
- Field Office Boundaries
- RSFO PHMA
- Sublette Mule Deer Migration Corridor

Herd Management Areas

- Adobe Town

Cumulative Impact Analysis

The CIAA for wildlife and fisheries is the planning area, plus any part of a big game herd unit that extends outside of the planning area. The primary impact identified that could have potential cumulative effects is competition for resources (such as water and forage) between wild horses, livestock and wildlife.

Other disruptive activities that occur within the CIAA for wildlife and fisheries include fires, vegetation treatments, mining activities, oil and gas development, roads, structures and utility lines. Overall, these disturbances represent approximately 5% of the CIAA. These activities can degrade wildlife habitat and inhibit migration. This decrease in overall habitat can increase the potential for competition with wild horses and livestock for resources.

Alternative A

This alternative represents current management. Approximately 86% of the CIAA for wildlife is available for use by livestock, while 44% of the CIAA is available for use by wild horses. Livestock and wild horses tend to concentrate grazing in areas near water sources. These areas typically represent a small portion of the rangelands in terms of area, but play a disproportionate role in supporting livestock, wild horses and wildlife on the range. Therefore, while the total acreage available for wildlife, wild horses and livestock is rather large, most competition occurs in relatively small, but highly important areas.

Alternative B

Under this alternative wild horses would be removed from approximately 6% of the CIAA. This would reduce potential competition with wildlife in the checkerboard portion of the CIAA. Livestock would continue to use this area, and would compete with wildlife for resources; however, since wild horses would be removed from this area overall competition for resources is expected to be less than Alternative A.

Since AML would remain the same under this alternative, the same number of wild horses would be concentrated in a smaller area, representing approximately 5% of the CIAA. While some livestock AUMs would be reduced to ensure adequate forage for wild horses, there would still be livestock grazing in these areas. Therefore, the combination of wild horse and livestock use would result in competition with wildlife for forage, water, cover and space. Overall, the intensity of competition in these areas is expected to be similar to that described under alternative A.

Alternative C

Under this alternative all wild horses would be removed from the planning area. However, there would still be 6 HMAs that at least partially intersect the CIAA. Overall, wild horse HMAs would still cover 9% of the CIAA (down from 44% under Alternative A). Livestock would continue to utilize 86% of the CIAA, and competition between wildlife and livestock would continue to occur. This alternative would not result in any additional long term disturbance associated with wild horse use within the CIAA.

Alternative D

Under this alternative wild horses would be removed from all HMAs within the planning area, except for Adobe Town. Approximately 15% of the CIAA would still be designated for use by wild horses (down from 44% under Alternative A). Overall, competition with wildlife would be reduced under this alternative, similar to Alternative C with the exception of the Adobe Town HMA area. Competition

between wildlife, wild horses and livestock would be similar to Alternative A for the portions of the Adobe Town HMA that remain under this alternative. This alternative would not result in any additional long term disturbance associated with wild horse use within the CIAA.

4.2.6 Special Status Species

Alternative A

Wild horses can compete with some special status wildlife species for some resources, such as forage, water or space (similar to the impacts described in **Section 4.2.5**). Wild horses could impact some special status plant species through grazing activities or trampling.

Managing wild horses for AML could reduce potential impacts to special status wildlife by reducing potential impacts to forage, cover, and water resources. This would also help maintain habitat for special status fish and wildlife by reducing vegetation loss, reducing soil compaction, erosion and sedimentation, and could reduce the influx of nutrients into riparian areas, wetlands, or streambeds. Minimal impacts to sage-grouse and migratory bird species would be expected in this alternative. Management of wild horses for AML within the planning area would continue to minimize impacts to nesting, foraging and stopover habitats. Any wild horse removal activities would continue to be designed and conducted in a manner that would avoid or minimize impacts (direct and indirect) to sage-grouse and migratory bird habitats. Water developments could support special status wildlife by providing additional sources of water, and locating use by wild horses away from riparian areas. Locating water sources to reduce impacts from wild horses congregating around riparian areas would reduce impacts from habitat loss, soil compaction, erosion, and sedimentation. Applying protective management would prevent surface disturbance, soil loss, and damage or mortality of special status plants. Gathers could cause short-term stress and displacement of some species, resulting in the disruption of life-cycle behaviors. However, properly siting trap sites and planning the timing of gathers would reduce these impacts on most species. No impacts to Threatened or Endangered Species have been identified from current management practices, and none are expected if existing management actions continue. Although yellow-billed cuckoo are known to be present in portions of the planning area, they do not occur in the areas that have been impacted by current management, and adverse impacts would not be expected under this alternative. Currently no known populations of blow-out penstemon or Ute-ladies tress occur within the planning area, and implementation of this alternative would have no effect on these species.

Alternative B

The types of impacts to Special Status Species from wild horse management under this alternative would be similar to those discussed in Alternative A. However, under this alternative the same number of wild horses would be concentrated in a smaller area within the checkerboard HMAs. This could cause increased impacts to Special Status Species in areas where wild horses are more concentrated. However, some of the impacts to Special Status Species would be reduced by the removal of 8,100 permitted livestock AUMs within the HMAs.

Yearlong use by wild horses could lead to increased competition with sensitive wildlife species especially during times when forage is limited (i.e. winter or drought). Depending on the level of competition, sensitive wildlife species could be forced to relocate to other habitats in search of adequate food or cover resources. Relocation, especially during critical life cycles, such as nesting, parturition, or in winter, could put undue stress on these species and lead to diminished health and/or mortality. However, some of the impacts to sensitive plant and wildlife species would be reduced by the removal of 8,100 permitted livestock AUMs within the HMAs. Under this alternative, several of the HMAs would overlap with less

sage-grouse PHMA, which would reduce impacts from wild horses on sage-grouse. There would be no change to the amount of PHMA in the White Mountain HMA, the Salt Wells HMA would contain 190,052 acres of PHMA (45% reduction in overlap), the Great Divide Basin HMA would contain 101,634 acres (60% reduction in overlap), and the Adobe Town HMA would have no change in acreages of PHMA (Map 4-1). If new barriers, such as fences, were needed to manage wild horses within these HMAs, they would have to be located at least 0.6 miles from any active sage-grouse leks, to minimize the chances of sage-grouse colliding with the fence..

No impacts to Threatened or Endangered Species are expected from this alternative. Although yellow-billed cuckoo are known to be present in portions of the planning area, they do not occur in the areas that would be impacted by this alternative. Currently no known populations of blow-out penstemon or Ute-ladies tress exist within the planning area, and implementation of this alternative would not impact these species.

Alternative C

Under Alternative C, removing all wild horses from the planning area would reduce competition between Special Status Species and wild horses for forage, rangeland, and water resources. Reduced competition would improve habitat conditions and provide greater forage and cover for special status wildlife within the HMAs. Removing wild horses would reduce damage to wetland and riparian areas which would decrease runoff, erosion, and sedimentation of substrates in stream channels, which would provide preferential habitat conditions for aquatic species for feeding, cover, and reproduction. Minimal impacts to sage-grouse and migratory bird species would be expected in this alternative, primarily from the process of gathering wild horses. Reduction of wild horses within the planning area would reduce impacts to nesting, foraging and stopover habitats. Any wild horse removal activities would be designed and conducted in a manner that would avoid or minimize impacts (direct and indirect) to sage-grouse and migratory bird habitats. Reduced use of riparian areas and wetlands by wild horses would improve water quality, reduce the likelihood of stream bank erosion, stream channel alteration, and loss of wetland or riparian vegetation. Removing wild horses would benefit special status plant species populations by reducing grazing pressure and the potential for trampling by wild horses. No impacts to Threatened or Endangered Species are expected from this alternative. Although yellow-billed cuckoo are known to be present in portions of the planning area, they do not occur in the areas that would be impacted by this alternative. Currently no known populations of blow-out penstemon or Ute-ladies tress exist within the planning area, and implementation of this alternative would not impact these species.

Alternative D

The types of impacts on Special Status Species from managing wild horses for the Adobe Town HMA would be similar to those presented under Alternative A. These impacts would not occur within the portions of the planning area where approximately 2,466,118 acres would no longer be allocated for wild horse use. This represents an 87% reduction in total acreage allocated for wild horse use in the planning area. AUMs required to sustain wild horse populations under this alternative would be reduced by 18,348, compared to Alternative A, leaving that forage available for wildlife and other resource values. Minimal impacts to sage-grouse and migratory bird species would be expected in this alternative. Reduction of wild horses within the planning area would reduce impacts to nesting, foraging and stopover habitats. Any wild horse removal activities would be designed and conducted in a manner that would avoid or minimize impacts (direct and indirect) to sage-grouse and migratory bird habitats. Under this alternative, only the Adobe Town HMA would continue to be managed as an HMA and it would contain 57,700 acres of PHMA (2% reduction in overlap) (Map 4-2). This alternative would also reduce

potential impacts to sensitive plant species from wild horse activities. No impacts to Threatened or Endangered Species are expected from this alternative. Although yellow-billed cuckoo are known to be present in portions of the planning area, they do not occur in the areas that would be impacted by this alternative. Currently no known populations of blow-out penstemon or Ute-ladies tress occur within the planning area, and implementation of this alternative would have no effect on these species. Overall, this alternative would reduce the level and extent of impact on Special Status Species from the presence of wild horses.

Reduced competition would improve habitat conditions, and provide greater forage and cover for special status wildlife within the HMAs. Removing or reducing the presence of wild horses would reduce damage to wetland and riparian areas, which would decrease runoff, erosion, and cementation of substrates in stream channels. Reduced sediment runoff would provide preferential habitat conditions for aquatic species for feeding, cover, and reproduction. Less use of riparian areas and wetlands by wild horses could improve water quality, reduce the likelihood of stream bank erosion, stream channel alteration, and loss of wetland or riparian vegetation.

By providing a means of adjusting AML for the Adobe Town HMA based on up-to-date information about resource conditions, this alternative will allow for more timely adjustments to AML in response to changes in resource conditions. This is expected to benefit Special Status Species by ensuring the AML is appropriate to current conditions on the HMA.

Cumulative Impact Analysis

The CIAA for special status species is the planning area. The primary impacts identified that could have potential cumulative effects is competition for resources (for sensitive wildlife species) and potential grazing related impacts (for sensitive plant species). Livestock can impact sensitive species in a similar manner as wild horses. There are no anticipated cumulative impacts associate with wild horse gather activities because these impacts are limited in scope and duration. Other activities that occur within the CIAA (such as oil and gas developments, mining, roads, etc…) can also impact special status species (see Table 4-2). These activities can reduce the amount of available habitat, and impact migration activities. This can magnify the impacts of competition for resources between sensitive species, livestock and wild horses. Total existing disturbance is estimated at ~5% within the CIAA.

Alternative A

This alternative represents current management. The entire CIAA for sensitive species is available for livestock use. The entire CIAA is also available for wild horse use. Wild horses and livestock can compete with sensitive wildlife species for forage and water. Grazing activities from wild horses and livestock can also negatively impact sensitive plant species, as described earlier in this section.

Alternative B

Under this alternative wild horses would be removed from approximately 45% of the CIAA. This would reduce potential competition with special status wildlife species in the checkerboard portion of the CIAA. Livestock would continue to use this area, and would compete with sensitive wildlife species for resources; however, since wild horses would be removed from this area overall competition for resources is expected to be less than Alternative A.

Since AML would remain the same under this alternative, the same number of wild horses would be concentrated in a smaller area, representing approximately 41% of the CIAA. While some livestock AUMs would be reduced to ensure adequate forage for wild horses, there would still be livestock grazing

in these areas. Therefore, the combination of wild horse and livestock use would result in competition with special status wildlife species for forage, water, cover and space. Overall, the intensity of competition in these areas is expected to be similar to that described under Alternative A.

Some special status plant species occur within the area where more wild horses would be concentrated. However, due to the reduction in permitted livestock AUMs overall cumulative impacts to these species form the combination of wild horse and livestock grazing is expected to be similar to Alternative A. This alternative would not result in any additional long term disturbance associated with wild horse use within the CIAA.

Alternative C

Under this alternative all wild horses would be removed from the planning area. As a result there would be no impacts as a result of wild horse activities under this alternative. Livestock would continue to graze throughout the CIAA under this alternative, and potential impacts associated with livestock grazing would continue to occur. This alternative would not result in any additional long term disturbance associated with wild horse use within the CIAA.

Alternative D

Under this alternative wild horses would be permanently removed from approximately 88% of the CIAA. In areas where wild horses are permanently removed there would be less competition with sensitive wildlife species, and potential impacts to sensitive plant species would be reduced. Livestock would continue to graze these areas, and would compete with sensitive wildlife species for resources, and could impact sensitive plant species through grazing. Potential cumulative impacts to these species within the Adobe Town HMA would be the same as those described under Alternative A. This alternative would not result in any additional long term disturbance associated with wild horse use within the CIAA.

4.2.7 Wildland Fire

Alternative A

Grazing by wild horses reduces fine fuels that are easily ignited. Under this alternative approximately 24,780 AUMs of vegetation would be removed each year by wild horses within the HMAs. Decreasing fuel loads could reduce the occurrence of wildfires, thereby reducing the need for other fuel treatments and/or suppression activities and resources in some portions of the planning area. Wild horses may also impact areas where fires have recently occurred by grazing these areas. This can reduce the likelihood of successful reclamation of the burned area.

Alternative B

The types of impacts to wildland fire ecology and management from wild horse activities under this alternative would be similar to those discussed in Alternative A. However, under this alternative the same number of wild horses would be concentrated in a smaller area within the four HMAs. Concentrated wild horse use in these areas may remove additional forage and decrease the likelihood of a fire ignition. This reduced potential for wildfire may be somewhat offset by the removal of 8,100 permitted livestock AUMs within these HMAs. Because the checkerboard portions would no longer be included within the Great Divide Basin, Salt Wells Creek and Adobe Town HMAs, overall there would be 1,276,852 fewer acres within HMAs under this alternative. Areas excluded from wild horse grazing may be more susceptible to the ignition of wildfires, due to the presence of more fine fuels.

Alternative C

Removing wild horses from all HMAs and managing for zero wild horses could result in increased fuel loads that would potentially increase occurrences of wildfires. Under this alternative an estimated 24,780 AUMs that would have been consumed by wild horses would instead remain on the range, providing a potential ignition source for wildfires. This would increase the need for other fire fuel treatments and/or suppression activities and resources. However, the removal of wild horses would also improve the success of long-term fire rehabilitation treatments by reducing grazing and trampling in those areas.

Alternative D

Under this alternative the number of wild horses present within the planning area would be reduced by 74%, while there would be an 88% reduction in the area where wild horses would be managed. As a result some areas would have increased fuel loads that would be potentially increase occurrences of wildfires.. However, these areas would experience better success of fuels treatments and post fire rehabilitation, similar to Alternative C. The Adobe Town HMA would still have wild horse activities and the impacts to fire ecology and management would be similar to those described in Alternative A.

Cumulative Impact Analysis

The CIAA for Wildland Fire is the planning area. The primary impacts identified that could have potential cumulative effects is removal of possible ignition sources and impacts to vegetation communities within areas affected by wildland fires or vegetation treatments. Livestock have a similar impact as wild horses on these areas.

Alternative A

The entire CIAA for this resource is utilized by both wild horses and livestock. Grazing activities from both can reduce fine fuels, which can limit fire ignition and spread. However, grazing activities can also reduce the chance for successful regrowth of desirable plant communities in areas affected by wildland fires or vegetation treatments.

Alternative B

Under this alternative wild horses would be concentrated on the solid block portion of the HMAs. Livestock would also graze in this area, though at lower intensities as a result of removing some of the permitted livestock AUMs. Overall, removal of vegetation on solid block land is estimated to have a similar impact on fire potential and recovery as Alternative A. Livestock would continue to graze on the checkerboard land as well, but the reduced amount of overall grazing from removal of wild horses from these areas could lead to higher fine fuel loading, increasing the potential for fire ignition, while improving the likelihood that vegetation communities would successfully regenerate following a fire or vegetation treatment.

Alternative C

Under this alternative all wild horses would be removed from the planning area. Livestock would continue to graze within the area; however, grazing intensity would be lower overall. This would lead to higher fine fuel loads, which could increase the potential for fire ignition. Lower grazing intensity would also promote better recovery of vegetation communities following a fire or vegetation treatment.

Alternative D

Under this alternative wild horses would be permanently removed from approximately 2,466,118 acres and all of the HMAs except Adobe Town would revert to HA status. In areas where wild horses are permanently removed, potential cumulative impacts to fire potential and recovery would be the same as Alternative C. Within the Adobe Town HMA potential cumulative impacts would be the same as described for Alternative A.

4.2.8 Cultural Resources

Alternative A

Grazing and trampling of vegetation by wild horses disturbs the soil, which can accelerate erosion and weathering, and as cultural resources are directly impacted by the modification, displacement, and loss of artifacts in the soil, erosion and weathering can expose cultural resources. This can result in the loss of valuable cultural resource information such as site function, date of use, subsistence, and other research questions. Effects of trampling and grazing can be intensified when animals are concentrated near water sources where cultural resources are likely to be present. In addition, gathers may exacerbate impacts to cultural resources at gather sites as a result of increased vehicle and hoof action. However, these impacts would be reduced by locating trap sites and holding areas in places that have been inventoried for cultural resources and cleared for use.

However, the discovery of previously unknown cultural resources could occur in areas where water developments were to occur through surface disturbing activities. Allowing opportunities for the public to view wild horses and providing interpretive and educational sites could enhance cultural or heritage sites by including the historic context of the introduction of European and Asian horse breeds to the West.

Alternative B

Impacts to cultural resources from the management of wild horses would be similar to those described under Alternative A. However, under this alternative the same number of wild horses would be concentrated in a smaller area. This could lead to slightly higher impacts than those described in alternative A. Some of these impacts may be reduced by the removal of 8,100 permitted livestock AUMs from these areas. If fences or other manmade barriers are required along the border between the HMAs and checkerboard land, construction of these barriers could impact cultural resources and National Historic Trails.

Alternative C

The removal of wild horses from the planning area would eliminate potential impacts to cultural resources associated with wild horse activities. Some potential impacts may occur related to gather operations; however, these impacts could be reduced by locating trap sites and holding areas in places that have been inventoried for cultural resources and cleared for use. Overall, gather related impacts would be limited and temporary under this alternative.

Alternative D

The types of impacts for cultural resources from managing wild horses within the Adobe Town HMA would be similar to those presented under Alternative A. Impacts in the portions of the planning area where approximately 2,466,118 acres would no longer be allocated for wild horse use would be similar to Alternative C, as wild horses would be removed.

Cumulative Impact Analysis

The CIAA for Cultural Resources is the planning area. The primary wild horse impact that could add to the effects of other activities is the potential exposure of cultural resources in areas with concentrated grazing activities. Livestock can have a similar impact to cultural resources, though often to a lesser degree as livestock use is seasonal and often actively managed, compared to wild horses use which is year-round with no active management. Surface disturbing activities can also have a potential impact on cultural resources, though this is typically mitigated by conducting an inventory of the area prior to installation. A summary of disturbances within the planning area can be found in Table 4-2. Range improvements could potentially impact cultural resources in a similar way as other surface disturbing activities. However, like these other activities, a cultural inventory would be conducted for any new improvements to ensure the protection of important cultural resources.

Alternative A

Under this alternative the combination of livestock grazing and wild horse activities has the potential to impact soils and thereby expose cultural resources to a greater degree than either use alone. Other activities, such as road construction, oil and gas development and mining activities also have the potential to impact cultural resources within the CIAA. Standard stipulations related to the discovery of cultural properties help minimize the potential impacts these activities can have on cultural resources.

Alternative B

Under this alternative grazing pressure would be reduced on checkerboard lands as a result of removing wild horses from these areas. This would reduce impacts to soils, and thereby reduce potential to expose and impact cultural resources. On solid block lands, wild horses would be present in higher concentrations, but permitted livestock use would be reduced. This alternative would not result in any additional long term disturbance associated with wild horse use within the CIAA. Overall, potential impacts to cultural resources are expected to be the same as under Alternative A in this area.

Alternative C

Under this alternative all wild horses would be permanently removed from the planning area. However, livestock would continue to graze throughout the CIAA. Overall, there would still be a potential impact to cultural resources as a result of livestock grazing, but overall grazing pressure would be reduced after removing all wild horses from the area. This would reduce the overall potential impact to soils and thereby reduce the overall possibility of exposing and impacting cultural resources. This alternative would not result in any additional long term disturbance associated with wild horse use within the CIAA.

Alternative D

Under this alternative wild horses would be permanently removed from approximately 2,466,118 acres and all of the HMAs except Adobe Town would revert to HA status. Livestock would continue to graze throughout the CIAA. Overall, in areas where wild horses are removed, potential cumulative impacts to cultural resources would be reduced as a result of lower grazing pressure, similar to that described under Alternative C. Within the portion of the Adobe Town HMA that remains under this alternative, continued grazing by wild horses and livestock would likely have the same cumulative impact as described under Alternative A. This alternative would not result in any additional long term disturbance associated with wild horse use within the CIAA.

4.2.9 Paleontological Resources

Alternative A

Wild horses can expose and damage paleontological resources in a manner similar to the discussion for Cultural Resources (**Section 4.2.8**). Proper management of wild horses could indirectly provide some protections to soil health and stability, which would reduce potential damage to known and unknown paleontological resources. The discovery of previously unknown paleontological resources could occur in areas where water is developed. Managing wild horse populations within AML could protect known and unknown paleontological resources by reducing the potential for direct damage or destruction by amplified erosion or direct contact of resources by horses.

Alternative B

Impacts to paleontological resources from the management of wild horses would similar to those described under Alternative A. However, under this alternative the same number of wild horses would be concentrated in a smaller area. This could lead to slightly higher impacts than those described in alternative A. Some of these impacts may be reduced by the removal of 8,100 permitted livestock AUMs from these areas. If fences or other manmade barriers are required along the border between the HMAs and checkerboard land, construction of these barriers could impact paleontological resources.

Alternative C

The removal of wild horses from the planning area would eliminate potential impacts to paleontological resources associated with wild horse activity. Some potential impacts may occur related to gather operations; however, these impacts could be reduced by locating trap sites and holding areas in places that have been inventoried for paleontological resources and cleared for use. Overall, gather related impacts would be limited and temporary under this alternative.

Alternative D

The types of impacts for paleontological resources from managing wild horses within the Adobe Town HMA would be similar to those presented under Alternative A. Impacts in the portions of the planning area where approximately 2,466,118 acres would no longer be allocated for wild horse use would be similar to Alternative C, as wild horses would be removed.

Cumulative Impact Analysis

The CIAA for paleontological resources is the planning area. Because potential impacts to paleontological resources is the same as those described for cultural resources, cumulative impacts under the four alternatives are identical to those described for cultural resources. See **Section 4.2.8** for a detailed analysis.

4.2.10 Livestock Grazing Management

Alternative A

Under this alternative approximately 24,780 AUMs would continue to be consumed by wild horses, and would not be available for livestock use. Wild horses and livestock can compete directly for resources, such as forage, water and space. Where wild horses utilize vegetation year round, and livestock graze within a specified season of use, wild horses can potentially utilize forage before livestock can be turned out on the range. However, historically the BLM has allocated use to each resource to ensure that competition is limited, and a TNEB can be reached. By managing wild horses within AML and

specifying the amount of use that can occur on a grazing permit the BLM balances use by wild horses and livestock, and limits opportunities for competition. Water developments can benefit both livestock and wild horses, but lead to some competition near these sites, and can cause high levels of grazing use in these areas. Water developments help distribute animals and open more area to potential grazing use. Fences constructed to control movement of wild horses could also benefit livestock operations by allowing them more control over their livestock on the range.

Alternative B

This alternative would have a greater impact on livestock grazing than Alternative A. Under this alternative, the same number of wild horses would be concentrated in a smaller area due to the removal of checkerboard lands from the Adobe Town, Great Divide Basin and Salt Wells Creek HMAs. A proportional reduction of wild horses would require the removal of 675 wild horses under this alternative. However, since these wild horses would not be removed, it is expected that the wild horses would require an additional 8,100 AUMs in the areas they would continue to occupy under this alternative. To provide this forage to wild horses, a total of 8,100 permitted livestock AUMs would be reallocated for wild horse use as follows:

- Adobe Town (RSFO): Reduce 1,176 AUMs (15% of the permitted livestock AUMs within the HMA)
- Adobe Town (RFO): Reduce 48 AUMs (less than 1% of the permitted livestock AUMs within the HMA)
- Great Divide Basin: Reduce 3,612 AUMs (10% of the permitted livestock AUMs within the HMA)
- Salt Wells Creek: Reduce 3,264 AUMs (5% of the permitted livestock AUMs within the HMA)

While this would help limit competition between livestock and wild horses, it would be detrimental to livestock operators who graze within these HMAs.

Alternative C

Under this alternative 24,780 AUMs that had previously been consumed by wild horses would remain on the range. While the permitted number of AUMs allocated to livestock would not change, there would be benefits to livestock grazing under this alternative. The 24,780 AUMs no longer utilized by wild horses could be reallocated to livestock use (or to wildlife or ecosystem functions) depending on the results of an in-depth review of intensive monitoring data. Forage would be more abundant and potential competition with wild horses, especially near water sources, would be eliminated. The reduction in the overall number of animals foraging on the range would likely lead to improvements in rangeland health. More abundant forage and reduced competition would likely be demonstrated in the better body condition and health of livestock in these areas.

Alternative D

Under this alternative 1,529 wild horses would be permanently removed from the planning area. This represents a 74% reduction in the total wild horse population within the four HMAs. The total area allocated for wild horse use would be reduced by 87%. Under this alternative the number of AUMs needed to sustain wild horses within the planning area would be reduced by an estimated 18,348 AUMs. The BLM would still allocate 6,432 AUMs to wild horse use in the remaining HMA. The 18,348 AUMs no longer utilized by wild horses could be reallocated to livestock use (or to wildlife or ecosystem functions) depending on the results of an in-depth review of intensive monitoring data.

In areas where wild horses are removed the benefits to livestock operations described in Alternative C would occur. Rangeland health would be expected to improve in these areas due to the reduced number of animals utilizing the range. In areas where wild horses remain, managing wild horses within AML would limit competition and allow livestock and wild horses to be managed together while promoting a TNEB.

By providing a means of adjusting AML for the Adobe Town HMA based on up-to-date information about resource conditions, this alternative will allow for more timely adjustments to AML in response to changes in resource conditions. This is expected to benefit livestock grazing by ensuring the AML is appropriate to current conditions on the HMA and wild horse use is balanced with livestock use in these areas.

Cumulative Impact Analysis

The CIAA for livestock grazing is the planning area. The primary impact identified that could have potential cumulative effects is competition for resources (primarily water and forage). Livestock, wild horses and wildlife all compete for these resources. All of these species have the potential to utilize the entire CIAA. However, most competition occurs in areas near water, which represent a small percent of the landscape, but plays a disproportionally important role in providing habitat for wildlife, livestock and wild horses. Other activities that occur within the CIAA can also reduce the amount of available forage (see Table 4-2). This can magnify the impacts of competition for resources between wildlife, livestock and wild horses.

None of the alternatives would alter the number of wildlife present within the planning area. A detailed discussion of impacts to livestock grazing as a result of changes in wild horse management is already described earlier in this section. Therefore, no additional cumulative impact analysis is needed for this resource.

4.2.11 Recreation

Alternative A

Management for wild horses would offer unique recreation experiences for visitors to the HMAs, allow for sightseeing by vehicle, and provide opportunities for wild horse and wildlife viewing. Management actions involving placing interpretive signage and providing interpretive sites would enhance recreational experiences related to wild horse viewing, increase public awareness and stewardship, and educate visitors about wild horse herds. Wild horses can impact some dispersed recreational activities by displacing other wildlife, thereby impacting those who attempt to photograph or hunt wildlife. Wild horses can also impact fisheries habitat (see **Section 4.2.7**) which can impact fishing opportunities. However, these impacts would be limited by maintaining wild horses within AML and managing for a TNEB.

Alternative B

Impacts to recreation from the management of wild horses would be the similar to those described under Alternative A. However, under this alternative recreationists would have an increased likelihood of finding wild horses on the range due to concentrating the same number of wild horses in a smaller area. However, it is likely that many recreationists would have to travel farther to locate a wild horse herd, as a result of removing all checkerboard lands from the Adobe Town, Great Divide Basin and Salt Wells Creek HMAs. Impacts to those seeking to photograph or hunt wildlife, or to fish would likely be greater

under this alternative than Alternative A, though these impacts would be offset somewhat by the removal of some permitted livestock use.

Alternative C

Removing all wild horses from the planning area would remove recreation opportunities associated with sightseeing and viewing wild horses. The removal of wild horses from the planning area would be particularly impactful within the White Mountain HMA, as members of the public would no longer be able to view wild horses along the Pilot Butte Wild Horse Scenic Loop, which would impact visitor experience. This loop would still provide visitors with a scenic view including the high desert landscape, pilot butte and other wildlife, but opportunities to view wild horses in close proximity to Rock Springs and Green River would be eliminated. Recreationists could still view wild horses within the Little Colorado, Lost Creek and Antelope Hills HMAs which are in close proximity to the planning area, but they would have to drive further from larger population areas to do so. Conditions for those seeking to hunt or photograph wildlife, and those seeking fishing opportunities, would likely be improved under this alternative.

Alternative D

Under this alternative 1,529 wild horses would be removed from the planning area. Recreationists would have reduced opportunities to view wild horses. In particular, wild horses would no longer be present on lands that currently make up three of the HMAs (Great Divide Basin, Salt Wells Creek, and White Mountain), the RSFO portion of the Adobe Town HMA, or the lands removed from the RFO portion of the Adobe Town HMA (see Map 2-3). The loss of wild horses from the checkerboard lands, and in particular the White Mountain HMA, would be particularly impactful as these areas are closer to larger population centers. Of particular note would be the lost opportunity to view wild horses along the Pilot Butte Wild Horse Scenic Loop, as described in Alternative C; however, the scenic loop would be retained with opportunities to view wildlife and scenic views. Opportunities for a new wild horse viewing area in the remaining HMA could also be considered. Recreationists also could still view wild horses within the Little Colorado, Lost Creek and Antelope Hills HMAs, but they would have to drive further from larger population areas to do so. The removal of wild horses from some of the planning area would potentially improve conditions for those seeking to photograph or hunt wildlife and those seeking fishing opportunities.

Cumulative Impact Analysis

The CIAA for recreation is the state of Wyoming. The primary impact identified with a potential cumulative impact is the lost experience to view wild horses. Within the CIAA there are a total of 16 HMAs, 4 of which are located within the planning area (see Table 4-1). Other dispersed recreational opportunities such as hunting, wildlife viewing and camping can be negatively impacted by the presence of wild horses. Therefore, any alternative that removes wild horses from some of these areas would likely improve conditions for other recreational opportunities.

Alternative A

This alternative represents current management. Wild horses would remain within all 16 of the HMAs within the CIAA, and the public would have opportunities to view wild horses in all of these locations.

Alternative B

Under this alternative, wild horses would no longer occupy checkerboard land. As described above, this would make it more difficult to view wild horses in some areas, requiring more travel time to reach many of the HMAs. Wild horse viewing experiences would be unchanged in the other 13 HMAs within the CIAA under this alternative. If recreationists decided to view wild horses in these areas, though, it may require more travel time to do so. Other dispersed recreational activities would be improved, compared to Alternative A, in areas where wild horses are removed, and would likely be reduced in areas where wild horses are concentrated.

Alternative C

Under this alternative all wild horses would be removed from the planning area. Wild horses could still be viewed at the 12 other HMAs in the CIAA, but this would likely require more travel than is needed to view the wild horses in the planning area, particularly given the relatively easy access afforded by I-80, which roughly bisects the planning area. This increased travel time might deter visitors from visiting a wild horse HMA. Other recreational activities would likely be improved under this alternative as a result of removing wild horses from the planning area.

Alternative D

Under this alternative all wild horses would be removed from the planning area, with the exception of the remaining portion of the Adobe Town HMA. Wild horses could still be viewed at the 13 remaining HMAs within the CIAA; however, the travel related challenges discussed under Alternative C would apply to this alternative as well. Although the Adobe Town HMA is closer to I-80, it is a long drive from any nearby cities to reach the HMA. Other HMAs within the CIAA may be closer to population centers, but are a further drive from I-80, leading to a likely increase in travel time. This increased travel time might deter visitors from visiting a wild horse HMA. Overall, other recreational activities would likely be improved under this alternative, compared to Alternative A.

4.2.12 Socioeconomics

Alternative A

Management of wild horses under this alternative would continue to allow the free movement of wild horses within the four checkerboard HMAs, and maintain wild horse populations within these HMAs at an AML of 1,481 to 2,065. Though wild horse populations would continue to support the direct and indirect social and economic values associated with the existence and viewing of these herds, the removal of wild horses in excess of AML would adversely affect the values held by those who believe the gathering and removal of wild horses is inhumane. Since population growth suppression would only be utilized when necessary under this alternative, herds within the planning area would be more likely to exceed AML over time, resulting in more frequent gathers relative to the other alternatives. This would adversely affect social values held by many wild horse enthusiasts who strongly believe wild horses should remain free-roaming and not tamed or cared for in long-term holding. Managing wild horse populations in balance with the available habitat and other multiple uses would, however, lessen the deterioration of range conditions, which can adversely affect social and economic values associated with forage resources, rangeland habitats, and other recreational opportunities. At times, these other resource values may be adversely affected when herds are determined to exceed AMLs and gather plans must be developed and implemented.

Alternative B

Since the same number of wild horses would be kept on the range under Alternative B, this alternative would continue to support the direct and indirect social and economic values individuals derive from the existence and viewing of wild horses, as described under Alternative A. Under this alternative, however, all four checkerboard HMAs would be actively managed as non-reproducing herds. Methods to achieve and maintain AML would include a variety of population growth suppression tools and removal of wild horses in excess of AML. These management actions would adversely affect the values held by some who believe any type of active management is inhumane. Relative to Alternative A, managing these HMAs as non-reproducing herds could more effectively maintain populations at AML and lessen the competition for, and deterioration of, range habitat. In doing so, this alternative would better support the economic and social values associated with other resources (such as livestock grazing), relative to Alternative A. However, the removal of 8,100 permitted livestock grazing AUMs would be detrimental to the affected livestock operators, and could have an impact on that portion of the local economy.

Alternative C

Under Alternative C, the four checkerboard HMAs would be changed to HAs and BLM would no longer manage lands within the planning area for wild horses. Implementation of this alternative would result in the permanent removal of approximately 2,065 wild horses. Compared to the other alternatives, this alternative would be most detrimental to the direct and indirect social and economic values associated with wild horses. Since wild horses would no longer exist in the planning area, recreational opportunities to view wild horses in the area would be eliminated. This could reduce some tourism to the area and result in a small negative economic impact on that portion of the regional economy as some visitors choose to spend their money in other areas that still support wild horse viewing opportunities. Compared to the other alternatives, this alternative would best support the economic and social values associated with other resources since competition for range habitat, and risk of deterioration from the exceedance of AML, would be eliminated.

Alternative D

Implementation of Alternative D would result in fewer HMAs and a reduction in AML (259 to 536 wild horses) across the checkerboard HMAs, relative to Alternatives A and B. A total of 1,529 fewer wild horses would be present within the planning area (at high AML). Although wild horses that remain on the range would continue to support the direct and indirect social and economic values derived by individuals from the existence and viewing of wild horses, this alternative would provide less support for these values than Alternatives A and B because a greater number of wild horses would be removed to achieve AML, and opportunities to view wild horses would be more limited because three of these HMAs would be managed as HAs with zero wild horses. Methods to achieve and maintain fewer wild horses on the range would include the gathering and removal of wild horses in excess of AML, and the use of population growth suppression to help manage AML on the remaining HMAs. These management actions would adversely affect the values held by some individuals who believe any type of active management is inhumane. While the adverse impact on these values would be less than under Alternative C, they would be greater than Alternatives A and B since a greater number of wild horses would be removed from the area. Management of wild horses under this scenario would reduce competition for, and deterioration of, range habitat relative to Alternatives A and B. As a result, this alternative would support the economic and social values associated with other resources better than Alternatives A and B, but less than Alternative C.

Cumulative Impact Analysis

The CIAA for Socioeconomic resources is the state of Wyoming. The primary impact related to wild horses with the potential for cumulative effects is the permanent removal of wild horses from multiple HMAs.

Alternative A

Within the CIAA there are a total of 16 HMAs, 4 of which are located within the planning area (see Table 4-1). However, the HMAs within the planning area represent a large portion of HMAs within the CIAA when considering total wild horse population and acres. HMAs within the planning area currently make up 59% of all HMAs within the CIAA by acres, and 55% by population (at high AML). Therefore, the impacts described earlier in this section would have a disproportionate impact on the socioeconomic values associated with the presence of wild horses.

Alternative B

Under this alternative there would be a 27% decrease in the acres available for wild horses within the CIAA. AML would remain the same under this alternative so there would be no changes in the total number of wild horses present within the CIAA. Overall, the HMAs within the planning area would constitute 44% of all Wyoming HMAs by acres, and 55% of all Wyoming HMAs by high AML. The difference in cumulative effects under this alternative would be primarily related to the relocation of wild horses, as this alternative would continue to support many of the other wild horse related values throughout the CIAA.

This alternative would also have a socioeconomic impact on livestock operators who lose some of their permitted AUMs to make room for wild horses. The livestock industry is an important part of Wyoming's economy, and social identity. The loss of 8,100 AUMs would represent less than 1% of Wyoming's agricultural industry; however, this type of change in permitted use is uncommon in Wyoming, and may be perceived as a larger impact to the social values many in the state hold.

Alternative C

Under this alternative all of the HMAs within the planning area would revert to HAs, managed for zero wild horses. This represents a 59% decrease in the acres available for wild horses within the CIAA and a 45% decrease in the total number of wild horses (at high AML) within the CIAA. The impacts described earlier in this section would have a disproportionate cumulative impact within the CIAA relative to the number of HMAs involved. This alternative would have the greatest negative effect to those who value the presence of wild horses within the CIAA, while it would have the greatest positive effect to those who primarily value other resources that potentially conflict with wild horse use (such as livestock operations).

Alternative D

Under this alternative wild horses would be permanently removed from approximately 2,466,118 acres and all of the HMAs except Adobe Town would revert to HA status. This represents a 52% decrease in the acres available for wild horses within the CIAA and a 41% decrease in the number of wild horses (at high AML) within the CIAA. This alternative would likely have a similar cumulative impact to Alternative C, except for the Adobe Town area. It is likely that those who value wild horses on the range, would see an impact to their values throughout the CIAA, due to the disproportionate impact associated with the areas where wild horses would no longer be present. Conversely, those whose interests conflict

with the presence of wild horses would likely see a benefit to their values throughout the CIAA as a result of this alternative.

4.3 Irreversible and Irretrievable Commitments of Resources

The NEPA requires a discussion of any irreversible or irretrievable commitments of resources associated with implementation of a proposal. An irreversible commitment of a resource is one that cannot be reversed (e.g., the disturbance to a protected cultural resource). An irretrievable commitment of a resource is one in which the resource or use is lost for a period of time (e.g. extraction of a fluid mineral). An irreversible and irretrievable commitment of resources is possible under both Alternatives C and D. Under these alternatives the BLM would permanently remove all wild horses from multiple HMAs within the planning area. These herds would cease to exist on the range, and their genetic contributions to the wild horse populations in this area would be lost. The public would not have the opportunity to view wild horses within any HMA that reverts to HA status and is managed for zero wild horses.

4.4 Unavoidable Adverse Impacts

The NEPA requires disclosure of any adverse environmental effects that cannot be avoided should the RMP Amendment be implemented. Unavoidable adverse impacts are those that remain following the implementation of mitigation measures or impacts for which there are no mitigation measures. Some unavoidable adverse impacts could occur as a result of implementing this RMP Amendment. The public would have less opportunity to view wild horses in the planning area if Alternatives C or D were implemented as compared to Alternatives A and B.

4.5 Relationship between Local Short-Term Uses and Long-Term Productivity

The NEPA §102(C) requires discussion of the relationship between local, short-term uses of the human environment and the maintenance and enhancement of long-term productivity of resources. All of the alternatives would allow for the long-term productivity of rangeland resources. By managing wild horses at AML in combination with other permitted uses, the BLM would ensure a TNEB in Alternatives A, B, and D. Managing for a TNEB ensures the long-term productivity of the resources that may be impacted by management of wild horses. Under Alternative C, all wild horses would be permanently removed from the planning area.

Chapter 5 Consultation and Coordination

The BLM's decision making process for this planning effort has accorded with the requirements of the NEPA, CEQ regulations implementing NEPA, and DOI and BLM regulations and policies implementing NEPA. NEPA and its implementing regulations require that federal agencies involve the interested public in their decision making processes. Public involvement, consultation, and coordination have occurred through scoping for the Rock Springs RMP revision (ongoing), as well as public meetings, informal meetings, individual contacts, news releases, and *Federal Register* notices.

A Notice of Intent (NOI) for the Rock Springs RMP revision was published in the *Federal Register* on February 2, 2011 to formally announce that the Rock Springs Field Office was revising the existing Green River RMP and preparing an associated EIS. The notice invited the affected and interested agencies, organizations, and members of the public to participate in determining significant issues to be addressed in the planning alternatives and analyzed in the EIS. An additional NOI, published in the *Federal Register* on August 16, 2013, announced the start of the scoping period for the management of wild horses as a result of the settlement with Rock Springs Grazing Association, outlined in the Consent Decree. This chapter describes the public involvement process as well as other key consultation and coordination activities undertaken for the preparation of the Draft RMPA and EIS.

Date	Location	Type
February 23, 2011	Rock Springs, Wyoming	Cooperating agency training and workshop
February 28, 2011	Lander, Wyoming	Public scoping meeting
March 1, 2011	Rock Springs, Wyoming	Public scoping meeting
March 2, 2011	Farson, Wyoming	Public scoping meeting
March 3, 2011	Lyman, Wyoming	Public scoping meeting
September 14-16, 2011	Rock Springs, Wyoming	Cooperating agency meeting/Goals and Objectives workshop
November 2-4, 2011	Rock Springs, Wyoming	Cooperating agency meeting/Alternative development
January 9, 2012	Rock Springs, Wyoming	Public socioeconomic strategies workshop
January 9-13, 2012	Rock Springs, Wyoming	Cooperating agency meeting/Alternative development
February 21-23, 2012	Rock Springs, Wyoming	Cooperating agency meeting/Alternative development
March 20-23, 2012	Rock Springs, Wyoming	Cooperating agency meeting/Alternative development
April 16-19, 2012	Rock Springs, Wyoming	Cooperating agency meeting/Alternative development
November 13, 2012	Rock Springs, Wyoming	CTTMP cooperating agency meeting
November 13, 2012	Rock Springs, Wyoming	CTTMP public outreach meeting
November 14, 2012	Lyman, Wyoming	CTTMP public outreach meeting
November 15, 2012	Farson, Wyoming	CTTMP public outreach meeting
December 19-21, 2012	Rock Springs, Wyoming	Cooperating agency meeting/Alternative development
September 11, 2013	Rock Springs, Wyoming	Consent decree public outreach meeting
September 12, 2013	Rawlins, Wyoming	Consent decree public outreach meeting
August 24, 2016	Rock Springs, Wyoming	Public information meeting
October 18-20, 2016	Rock Springs, Wyoming	Cooperating agency meeting/Alternative development
November 8-10, 2016	Rock Springs, Wyoming	Cooperating agency meeting/Alternative development
April 19, 2017	Rock Springs, Wyoming	Cooperating agency meeting/Preliminary preferred alternative review
March 28, 2018	Rock Springs, Wyoming	Cooperating agency meeting/Review of comments on preliminary draft RMP/EIS
April 29 – May 10, 2019	Email invitation to comment	Cooperating agency review of a preliminary Draft EIS.

5.1 Consultation and Coordination

This section documents the consultation and coordination efforts undertaken by the BLM while developing this draft RMPA and EIS. Because of jurisdictional responsibilities, the BLM is required to consult with certain entities during the NEPA and land use planning processes. These entities include

other federal agencies, Native American tribes, and state and local governments. Consultation and coordination with these entities, as appropriate, in the development of this Draft RMPA and EIS was accomplished through frequent communications, meetings, and cooperative efforts between the BLM's interdisciplinary team and other federal, state, and local agencies and organizations. The U.S. Fish and Wildlife Service (USFWS) has been involved in the development of the alternatives as a cooperating agency and has been contacted for ESA Section 7 consultation.

5.1.1 Cooperating Agencies

The BLM extended cooperating agency status to government entities and agencies throughout the planning area:

- City of Rock Springs
- Coalition of Local Governments
- Eastern Shoshone Tribe of the Wind River Reservation
- Fremont County
- The Governor's Office
- Lincoln County
- Lincoln County Conservation District
- Northern Arapaho Tribe
- Representative Lummis' Office
- Rock Springs Grazing Association
- Senator Barrasso's Office
- Senator Enzi's Office
- Shoshone-Bannock Tribes of the Fort Hall Reservation
- Sublette County Commissioners
- Sublette County Conservation District
- Sweetwater County
- Sweetwater County Conservation District
- Uinta County
- Uinta County Conservation District
- The Ute Tribe of the Uintah and Ouray Reservation
- U.S. Bureau of Reclamation
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Forest Service
- U.S. Department of Agriculture: Animal and Plant Health Inspection Service
- U.S. National Park Service
- Wyoming County Commissioners Association
- Wyoming Department of Agriculture
- Wyoming Department of Environmental Quality
- Wyoming Game and Fish Department
- Wyoming Geological Survey
- Wyoming Office of State Lands and Investments
- Wyoming Pipeline Authority
- Wyoming State Historic Preservation Office.

5.1.2 Coordination and Consistency

Frequent communications and cooperative efforts between the BLM and federal, state, and local agencies allowed for coordination with these agencies and consistency with other agency, local, and state government plans, where consistent with federal public land laws. The Wyoming Governor will conduct a

consistency review for state and local land use plans before a Record of Decision is issued for this RMP Amendment. The interdisciplinary team reviewed county land use plans to ensure consistency. BLM held meetings with the respective county planners and commissioners to promote greater understanding of goals, objectives, and resources of the counties and the BLM.

5.1.3 Native American Interests

The BLM consulted with the following Native American tribes as part of the general RMP revision, which included the wild horse issues identified in this document: Eastern Shoshone, Northern Arapaho, Shoshone Bannock and the Ute Tribe of the Uintah and Ouray Reservation. These four tribes were invited to consult as part of the RMP revision effort. Tribes are interested in a wide variety of resources such as animals, plants, water, archeological resources, cultural resources and areas of spiritual significance, which are found throughout the planning area. Consultation with tribes is ongoing for this plan amendment process.

5.2 Public Participation

5.2.1 Scoping Period

The public was provided a scoping period to identify potential issues and concerns associated with the RMP and EIS. Information obtained by the BLM during public scoping was integrated with issues identified by the agencies to form the scope of the EIS. See **Section 1.3** for more details related to public scoping.

5.2.2 Public Comment Period

The public will be invited to comment on this Draft RMPA and EIS during a 90-day public comment period. The final EIS will be prepared following this public comment period and will respond to all substantive comments received on the DEIS. The BLM's issuance of the Final EIS and Proposed RMPA will initiate a 30-day public protest period. After review and consideration of protests, BLM will issue the Record of Decision and Approved RMPA.

5.3 List of Preparers

40 CFR 1502.17 requires the BLM to provide a list of the people primarily responsible for the development of this EIS.

Name	Education	Project Role
Kimberlee Foster	BS, Biochemistry	Rock Springs Field Office Manager, Planner
Spencer Allred	BS, Rangeland Management	Livestock Grazing
Jay D'Ewart	BS, Rangeland Management and Wildlife Resources	Wild Horses
Dennis Doncaster	BA, Physical Science MS, Natural Resources	Water Quality—Surface and Groundwater
Jennifer Fleuret	BS, Natural Resource Management MS, Forest Engineering and Hydrology	Planning and Environmental Coordinator
Georgia (Jo) Foster	BS, Applied Environmental Science BS, Anthropology	Recreation, Visual Resource Management, Special Designations, Travel Management

Jim Glennon	BS, Biology MS, Botany	Vegetation, Threatened and Endangered Plants
Gavin Lovell	BS, Range/Wildlife	Assistant Field Office Manager, Resources
Jenn Dobb		Social and Economics
Joanna Nara-Kloepper	BS, Mining Engineering	Assistant Field Office Manager, Minerals and Lands
Brian Roberts	BS, Natural Resources MS, Soils	Soil Resources
Gene Smith	BA, Anthropology	Paleontology
Mark Snyder	BS, Wildlife Resources	Wildlife and Fisheries, Special Status Species
Scott Stadler	BA and MA, Anthropology	Cultural Resources

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LIST OF ACRONYMS

AML	Appropriate Management Level
AO	Authorized Officer
ARPA	Archaeological Resources Protection Act
AUM	Animal Unit Months
BLM	Bureau of Land Management
BMP	Best Management Practice
BO	Biological Opinion
BOR	Bureau of Reclamation
CAP	Coordinated Activity Plan
CEQ	Council on Environmental Quality
CIAA	Cumulative Impact Analysis Area
CFR	Code of Federal Regulation
CWR	Crucial Winter Range
DOI	Department of the Interior
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FLPMA	Federal Land Policy and Management Act of 1976
FR	Federal Register
FYPC	Fossil Yield Potential Classification
GIS	Geographic Information System
GnRH	Gonadotropin Releasing Hormone
GRSG	Greater Sage-Grouse
HMA	Herd Management Area
HMAP	Herd Management Area Plans
HMP	Habitat Management Plan
IDT	Interdisciplinary Team
IM	Instruction Memorandum
JMH	Jack Morrow Hills
LUP	Land Use Plan
MA	Management Area

MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NAS	National Academies of Science
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOA	Notice of Availability
NOI	Notice of Intent
NRHP	National Register of Historic Places
NPS	National Park Service
NRC	National Research Council
NRCS	Natural Resources Conservation Service
NWR	National Wildlife Refuge
OHV	Off Highway Vehicle
PFYC	Potential Fossil Yield Classification
PHMA	Priority Habitat Management Area
PRPA	Paleontological Resource Preservation Act
PSD	Prevention of Significant Deterioration
PZP	Porcine Zona Pellucida
RAATS	Reduced Agent-Area Treatments
RDF	Required Design Feature
RFO	Rawlins Field Office
RMP	Resource Management Plan
ROD	Record of Decision
RSFO	Rock Springs Field Office
RSGA	Rock Springs Grazing Association
SHPO	State Historic Preservation Office
T&C	Terms and Conditions
T&E	Threatened and Endangered
TCP	Traditional Cultural Property
TES	Threatened and Endangered Species
TNEB	Thriving Natural Ecological Balance
USC	United States Code
USDA	United States Department of Agriculture

USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WARMS	Wyoming Air Resources Monitoring System
WDEQ	Wyoming Department of Environmental Quality
WDEQ-AQD	Wyoming Department of Environmental Quality-Air Quality Division
WGFD	Wyoming Game and Fish Department
WGO	Wyoming Governor's Office
WGSGCP	Wyoming Greater Sage-Grouse Conservation Plan
WHT	Wild Horse Territories
WHTP	Wild Horse Territory Plans
WSA	Wilderness Study Area
WYDOT	Wyoming Department of Transportation
WYNDD	Wyoming Natural Diversity Database

GLOSSARY

Allotment: An area of land designated and managed for livestock grazing. Allotments generally consist of BLM-administered lands but may include other federally managed, state-owned, and private lands. An allotment may include one or more separate pastures. Livestock numbers and periods of use are specified for each allotment.

Amendment: The process for considering or making changes in the terms, conditions, and decisions of approved RMPs or Management Framework Plans using the prescribed provisions for resource management planning appropriate to the proposed action or circumstances. Usually only one or two issues are considered that involve only a portion of the planning area.

Animal Unit: Considered to be one mature cow of about 1,000 pounds (450 kg), either dry or with calf up to 6 months of age, or their equivalent, consuming about 26 pounds of forage/day on an oven dry basis.

Animal Unit Month (AUM): The amount of forage necessary for the sustenance of one cow or its equivalent for a period of 1 month (43 CFR 4100.0-5). For the purpose of calculating grazing fees, an animal unit month is defined as a month's use and occupancy of range by one cow, bull, steer, heifer, horse, burro, mule, 5 sheep or 5 goats over the age of 6 months (43 CFR 4130.8-1(c)).

Appropriate Management Level: The number of adult horses or burros (expressed as a range with an upper and lower limit) to be managed within an HMA. Forage for WH&B (AUMs) is allocated based on the AML upper limit.

Authorized Officer: Any employee of the BLM to whom authority has been delegated to perform the duties described.

Best Management Practices (BMPs): A suite of techniques that guide or may be applied to management actions to aide in achieving desired outcomes. BMPs are often developed in conjunction with land use plans, but they are not considered a planning decision unless the plans and authorizations specify that they are mandatory. BMPs may be updated or modified without a plan amendment (BLM Manual Handbook H-1601-1).

Big Game: Large species of wildlife that are hunted, such as elk, deer, bighorn sheep, moose, and pronghorn.

Checkerboard: This term refers to a land ownership pattern of alternating sections of federal-owned lands with private or state-owned lands for 20 miles on either side of a land grant railroad (e.g. Union Pacific, Northern Pacific, etc.). On land status maps this alternating ownership is either delineated by color coding or alphabetic code resulting in a "checkerboard" visual pattern.

Checkerboard HMA: The Herd Management Areas (HMAs) that contain some checkerboard land. These include the Adobe Town, Great Divide Basin, Salt Wells Creek and White Mountain HMAs.

Code of Federal Regulations (CFR): The official, legal tabulation of regulations directing Federal Government activities.

Collaboration: Working together, sometimes with individuals or groups of opposing points a view, to reach a common agreement.

Conformance: That a proposed action shall be specifically provided for in the land use plan or, if not specifically mentioned, shall be clearly consistent with the goals, objectives, or standards of the approved land use plan.

Consent Decree: An agreement or settlement that resolves a dispute between two parties without admission liability or guilt. In this document "Consent Decree" refers to an April 2013 settlement agreement between the RSGA and the BLM. The purpose of this consent decree was to settle a dispute related to wild horse use of private land within the checkerboard.

Consistency: The requirement that a proposed land use plan be consistent with officially approved plans, programs, and policies of Native American tribes, other federal agencies, and state, and local governments consistent with the purposes, policies, and programs of Federal laws and regulations applicable to the public lands.

Council on Environmental Quality (CEQ): An advisory council to the President of the United States established by the national Environmental Policy Act of 1969. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

Cultural Resource: A fragile and nonrenewable remnant of human activity, occupation, or endeavor reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, architecture, or natural features.

Cultural Resource Inventory: A descriptive listing and documentation, including photographs and maps, of cultural resources. Processes involved are locating, identifying, and recording of sites, structures, buildings, objects, and districts through library and archival research; collecting information from persons knowledgeable about cultural resources; and conducting on-the-ground field surveys of varying levels of intensity. (See also Cultural Resource Inventory Classes.)

Cultural Resource Inventory Classes:

A class I inventory is a professionally prepared study that includes a compilation and analysis of all reasonably available cultural resource data and literature, and a management-focused, interpretive, narrative overview, and synthesis of the data. The overview also defines regional research questions and treatment options

A class II probabilistic field survey is a statistically based sample survey, designed to aid in characterizing the probable density, diversity, and distribution of cultural properties in an area, to develop and test predictive models, and to answer certain kinds of research questions. Within individual sample units, survey aims, methods, and intensity are the same as those applied in class III survey.

Class III intensive survey describes the distribution of properties in an area; determines the number, location and condition of properties; determines the types of properties actually present within the area; permits classification of individual properties; and records the physical extent of specific properties.

Cultural Resource Site (Cultural Property): A physical location of past human activities or events. Cultural properties are extremely variable in size, ranging from the location of a single cultural resource feature to a cluster of cultural resource structures with associated objects.

Cumulative Impact (Effect): The impact on the environment that results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions regardless of what

agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Direct Impacts (Effects): Direct impacts are caused by the action and occur at the same time and place.

Disturbance: A discrete event, either natural or human induced, that causes a change in the existing condition of an ecological system.

Endangered Species: Any plant or animal species that is in danger of extinction throughout all or a significant portion of its range, as defined by the U.S. Fish and Wildlife Service under the authority of the Endangered Species Act of 1973.

Environmental Assessment (EA): Concise, analytical documents, authorized by the National Environmental Policy Act (NEPA) of 1969, that are prepared with public participation to determine whether an Environmental Impact Statement (EIS) is needed for a particular project or action. If an EA determines an EIS is not needed, the EA documents compliance with NEPA requirements.

Environmental Impact Statement (EIS): A document required by the National Environmental Policy Act (NEPA) for certain actions "significantly affecting the quality of the human environment." An EIS is a tool for decision making. It describes the positive and negative environmental effects of a proposed action, and it usually also lists one or more alternative actions that may be chosen instead of the proposed action.

Ephemeral Channels/Streams: A defined channel formed in response to ephemeral surface flow conditions. Defined channels typically can be identified by an abrupt bank along a water flow path with evidence of scouring, sorting, and/or vegetation removal during flood events. These channels generally form in concave erosional features such as gullies, ravines, swales, etc. These channels are above the water table at all times, and lose water to the groundwater system.

Ephemeral Surface Waters: Streams, lakes, or other surface water bodies that have open water *only* during or immediately after periods of rainfall or snowmelt. These water bodies are above the water table at all times, and lose water to the groundwater system.

Erosion: The wearing away of the land surface by running water, wind, ice, or other geological agents.

Federal Lands: As used in this document, lands owned by the United States, without reference to how the lands were acquired or what federal agency administers the lands. The term includes mineral estates or coal estates underlying private surface but excludes lands held by the United States in trust for Indians, Aleuts, or Eskimos. (See also Public Land.)

Federal Land Policy and Management Act of 1976 (FLPMA) as amended: Public Law 94-579. October 21, 1976, often referred to as the BLM' s "Organic Act," which provides the majority of the BLM's legislated authority, direction, policy, and basic management guidance.

Federal Register (FR): A daily publication that reports Presidential and federal agency activities.

Forage: All browse and herbaceous foods available to grazing animals that may be grazed or harvested for feeding.

Fossil: The physical remains or traces of plants and animals preserved in soils and sedimentary rock formations.

General Habitat Management Areas: Occupied (seasonal or year-round) habitat outside of priority habitat. These areas have been identified by the BLM in coordination with respective state wildlife agencies.

Genetic Diversity: The variation in genetic information available among a population, such as a wild horse herd. For purposes of this document adequate genetic diversity means adequate levels of genetic heterozygosity.

Goal: A broad statement of a desired outcome. Goals are usually not quantifiable and may not have established time frames for achievement.

Habitat: An environment that meets a specific set of physical, biological, temporal, or spatial characteristics that satisfy the requirements of a plant or animal species or group of species for part or all of their life cycle. In wildlife management, the major components of habitat are food, water, cover and the adequate juxtaposition of the three.

Herd Area: The geographic area identified as having been used by a herd of wild horses or burros as its habitat in 1971.

Herd Management Area (HMA): Areas established by the Authorized Officer for the maintenance of wild horse and burro herds. Herd management areas are established in consideration of the appropriate management level for the herd, the habitat requirements of the animals, the relationships with other uses of the public and adjacent private lands, and the constraints contained in 43 CFR 4710.4.

Impacts (or Effects): Consequences (the scientific and analytical basis for comparison of alternatives) as a result of a proposed action. Effects may be either direct, which are caused by the action and occur at the same time and place, or indirect, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable, or cumulative.

Implementation Plan: A site-specific plan written to implement decisions made in a land use plan. An implementation plan usually selects and applies best management practices to meet land use plan objectives. Implementation plans are synonymous with "activity" plans. Examples of implementation plans include interdisciplinary management plans, habitat management plans, and allotment management plans.

Indirect Impacts (Effects): Indirect impacts are caused by the action and occur later in time or further removed in distance.

Interdisciplinary Team: A group of individuals with different training, representing the physical sciences, social sciences, and environmental design arts, assembled to solve a problem or perform a task. The members of the team proceed to a solution with frequent interaction so that each discipline may provide insights on any stage of the problem, and disciplines may combine to provide new solutions. The number and disciplines of the members preparing the plan vary with circumstances. A member may represent one or more discipline or program interest.

Intermittent Surface Waters: Streams, lakes, or other surface water bodies that generally flow or contain during a portion of the year when they receive water from springs or during runoff from rain or snow. In the case of streams, this term can also refer to spatially noncontinuous flow because of groundwater interaction (i.e., portions of the stream are generally dry and portions are generally wet in most years).

Irreversible and Irretrievable Commitment of Resources: An irretrievable commitment of a resource is one in which the resource or its use is lost for a period of time. An irreversible commitment of a resource is one that cannot be reversed. NEPA §102(2)C requires a discussion of any irreversible or irretrievable commitments of resources that would be involved in a proposal should it be implemented.

Land Health Standard: A description of the physical and biological conditions or degree of function required for healthy, sustainable lands (e.g., land health standards).

Land Use Plan: A set of decisions that establish management direction for land within an administrative area, as prescribed under the planning provisions of FLPMA; an assimilation of land-use-plan-level decisions developed through the planning process, regardless of the scale at which the decisions were developed.

Management Decision: A decision made by the BLM about how to manage public lands. Management decisions include both land use plan decisions and implementation decisions.

Monitoring: The orderly collection, analysis, and interpretation of resource data to evaluate progress toward meeting management objectives. This process must be conducted over time in order to determine whether or not management objectives are being met. Monitoring also includes observations to evaluate baseline (i.e., pre-activity) conditions, evaluation of whether activities met desired goals and permit requirements (implementation monitoring), and evaluation of how well mitigation measures protected resource conditions (effectiveness monitoring).

Multiple Use: Management of the public lands and their various resource values so that they are used in the combination that will best meet the present and future needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; the use of some land for less than all of the resources; a combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and non-renewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values; and harmonious and coordinated management of the various resources without permanent impairment of the productivity of the land and the quality of the environment with consideration being given to the relative values of the resources and not necessarily to the combination of uses that will give the greatest economic return or the greatest unit output, as provided in the Multiple Use Sustained Yield Act and FLPMA.

National Environmental Policy Act of 1969 (NEPA): The National Environmental Policy Act (NEPA) [42 U.S.C. 4321 et seq.] was signed into law on January 1, 1970. The Act establishes national environmental policy and goals for the protection, maintenance, and enhancement of the environment and provides a process for implementing these goals within the federal agencies. The Act also establishes the Council on Environmental Quality (CEQ).

National Historic Preservation Act (NHPA): The National Historic Preservation Act (Public law 113-287; 54 U.S.C. 300101 et seq.) is legislation intended to preserve historical and archaeological sites in the United States of America. The act created the National Register of Historic Places, the list of National Historic Landmarks, and the State Historic Preservation Offices.

Noxious Weeds: A plant species designated by federal or State law as generally possessing one or more of the following characteristics: aggressive and difficult to manage; parasitic; a carrier or host of serious insects or disease; or nonnative, new, or not common to the United States.

Paleontological Resources (Fossils): Any fossilized remains, traces, or imprints of organisms, preserved in or on the earth's crust, that are of paleontological interest, and that provide information about the history of life on earth. The term does not include: (1) Any materials associated with an archaeological resource (as defined in section 3(1) of the Archaeological Resources Protection Act of 1979 (16 U.X.C. 480bb(1)); or (2) Any cultural item (as defined in section 2 of the Native American Graves Protection and Repatriation Act [25 U.S.C. 3001]).

Partners: An association of individuals or groups with like interests due to the scope or location of a project on federal lands or in regard to a federal permitting process.

Perennial Surface Waters: Streams, lakes, or other surface water bodies that flow or contain water year-round in most years. These water bodies are primarily fed by groundwater during the low-flow season. These systems would generally *only* dry up during drought conditions. In the case of streams, this term can refer to the persistence of surface waters along a channel (i.e., few reaches where the infiltration into the stream aquifer exceeds the flow).

Permittee: A person or company authorized to use or occupy BLM-administered land.

Plan: A document that contains a set of comprehensive, long-range decisions concerning the use and management of BLM-administered resources in a specific geographic area.

Planning Area: A geographical area for which land use and resource management plans are developed and maintained.

Planning Criteria: The standards, rules, and other factors developed by managers and interdisciplinary teams for their use in forming judgments about decision making, analysis, and data collection during planning. Planning criteria streamline and simplify the resource management planning actions**.**

Planning Base: Law, regulation, policy, land use plan decisions (e.g., RMPs, Resource Management Plan Amendments, and Management Framework Plan Amendments), NEPA documents (e.g., EISs Administrative Determinations, EAs, and Categorical Exclusion Reviews), and supporting data (e.g., automated databases, research, and evaluations).

Policy: This is a statement of guiding principles, or procedures, designed and intended to influence planning decisions, operating actions, or other affairs of the BLM. Policies are established interpretations of legislation, executive orders, regulations, or other presidential, secretarial, or management directives.

Population: A group of organisms, all the same species, which occupies a particular area. The term is used to refer to the number of individuals of a species within an ecosystem or of any group of like individuals.

Priority Habitat Management Area: Sage-grouse priority habitats are areas that have the highest conservation value to maintaining or increasing Sage-grouse populations. These areas would include breeding, late brood-rearing, winter concentration areas, and where known, migration or connectivity corridors. Sage-grouse Priority Habitat Management Area includes core plus connectivity habitat.

Proposed Species: Species that have been officially proposed for listing as threatened or endangered by the Secretary of the Interior as determined by the US Fish and Wildlife Service. A proposed rule has been published in the *Federal Register*.

Public Lands: As used in this document, federally owned surface or mineral estate specifically administered by the BLM.

Range Improvement: The term range improvement means any activity, structure or program on or relating to rangelands which is designed to improve production of forage, change vegetative composition, control patterns of use, provide water, stabilize soil and water conditions, and provide habitat for livestock and wildlife. The term includes, but is not limited to, structures, treatment projects, and use of mechanical means to accomplish the desired results.

Reclamation: The suite of actions taken within an area affected by human disturbance, the outcome of which is intended to change the condition of the disturbed area to meet pre-determined objectives and/or make it acceptable for certain defined resources (e.g., wildlife habitat, grazing, ecosystem function, etc.).

Residual Impacts: Impacts from an authorized land use or implementation-level decision that remain after applying avoidance and minimization mitigation; also referred to as unavoidable impacts.

Resource Damage: Damage to any natural or cultural resources that results in impacts such as erosion, water pollution, degradation of vegetation, loss of archeological resources, or the spread of weeds.

Resource Management Plan (RMP): A land use plan as prescribed by the Federal Land Policy and Management Act that establishes, for a given area of land, land-use allocations, coordination guidelines for multiple-use, objectives, and actions to be achieved.

Right-of-Way Corridor: A parcel of land (often linear in character) that has been identified through the land use planning process as being a preferred location for existing and future utility rights-of-way and that is suitable to accommodate one or more rights-of-way that are similar, identical, or compatible. Corridors may accommodate multiple pipelines (such as for oil and gas), electricity transmission **lines**, and related infrastructure, such as access and maintenance roads, compressors, pumping stations, and other structures.

Riparian: Referring to or relating to areas adjacent to water or influenced by free water associated with streams or rivers on geologic surfaces occupying the lowest position in the watershed. (See definition for Lentic and Lotic). (See also Wetland/Riparian.)

Riparian Area: A form of wetland transition between permanently saturated wetlands and upland areas. These areas exhibit vegetation or physical characteristics reflective of permanent surface or subsurface water influence. Lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers and streams, glacial potholes, and the shores of lakes and reservoirs with stable water levels are typical riparian areas (See BLM Manual 1737). Included are ephemeral streams that have vegetation dependent upon free water in the soil. All other ephemeral streams are excluded.

Riparian Communities: Communities of vegetation associated with either open water or wetlands. Examples are cottonwood and willow communities, meadows, aspens near water sources, and other trees, grasses, forbs, and shrubs associated with water.

Road: A linear route declared a road by the owner, managed for use by low-clearance vehicles having four or more wheels, and maintained for regular and continuous use (H-8342-1, Travel and Transportation Management Handbook).

Rock Springs Grazing Association (RSGA): A private organization that owns and/or leases a large amount of private land within the checkerboard.

Runoff: The total stream discharge of water, including both surface and subsurface flow, usually expressed in acre-feet of water yield.

Scoping: The process of identifying the range of issues, management concerns, preliminary alternatives, and other components of an environmental impact statement or land-use planning document. It involves both internal and public viewpoints.

Sensitive Species: Those species designated by a State Director, usually in cooperation with the State agency responsible for managing the species and state natural heritage programs. They are those species that: (1) could easily become endangered or extinct in a state; (2) are under status review by the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service; (3) are undergoing significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution; (4) are undergoing significant current or predicted downward trends in population or density such that federal listing, proposal, or candidate status may become necessary; (5) typically have small and widely dispersed populations, or (6) inhabit ecological refugia or other specialized or unique habitats.

Shrub: A plant that has persistent woody stems and a relatively low growth habit, and that generally produces several basal shoots instead of a single bole.

Solid-block: Areas where BLM managed lands are more concentrated in larger blocks of land. This is in contrast to checkerboard lands where land ownership alternates every square mile (see Checkerboard in Glossary).

Special Status Species: Proposed species, listed species, and candidate species under the Endangered Species Act; state-listed species; and BLM State Director-designated sensitive species (see BLM Manual 6840—Special Status Species Policy).

Stakeholders: Individuals or groups who are involved in or affected by a course of action that is being proposed in a project plan affecting federal lands or a federal permitting process.

State Listed Species: Species proposed for listing or listed by a state in a category implying but not limited to potential endangerment or extinction. Listing is either by legislation or regulation.

Threatened Species: Any plant or animal species defined under the Endangered Species Act as likely to become endangered within the foreseeable future throughout all or a significant portion of its range; listings are published in the *Federal Register* as determined by the US Fish and Wildlife Service and the Secretary of Interior.

Watershed: The area of land, bounded by a divide, that drains water, sediment, and dissolved materials to a common outlet at some point along a stream channel (Dunne and Leopold, 1978), or to a lake, reservoir, or other body of water. Also called drainage basin or catchment.

Wetlands: Those areas that are inundated by surface water or groundwater with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mudflats, and natural ponds.

Appendix A
Wild Horse AML Analysis by HMA and Alternative

Introduction

The Bureau of Land Management (BLM) Rock Springs Field Office (RSFO) and Rawlins Field Office (RFO) are amending their Resource Management Plans (RMPs) to address challenges associated with managing wild horses on checkerboard land (see EIS **Section 1.1** for more information). As part of that process, the BLM is evaluating the Appropriate Management Level (AML) of each wild horse Herd Management Area (HMA). The purpose of this document is to analyze the proposed AML for each HMA under each alternative. Under Alternative C all HMAs would revert to HA status and be managed at an AML of zero, so no detailed analysis will be included for Alternative C in this appendix.

AML establishes the number of wild horses to be managed within an HMA. AML is expressed as a population range with an upper and lower limit. The AML upper limit is the number of wild horses which results in a Thriving Natural Ecological Balance (TNEB) and avoids a deterioration of the range. The AML lower limit is normally set at a number that allows the population to grow to the upper limit over a 4-5 year period, without any interim gathers to remove excess wild horses. A summary of the proposed AML by alternative is presented in Table 1.

Table 1. AML Summary by HMA.

HMA	AML Alt A (No Action)	AML Alt B	AML Alt C	AML Alt D
Adobe Town (RSFO)	*165 – 235*	*165 – 235*	*0*	*0*
Adobe Town (RFO)	*445 – 565*	*445 – 565*	*0*	*259 – 536*
Adobe Town Combined	610 – 800	610 – 800	0	259 – 536
Great Divide Basin	415 – 600	415 – 600	0	0
Salt Wells Creek	251 – 365	251 – 365	0	0
White Mountain	205 – 300	205 – 300	0	0
Total AML (All HMAs):	**1,481 – 2,065**	**1,481 – 2,065**	**0**	**259 – 536**

A detailed description of each alternative and the changes that occur in each HMA can be found in **Chapter 2** of this EIS.

How AML was Determined for Each Alternative

Alternative A

Alternative A represents current management. The existing AML for the Adobe Town, Great Divide Basin, Salt Wells Creek and White Mountain HMAs was established through agreement with wild horse advocacy groups and the Rock Springs Grazing Association (RSGA). The AML under this alternative reflected the permissive use of private land.

Alternative B

For Alternative B the BLM would reduce the area of each of the checkerboard HMAs to include only solid-block BLM land; however, AML would remain the same as under Alternative A. Because of this a specific AML calculation was not done for this alternative.

Under this alternative the BLM would reduce permitted livestock AUMs to provide adequate forage for concentrating the same number of wild horses in a smaller area. The BLM determined the number of additional AUMs needed to provide adequate forage for wild horses under this alternative by calculating what the high AML would be if it was reduced in proportion to the reduced number of acres in each HMA. This reduced AML was then compared to the existing AML (from Alternative A) to determine how much additional forage would be needed to sustain the wild horse herd under this alternative. These calculations are provided in Table 2. The proportional adjustment in acres accounted for the fact that private land acres were included in the AML calculation for Alternative A, but were not included in the acres for Alternative B (with the exception of White Mountain, see **Section 2.2.2** for rationale).

Table 2. Alternative B AML/AUM Calculation

HMA	Proportion of Original Acres (%)	High AML (Alt A)	High AML (Proportional to Alt B acres)	Difference in AML (A vs B)	AUMs Needed to Support AML Difference in Alt B
Adobe Town (RSFO)	58%	235	137	98	1,176
Adobe Town (RFO)	99%	565	561	4	48
Great Divide Basin	50%	600	299	301	3,612
Salt Wells Creek	26%	365	93	272	3,264
White Mountain	100%	300	300	0	0
			Totals:	**675**	**8,100**

Alternative C

Under this alternative all four HMAs would revert to HA status with an AML of zero wild horses. As such, no AML calculation was required under this alternative.

Alternative D

Under this alternative the Great Divide Basin, Salt Wells Creek and White Mountain HMAs would revert to HA status and be managed for zero wild horses. The RSFO portion of the Adobe Town HMA would also revert to HA status, managed for zero wild horses. The RFO portion of the Adobe Town HMA would be reduced slightly to remove any checkerboard lands, and to align it with an existing fence on the northwest boundary. Due to these actions, only the portion of the Adobe Town HMA within the RFO would remain.

Under this Alternative AML was calculated by reducing the existing high AML (from Alternative A) in proportion to the reduction in acres within the Adobe Town HMA. This proportional adjustment in acres accounted for the fact that private land acres were included in the AML calculation for Alternative A, but were not included in the acres for Alternative D. The RFO portion of the Adobe Town HMA was reduced by approximately 5% under this alternative. A proportional adjustment of the Alternative A high AML (565) results in a high AML of 536 for Adobe Town under Alternative D. Low AML (259) was calculated by determining the lower range that would allow the herd to grow to high AML over a 5 year period (assuming an annual growth rate of 20%).

Three Tier Analysis

BLM's Wild Horses and Burros Management Handbook (H-4700-1) outlines a three-tiered analysis for establishing and adjusting the AML for an HMA. Each tier is briefly described below:

- The Tier 1 analysis determines whether the four essential habitat components (forage, water, cover and space) are present in sufficient amounts to sustain healthy wild horse populations and healthy rangelands over the long-term.
- The Tier 2 analysis determines the amount of sustainable forage available for wild horse use.
- The Tier 3 analysis determines whether or not the projected wild horse herd size is sufficient to maintain genetically diverse wild horse populations (i.e., avoid inbreeding depression).

This document follows this three-tiered analysis approach for assessing AML for each HMA within the planning area. This analysis is organized first by HMA, then by Alternative.

Adobe Town HMA

The Adobe Town HMA is located partially within the RSFO and partially within the RFO. While AML is broken out by field office in the table above, it is managed as a single HMA. Therefore, the analysis in this section will focus on the combined (or total) AML for this HMA, except in Alternative D where only the RFO portion remains as an HMA.

Tier 1 Analysis

This analysis determines if there is adequate forage, water cover and space to sustain the wild horse herd.

Alternative A (No Action)

Under this alternative AML would be 610 – 800 wild horses. The HMA would encompass 476,986 acres, of which 442,428 acres are public land.

Forage

Under this alternative an estimated 9,600 Animal Unit Months (AUMs) would be required to sustain the wild horse herd at high AML. Permitted livestock would utilize an estimated 29,412 Active Permitted AUMs within this HMA. Combined wild horse and permitted livestock use is estimated at 41,854 AUMs, which is 11 acres per AUM (on public land). This is considered a normal stocking rate within the vegetation communities that are present within the HMA. Based on this analysis there is adequate forage to sustain a wild horse herd within the HMA under this alternative.

Water

Wild horses require a minimum of 10 gallons of water per day. For the entire herd at high AML this equates to a need of 8,000 gallons per day. There are approximately 191 reservoirs, 39 springs and 27 water wells present within the HMA. There is also approximately 60 miles of stream on public land within this HMA. Each of these sources provides various quantities of water at various times of the year. Furthermore, the water sources are spread out through the entire HMA, allowing for a proper distribution of the wild horses. Overall, there is adequate water within the HMA to meet the needs of the wild horse herd.

Cover and Space

There are 442,428 acres of public land within the Adobe Town HMA under this alternative. At high AML this equates to 553 acres per wild horse, on average. While this is a higher concentration of wild horses than is present on some other HMAs within the planning area, it still provides adequate space for the needs of the herd. Water distribution in the area provides for good distribution of animals throughout the HMA. Opportunities for cover from trees are limited within this HMA, as few stands exist within the area. However, brush and topography provide adequate cover in this area, as thermal cover needs and shade are not typically limiting factors for wild horses in this area, due to short summers and relatively cooler temperatures in the hot season. While there is some movement of wild horses between the Adobe Town and Salt Wells Creek HMAs, this movement is bidirectional. This demonstrates that there is adequate cover and space within this HMA to meet the needs of the wild horse herd in this area.

Alternative B

Under this alternative AML would be 610 – 800 wild horses. The HMA would encompass 432,016 acres, of which 420,156 acres are public land.

Forage

Under this alternative an estimated 9,600 AUMs would be required to sustain the wild horse herd at high AML. Permitted livestock would utilize an estimated 28,887 AUMs within this HMA (after 1,224 AUMs are removed from permitted livestock use and allocated to wild horse use). Combined wild horse and livestock use is estimated at 38,487 AUMs, which is 11 acres per AUM. This is considered a normal stocking rate within the vegetation communities that are present within the HMA. Based on this analysis there is adequate forage to sustain a wild horse herd within the HMA under this alternative.

Water

Wild horses require a minimum of 10 gallons of water per day. For the entire herd at high AML this equates to a need of 8,000 gallons per day. There are approximately 191 reservoirs, 29 springs and 27 water wells present within the HMA. There is also approximately 60 miles of stream on public land within this HMA. Each of these sources provides various quantities of water at various times of the year. Furthermore, the water sources are spread out through the entire HMA, allowing for a proper distribution of the wild horses. Overall, there is adequate water within the HMA to meet the needs of the wild horse herd.

Cover and Space

There are 420,156 acres of public land within the Adobe Town HMA under this alternative. At high AML this equates to 525 acres per wild horse, on average. While this is a higher concentration of wild horses than is present on some other HMAs within the planning area, it still provides adequate space for the needs of the herd. Water distribution in the area provides for good distribution of animals throughout the HMA. Opportunities for cover from trees are limited within this HMA, as few stands exist within the area. However, brush and topography provide adequate cover in this area, as thermal cover needs and shade are not typically limiting factors for wild horses in this area, due to short summers and relatively cooler temperatures in the hot season. While there is some movement of wild horses between the Adobe Town and Salt Wells Creek HMAs, this movement is bidirectional. This demonstrates that there is adequate cover and space within this HMA to meet the needs of the wild horse herd in this area.

Alternative D

Under this alternative AML would be 259 – 536 wild horses. The HMA would encompass 355,094 acres, of which 345,227 acres are public land.

Forage

Under this alternative an estimated 6,432 AUMs would be required to sustain the wild horse herd at high AML. Permitted livestock would utilize an estimated 22,955 Active Permitted AUMs within this HMA. Combined wild horse and permitted livestock use is estimated at 29,387 AUMs, which is 12 acres per AUM. This is considered a normal stocking rate within the vegetation communities that are present within the HMA, and represents a slightly lighter stocking rate than Alternative A. Based on this analysis there is adequate forage to sustain a wild horse herd within the HMA under this alternative.

Water

Wild horses require a minimum of 10 gallons of water per day. For the entire herd at high AML this equates to a need of 5,360 gallons per day. There are approximately 175 reservoirs, 21 springs and 22 water wells present within the HMA. There is also approximately 60 miles of stream on public land within this HMA. Each of these sources provides various quantities of water at various times of the year. Furthermore, the water sources are spread out through the entire HMA, allowing for a proper distribution of the wild horses. Overall, there is adequate water within the HMA to meet the needs of the wild horse herd.

Cover and Space

There are 345,227 acres of public land within the Adobe Town HMA under this alternative. At high AML this equates to 644 acres per wild horse, on average. This would provide adequate space for the needs of the herd. Water distribution in the area provides for good distribution of animals throughout the HMA. Opportunities for cover from trees are limited within this HMA, as few stands exist within the area. However, brush and topography provide adequate cover in this area, as thermal cover needs and shade are not typically limiting factors for wild horses in this area, due to short summers and relatively cooler temperatures in the hot season. While there is some movement of wild horses between the Adobe Town and Salt Wells Creek HMAs, this movement is bidirectional. This demonstrates that there is adequate cover and space within this HMA to meet the needs of the wild horse herd in this area.

Tier 2 Analysis

This analysis determines the amount of sustainable forage available for wild horse use. The current AML for this HMA was established by agreement, and was not based on analysis of utilization data and use pattern mapping. The BLM currently lacks adequate utilization and use pattern mapping data to calculate an updated proposed carrying capacity for wild horses in this area. Therefore, the analysis in this appendix will focus on forage needs as proposed in each alternative, and their anticipated stocking rate relative to the types of vegetation communities found within the HMA.

Alternative A (No Action)

Under this alternative AML would be 610 – 800 wild horses. The HMA would encompass 442,428 acres of public land. Under this alternative the herd would require 9,600 AUMs, and combined use with livestock would place total AUM use at 11 acres per AUM. This is generally considered a normal stocking rate for the types of vegetation communities present in the area.

There are 14 livestock grazing allotments within the HMA under this alternative. Table 3 summarizes the results of current rangeland health condition assessments for these allotments, and indicates whether wild horses are potential causal factors for not meeting any of the standards for rangeland health.

Table 3. Summary of Rangeland Health Assessments for the Adobe Town HMA.

Allotment	Wyoming Rangeland Health Standards Not Met						Wild Horses Potential Causal Factor?
	1	2	3	4	5	6	
Adobe Town							
Continental							
Corson Springs							
Cow Creek							
Crooked Wash (Hiawatha Tridistrict)							
Espitalier							
Grindstone Springs							
Little Powder Mountain							
Powder Mountain							
Red Creek							
Rock Springs		X					Yes
Rotten Springs							
Sand Creek							
Willow Creek							

Standard 1: Within the potential of the ecological site (soil type, landform, climate, and geology), soils are stable and allow for water infiltration to provide for optimal plant growth and minimal surface runoff.
Standard 2: Riparian and wetland vegetation has structural, age, and species diversity characteristics of the stage of channel succession and is resilient and capable of recovering from natural and human disturbance in order to provide forage and cover, capture sediment, dissipate energy, and provide for ground water recharge.
Standard 3: Upland vegetation on each ecological site consists of plant communities appropriate for the site which are resilient, diverse, and able to recover from natural and human disturbance.
Standard 4: Rangelands are capable of sustaining viable populations and a diversity of native plant and animal species appropriate to the habitat. Habitats that support or could support threatened species, endangered species, species of special concern, or sensitive species will be maintained or enhanced.
Standard 5: Water quality meets State standards.
Standard 6: Air quality meets State standards.

The only allotment within this HMA not currently meeting all of the standards for healthy rangelands is the Rock Springs allotment. While wild horse use is considered a contributing factor to not meeting Standard #2 on the Rock Springs allotment, the areas not meeting this standard are not located within the Adobe Town HMA.

Considering all factors (including the condition of the rangeland, forage needs at the proposed AML and estimated available forage) the AML of 610 – 800 wild horses under this alternative is appropriate for this HMA.

Alternative B

Under this alternative AML would be 610 – 800 wild horses. The HMA would encompass 420,156 acres of public land. Under this alternative the herd would require 9,600 AUMs, and combined use with livestock would place total AUM use at 11 acres per AUM. This is generally considered a normal stocking rate for the types of vegetation communities present in the area.

There are 14 livestock grazing allotments within the HMA under this alternative, the same as described under Alternative A. Table 3 summarizes the results of current rangeland health condition assessments for these allotments, and indicates whether wild horses are potential causal factors for not meeting any of the standards for rangeland health. Conclusions associated with these assessments are discussed under Alternative A.

Considering all factors (including the condition of the rangeland, forage needs at the proposed AML and estimated available forage) the AML of 610 – 800 wild horses under this alternative is appropriate for this HMA.

Alternative D

Under this alternative AML would be 259 – 536 wild horses. The HMA would encompass 345,227 acres of public land. Under this alternative the herd would require 6,432 AUMs, and combined use with livestock would place total AUM use at 12 acres per AUM. This is generally considered a normal stocking rate for the types of vegetation communities present in the area.

There are 13 livestock grazing allotments within the HMA under this alternative, the same as described under Alternative A, minus the Rock Springs allotment. Table 3 summarizes the results of current rangeland health condition assessments for these allotments, and indicates whether wild horses are potential causal factors for not meeting any of the standards for rangeland health. Conclusions associated with these assessments are discussed under Alternative A.

Considering all factors (including the condition of the rangeland, forage needs at the proposed AML and estimated available forage) the AML of 259 – 536 wild horses under this alternative is appropriate for this HMA.

Tier 3

This analysis determines if the herd size proposed for this HMA is adequate to maintain the genetic diversity of the herd. A genetic report was prepared for the Adobe Town HMA in 2011. The report described genetic diversity as follows:

> “Genetic variability of this herd is quite high probably due to mixed ancestry and a large population size. There is a somewhat high percentage of variation that is at risk but this

is unlikely to be a problem unless there is a drastic reduction in population size. Genetic variation levels have remained high in comparison to 2003. Genetic similarity results suggest a herd with mixed ancestry but a high probability of Spanish blood…

RECOMMENDATIONS
Current variability levels are high enough that no action is needed as long as there is no serious reduction in population size." (Cothran 2011a).

Based on the results of the 2011 genetic analysis current genetic diversity is good. Following is an analysis of the anticipated genetic diversity for each alternative. The Wild Horses and Burros Management Handbook (H-4700-1) states that "to avoid inbreeding depression in wild horse populations, a minimum herd size of 50 effective breeding animals (a total population size of about 150 – 200 animals) is recommended." The following analysis will be based on this presumption.

Alternative A (No Action)

Under this alternative AML would be 610 – 800 wild horses. This AML would ensure that low AML would be 460 animals over the recommended 150 to maintain adequate genetic diversity. This AML is anticipated to provide for adequate genetic diversity.

Alternative B

Since AML is the same as Alternative A, the discussion on genetic diversity in that section applies to Alternative B as well.

Alternative D

Under this alternative AML would be 259 – 536 wild horses. This AML would ensure that low AML would be 109 animals over the recommended 150 to maintain adequate genetic diversity. This AML is anticipated to provide for adequate genetic diversity.

Great Divide Basin HMA

Tier 1 Analysis

This analysis determines if there is adequate forage, water cover and space to sustain the wild horse herd.

Alternative A (No Action)

Under this alternative AML would be 415 – 600 wild horses. The HMA would encompass 776,189 acres, of which 559,398 acres are public land.

Forage

Under this alternative an estimated 7,200 Animal Unit Months (AUMs) would be required to sustain the wild horse herd at high AML. Permitted livestock would utilize an estimated 35,914 Active Permitted AUMs within this HMA. Combined wild horse and permitted livestock use is estimated at 43,114 AUMs, which is 13 acres per AUM (on public land). This is considered a normal stocking rate within the vegetation communities that are present within the HMA. Based on this analysis there is adequate forage to sustain a wild horse herd within the HMA under this alternative.

Water

Wild horses require a minimum of 10 gallons of water per day. For the entire herd at high AML this equates to a need of 6,000 gallons per day. There are approximately 58 reservoirs, 31 springs and 33 water wells present within the HMA. There is also approximately 20 miles of stream on public land within this HMA. Each of these sources provides various quantities of water at various times of the year. Furthermore, the water sources are spread out through the entire HMA, allowing for a proper distribution of the wild horses. Overall, there is adequate water within the HMA to meet the needs of the wild horse herd.

Cover and Space

There are 559,398 acres of public land within the Great Divide Basin HMA under this alternative. At high AML this equates to 932 acres per wild horse, on average. This will provide adequate space for the needs of the herd. Water distribution in the area provides for good distribution of animals throughout the HMA. Scattered cover from trees is present throughout the HMA. Brush and topography provide additional cover in this area. There is no evidence that wild horses are leaving the HMA to find adequate cover and space. Overall, this analysis demonstrates that there is adequate cover and space within this HMA to meet the needs of the wild horse herd in this area.

Alternative B

Under this alternative AML would be 415 – 600 wild horses. The HMA would encompass 397,936 acres of which 374,697 acres are public land.

Forage

Under this alternative an estimated 7,200 AUMs would be required to sustain the wild horse herd at high AML. Permitted livestock would utilize an estimated 13,652 Active Permitted AUMs within this HMA (after 3,612 AUMs are removed from permitted livestock use and allocated to wild horse use). Combined wild horse and permitted livestock use is estimated at 20,852 AUMs, which is 18 acres per AUM. This is considered a normal stocking rate within the vegetation communities that are present within the HMA. Based on this analysis there is adequate forage to sustain a wild horse herd within the HMA under this alternative.

Water

Wild horses require a minimum of 10 gallons of water per day. For the entire herd at high AML this equates to a need of 6,000 gallons per day. There are approximately 47 reservoirs, 30 springs and 19 water wells present within the HMA. There is also approximately 11 miles of stream on public land within this HMA. Each of these sources provides various quantities of water at various times of the year. Furthermore, the water sources are spread out through the entire HMA, allowing for a proper distribution of the wild horses. Overall, there is adequate water within the HMA to meet the needs of the wild horse herd.

Cover and Space

There are 374,697 acres of public land within the Great Divide Basin HMA under this alternative. At high AML this equates to 624 acres per wild horse, on average. While the northern portion of the HMA

receives high snow loads during the winter (3 – 6 feet deep), there is still adequate space in the southern portion of the HMA to meet the needs of the herd. Water distribution in the area provides for good distribution of animals throughout the HMA. Scattered cover from trees is present throughout the HMA. Brush and topography provide additional cover in this area. There is no evidence that wild horses would leave the HMA area to find adequate cover and space. Overall, this analysis demonstrates that there is adequate cover and space within this HMA to meet the needs of the wild horse herd in this area.

Alternative D

Under this alternative the Great Divide Basin HMA would revert to HA status and be managed for zero wild horses. As a result, there is no AML analysis associated with this alternative.

Tier 2 Analysis

This analysis determines the amount of sustainable forage available for wild horse use. The current AML for this HMA was established by agreement, and was not based on analysis of utilization data and use pattern mapping. The BLM currently lacks adequate utilization and use pattern mapping data to calculate an updated proposed carrying capacity for wild horses in this area. Therefore, the analysis in this appendix will focus on forage needs as proposed in each alternative, and their anticipated stocking rate relative to the types of vegetation communities found within the HMA.

Alternative A (No Action)

Under this alternative AML would be 415 – 600 wild horses. The HMA would encompass 559,398 acres of public land. Under this alternative the herd would require 7,200 AUMs, and combined use with livestock would place total AUM use at 13 acres per AUM. This is generally considered a normal stocking rate for the types of vegetation communities present in the area.

There are 4 livestock grazing allotments within the HMA under this alternative. Table 4 summarizes the results of current rangeland health condition assessments for these allotments, and indicates whether wild horses are potential causal factors for not meeting any of the standards for rangeland health.

Table 4. Summary of Rangeland Health Assessments for the Great Divide Basin HMA, Alternative A.

Allotment	Wyoming Rangeland Health Standards Not Met						Wild Horses Potential Causal Factor?
	1	2	3	4	5	6	
Bush Rim		X					No
Continental Peak							
Red Desert							
Rock Springs		X					Yes

Standard 1: Within the potential of the ecological site (soil type, landform, climate, and geology), soils are stable and allow for water infiltration to provide for optimal plant growth and minimal surface runoff.
Standard 2: Riparian and wetland vegetation has structural, age, and species diversity characteristics of the stage of channel succession and is resilient and capable of recovering from natural and human disturbance in order to provide forage and cover, capture sediment, dissipate energy, and provide for ground water recharge.
Standard 3: Upland vegetation on each ecological site consists of plant communities appropriate for the site which are resilient, diverse, and able to recover from natural and human disturbance.
Standard 4: Rangelands are capable of sustaining viable populations and a diversity of native plant and animal species appropriate to the habitat. Habitats that support or could support threatened species, endangered species, species of special concern, or sensitive species will be maintained or enhanced.
Standard 5: Water quality meets State standards.
Standard 6: Air quality meets State standards.

Both the Bush Rim and Rock Springs allotments are currently not meeting Standard #2. Wild horses were considered a potential contributing factor for the Rock Springs allotment, along with livestock grazing, roads, mining activities, man-made adjustments to stream channels, and a number of other impacts. Considering all of the activities impacting streams within this allotment, wild horses are likely a minor contributing factor. Wild horse impacts were not listed as a contributing factor for the Bush Rim allotment.

Considering all factors (including the condition of the rangeland, forage needs at the proposed AML and estimated available forage) the AML of 415 – 600 wild horses under this alternative is appropriate for this HMA.

Alternative B

Under this alternative AML would be 415 – 600 wild horses. The HMA would encompass 374,697 acres of public land. Under this alternative the herd would require 7,200 AUMs, and combined use with livestock would place total AUM use at 18 acres per AUM. This is considered a normal stocking rate within the vegetation communities that are present within the HMA.

There are 3 livestock grazing allotments within the HMA under this alternative. Table 5 summarizes the results of current rangeland health condition assessments for these allotments, and indicates whether wild horses are potential causal factors for not meeting any of the standards for rangeland health.

Table 5. Summary of Rangeland Health Assessments for the Great Divide Basin HMA, Alternative B.

Allotment	Wyoming Rangeland Health Standards Not Met						Wild Horses Potential Causal Factor?
	1	2	3	4	5	6	
Bush Rim		X					No
Continental Peak							
Red Desert							

Standard 1: Within the potential of the ecological site (soil type, landform, climate, and geology), soils are stable and allow for water infiltration to provide for optimal plant growth and minimal surface runoff.
Standard 2: Riparian and wetland vegetation has structural, age, and species diversity characteristics of the stage of channel succession and is resilient and capable of recovering from natural and human disturbance in order to provide forage and cover, capture sediment, dissipate energy, and provide for ground water recharge.
Standard 3: Upland vegetation on each ecological site consists of plant communities appropriate for the site which are resilient, diverse, and able to recover from natural and human disturbance.
Standard 4: Rangelands are capable of sustaining viable populations and a diversity of native plant and animal species appropriate to the habitat. Habitats that support or could support threatened species, endangered species, species of special concern, or sensitive species will be maintained or enhanced.
Standard 5: Water quality meets State standards.
Standard 6: Air quality meets State standards.

The Bush Rim allotment is currently not meeting Standard #2. Wild horse impacts were not listed as a contributing factor for not meeting this standard.

Considering all factors (including the condition of the rangeland, forage needs at the proposed AML and estimated available forage) the AML of 415 – 600 wild horses under this alternative is appropriate for this HMA.

Alternative D

Under this alternative the Great Divide Basin HMA would revert to HA status and be managed for zero wild horses. As a result, there is no AML analysis associated with this alternative.

Tier 3

This analysis determines if the herd size proposed for this HMA is adequate to maintain the genetic diversity of the herd. A genetic report was prepared for the Great Divide Basin HMA in 2012. The report described genetic diversity as follows:

> "Genetic variability of this herd in general is high but understanding the diversity of this herd is somewhat complicated. This herd was previously sampled in 2003. At that time the sample consisted of two subdivisions of the herd area labeled North and South. Genetic variability levels of both groups were relatively high but not quite as high as seen here. Much of the high variability was attributed to mixing of the two groups and that would fit the herd now. However, the herds did not appear to be a single population but maintained some independence. This may not be the case now... The high percentage of variation that is at risk also is consistent with a formally subdivided population now interbreeding. Genetic similarity results suggest a herd with mixed ancestry…
>
> RECOMMENDATIONS
> Current variability levels are high enough that no action is needed, however, if population size drops below 150 breeding age animals, diversity levels can change quickly." (Cothran 2012a).

Based on the results of the 2012 genetic analysis current genetic diversity is good. Following is an analysis of the anticipated genetic diversity for each alternative. The Wild Horses and Burros Management Handbook (H-4700-1) states that "to avoid inbreeding depression in wild horse populations, a minimum herd size of 50 effective breeding animals (a total population size of about 150 – 200 animals) is recommended." The following analysis will be based on this presumption.

Alternative A (No Action)

Under this alternative AML would be 415 – 600 wild horses. This AML would ensure that low AML would be 265 animals over the recommended 150 to maintain adequate genetic diversity. This AML is anticipated to provide for adequate genetic diversity.

Alternative B

Since AML is the same as Alternative A, the discussion on genetic diversity in that section applies to Alternative B as well.

Alternative D

Under this alternative the Great Divide Basin HMA would revert to HA status and be managed for zero wild horses. As a result, there is no AML analysis associated with this alternative.

Salt Wells Creek HMA

Tier 1 Analysis

This analysis determines if there is adequate forage, water cover and space to sustain the wild horse herd.

Alternative A (No Action)

Under this alternative AML would be 251 – 365 wild horses. The HMA would encompass 1,169,288 acres, of which 689,511 are public lands.

Forage

Under this alternative an estimated 4,380 Animal Unit Months (AUMs) would be required to sustain the wild horse herd at high AML. Livestock would utilize an estimated 59,592 AUMs within this HMA. Combined wild horse and livestock use is estimated at 63,972 AUMs, which is 11 acres per AUM. This is generally considered a normal stocking rate within the vegetation communities that are present within the HMA. Based on this analysis there is adequate forage to sustain a wild horse herd within the HMA under this alternative.

Water

Wild horses require a minimum of 10 gallons of water per day. For the entire herd at high AML this equates to a need of 3,650 gallons per day. There are approximately 88 reservoirs, 31 springs and 14 water wells present within the HMA. There is also approximately 191 miles of stream on public land within this HMA. Each of these sources provides various quantities of water at various times of the year. Furthermore, the water sources are spread out through the entire HMA, allowing for a proper distribution of the wild horses. Overall, there is adequate water within the HMA to meet the needs of the wild horse herd.

Cover and Space

There are 689,511 acres of public land within the Salt Wells Creek HMA under this alternative. At high AML this equates to 1,889 acres per wild horse, on average. This will provide adequate space for the needs of the herd. Water distribution in the area provides for good distribution of animals throughout the HMA. Scattered cover from trees is present throughout the HMA. Brush and topography provide additional cover in this area. While there is some movement of wild horses between the Adobe Town and Salt Wells Creek HMAs, this movement is bidirectional. This demonstrates that there is adequate cover and space within this HMA to meet the needs of the wild horse herd in this area.

Alternative B

Under this alternative AML would be 251 – 365 wild horses. The HMA would encompass 319,556 acres, of which 287,203 are public lands.

Forage

Under this alternative an estimated 4,380 AUMs would be required to sustain the wild horse herd at high AML. Livestock would utilize an estimated 16,759 AUMs within this HMA (after 3,264 AUMs are removed from permitted livestock use and allocated to wild horse use). Combined wild horse and livestock use is estimated at 21,139 AUMs, which is 14 acres per AUM. This is generally considered a normal stocking rate within the vegetation communities that are present within the HMA. Based on this analysis there is adequate forage to sustain a wild horse herd within the HMA under this alternative.

Water

Wild horses require a minimum of 10 gallons of water per day. For the entire herd at high AML this equates to a need of 3,650 gallons per day. There are approximately 71 reservoirs, 10 springs and 5 water wells present within the HMA under this alternative. There is also approximately 100 miles of stream on public land within this HMA. Each of these water sources provides various quantities of water at various times of the year. Furthermore, the water sources are spread out through the entire HMA, allowing for a proper distribution of the wild horses. Overall, there is adequate water within the HMA to meet the needs of the wild horse herd.

Cover and Space

There are 287,203 acres of public land within the Salt Wells Creek HMA under this alternative. At high AML this equates to 787 acres per wild horse, on average. This will provide adequate space for the needs of the herd. Water distribution in the area provides for good distribution of animals throughout the HMA. Scattered cover from trees is present throughout the HMA. Brush and topography provide additional cover in this area. While there is some movement of wild horses between the Adobe Town and Salt Wells Creek HMAs, this movement is bidirectional. This demonstrates that there is adequate cover and space within this HMA to meet the needs of the wild horse herd in this area.

Alternative D

Under this alternative the Salt Wells Creek HMA would revert to HA status and be managed for zero wild horses. As a result, there is no AML analysis associated with this alternative.

Tier 2 Analysis

This analysis determines the amount of sustainable forage available for wild horse use. The current AML for this HMA was established by agreement, and was not based on analysis of utilization data and use pattern mapping. The BLM currently lacks adequate utilization and use pattern mapping data to calculate an updated proposed carrying capacity for wild horses in this area. Therefore, the analysis in this appendix will focus on forage needs as proposed in each alternative, and their anticipated stocking rate relative to the types of vegetation communities found within the HMA.

Alternative A (No Action)

Under this alternative AML would be 251 – 365 wild horses. The HMA would encompass 689,511 acres of public land. Under this alternative the herd would require 4,380 AUMs, and combined use with livestock would place total AUM use at 11 acres per AUM. This is generally considered a normal stocking rate for the types of vegetation communities present in the area.

There are 9 livestock grazing allotments within the HMA under this alternative. Table 6 summarizes the results of current rangeland health condition assessments for these allotments, and indicates whether wild horses are potential causal factors for not meeting any of the standards for rangeland health.

Table 6. Summary of Rangeland Health Assessments for the Salt Wells Creek HMA, Alternative A.

Allotment	Wyoming Rangeland Health Standards Not Met						Wild Horses Potential Causal Factor?
	1	2	3	4	5	6	
Alkali Creek							
Circle Springs							
Crooked Wash (Hiawatha Tridistrict)							

Horseshoe Wash							
Mellor Mountain		X					No
Rife							
Rock Springs		X					Yes
Salt Wells		X					No
Vermillion Creek		X					Yes

Standard 1: Within the potential of the ecological site (soil type, landform, climate, and geology), soils are stable and allow for water infiltration to provide for optimal plant growth and minimal surface runoff.
Standard 2: Riparian and wetland vegetation has structural, age, and species diversity characteristics of the stage of channel succession and is resilient and capable of recovering from natural and human disturbance in order to provide forage and cover, capture sediment, dissipate energy, and provide for ground water recharge.
Standard 3: Upland vegetation on each ecological site consists of plant communities appropriate for the site which are resilient, diverse, and able to recover from natural and human disturbance.
Standard 4: Rangelands are capable of sustaining viable populations and a diversity of native plant and animal species appropriate to the habitat. Habitats that support or could support threatened species, endangered species, species of special concern, or sensitive species will be maintained or enhanced.
Standard 5: Water quality meets State standards.
Standard 6: Air quality meets State standards.

The Mellor Mountain, Rock Springs, Salt Wells and Vermillion Creek allotments are not currently meeting Standard #2. Wild horse use was identified as a contributing factor for the Rock Springs and Vermillion Creek allotments, along with a number of other factors including: livestock grazing, roads, mining activities and man-made adjustments to stream channels.

Considering all factors (including the condition of the rangeland, forage needs at the proposed AML and estimated available forage) the AML of 251 – 365 wild horses under this alternative is appropriate for this HMA. However, improved management of wild horses may be needed to make better progress toward meeting Standard #2 in the Rock Springs and Vermillion Creek allotments. Management actions such as development of additional upland water, or the addition of riparian fences could help improve riparian conditions by reducing impacts from wild horse use.

Alternative B

Under this alternative AML would be 251 – 365 wild horses. The HMA would encompass 287,203 acres of public lands. Under this alternative the herd would require 4,380 AUMs, and combined use with livestock would place total AUM use at 14 acres per AUM. This is generally considered a normal stocking rate for the types of vegetation communities present in the area.

The same grazing allotments would be present in this alternative as described in Alternative A, except for the Rock Springs, Rife and Circle Springs allotments. Information regarding rangeland health assessments associated with the allotments within this HMA under this alternative are provided in the discussion for Alternative A.

Alternative D

Under this alternative the Salt Wells Creek HMA would revert to HA status and be managed for zero wild horses. As a result, there is no AML analysis associated with this alternative.

Tier 3

This analysis determines if the herd size proposed for this HMA is adequate to maintain the genetic diversity of the herd. Two genetic reports were prepared for the Salt Wells Creek HMA in 2011, one for the Miller Mountain area and one for the Manual Gap area. The reports described genetic diversity as follows:

> "Genetic variability of this herd in general is high… Genetic similarity results suggest a herd with mixed ancestry…
>
> RECOMMENDATIONS
> Current variability levels are high enough that no action is needed at this point but the herd should be monitored closely if it is known that the herd size has seen a recent decline. If there has been a recent population decline, variability levels could drop quickly over the next 5-10 years." (Cothran 2011b).
>
> Genetic variability of this herd in general is on the high side but some of the diversity may be related to unrecognized population subdivision. Even if this is true, the… values indicated good levels of genetic variation. Genetic similarity results suggest a herd with mixed ancestry.
>
> RECOMMENDATIONS
> Current variability levels are high enough that no action is needed at this point." (Cothran 2011c).

Based on the results of the 2011 genetic analysis current genetic diversity is good. Following is an analysis of the anticipated genetic diversity for each alternative. The Wild Horses and Burros Management Handbook (H-4700-1) states that "to avoid inbreeding depression in wild horse populations, a minimum herd size of 50 effective breeding animals (a total population size of about 150 – 200 animals) is recommended." The following analysis will be based on this presumption.

Alternative A (No Action)

Under this alternative AML would be 251 – 365 wild horses. This AML would ensure that low AML would be 101 animals over the recommended 150 to maintain adequate genetic diversity. This AML is anticipated to provide for adequate genetic diversity.

Alternative B

Since AML is the same as Alternative A, the discussion on genetic diversity in that section applies to Alternative B as well.

Alternative D

Under this alternative the Salt Wells Creek HMA would revert to HA status and be managed for zero wild horses. As a result, there is no AML analysis associated with this alternative.

White Mountain HMA

Tier 1 Analysis

This analysis determines if there is adequate forage, water cover and space to sustain the wild horse herd.

Alternative A (No Action)

Under this alternative AML would be 205 – 300 wild horses. The HMA would encompass 388,488 acres, of which 207,350 acres are public land.

Forage

Under this alternative an estimated 3,600 Animal Unit Months (AUMs) would be required to sustain the wild horse herd at high AML. Livestock would utilize an estimated 34,588 AUMs within this HMA. Combined wild horse and livestock use is estimated at 38,188 AUMs, which is 10 acres per AUM. This is generally considered a normal stocking rate within the vegetation communities that are present within the HMA. Based on this analysis there is adequate forage to sustain a wild horse herd within the HMA under this alternative.

Water

Wild horses require a minimum of 10 gallons of water per day. For the entire herd at high AML this equates to a need of 3,000 gallons per day. There are approximately 31 reservoirs, zero springs and 34 water wells present within the HMA. There is also approximately 36 miles of stream on public land within this HMA. Each of these sources provides various quantities of water at various times of the year. The majority of these water sources are located in the northern portion of the HMA, leaving limited water sources in the southern portion of the HMA. However, wild horses are frequently observed in the southern portion of the HMA, utilizing the water sources available in that area. Overall, there is adequate water within the HMA to meet the needs of the wild horse herd, though there is less water available for this HMA than the others within the planning area.

Cover and Space

There are 207,350 acres of public land within the White Mountain HMA under this alternative. At high AML this equates to 782 acres per wild horse, on average. This will provide adequate space for the needs of the herd. Water distribution in the area provides for adequate distribution of animals throughout the HMA. Scattered cover from trees is present throughout the HMA. Brush and topography provide additional cover in this area. There is no evidence that wild horses are leaving the HMA area to find adequate cover and space. Overall, this analysis demonstrates that there is adequate cover and space within this HMA to meet the needs of the wild horse herd in this area.

Alternative B

Because the analysis in this section focuses on AML, and because AML remains the same under this alternative, the analysis for Alternative B apply to this section as well.

Alternative D

Under this alternative the White Mountain HMA would revert to HA status and be managed for zero wild horses. Consideration was given to managing wild horses within this HMA without the use of the Checkerboard lands. If this were to occur then approximately 110,000 acres would be available for wild horse use within this HMA. A proportional reduction in herd size would make the AML 41 – 85 wild horses. Under this scenario, it would be expected that wild horses would constantly leave this area to enter either the Little Colorado HMA, or the Checkerboard lands to seek adequate resources. Overall, this analysis demonstrates that without the use of Checkerboard lands there is inadequate forage, water, cover and space within this HMA to sustain a wild horse herd. BLM Considered managing this portion of the White Mountain HMA in conjunction with the Little Colorado HMA; however, a fence or some other barrier would be required between the solid block portion and the checkerboard portion of

the White Mountain HMA. This would be needed to prevent wild horses that have historically used the checkerboard portion of the HMA from ranging onto private lands in that area.

Tier 2 Analysis

This analysis determines the amount of sustainable forage available for wild horse use. The current AML for this HMA was established by agreement, and was not based on analysis of utilization data and use pattern mapping. The BLM currently lacks adequate utilization and use pattern mapping data to calculate an updated proposed carrying capacity for wild horses in this area. Therefore, the analysis in this appendix will focus on forage needs as proposed in each alternative, and their anticipated stocking rate relative to the types of vegetation communities found within the HMA.

Alternative A (No Action)

Under this alternative AML would be 205 – 300 wild horses. The HMA would encompass 207,350 acres of public land. Under this alternative the herd would require 3,600 AUMs, and combined use with livestock would place total AUM use at 10 acres per AUM. This is generally considered a normal stocking rate for the types of vegetation communities present in the area.

There are 3 livestock grazing allotments within the HMA under this alternative. Table 7 summarizes the results of current rangeland health condition assessments for these allotments, and indicates whether wild horses are potential causal factors for not meeting any of the standards for rangeland health.

Table 7. Summary of Rangeland Health Assessments for the White Mountain HMA.

Allotment	Wyoming Rangeland Health Standards Not Met						Wild Horses Potential Causal Factor?
	1	2	3	4	5	6	
Highway Gasson							
Lombard		X					No
Rock Springs		X					Yes

Standard 1: Within the potential of the ecological site (soil type, landform, climate, and geology), soils are stable and allow for water infiltration to provide for optimal plant growth and minimal surface runoff.
Standard 2: Riparian and wetland vegetation has structural, age, and species diversity characteristics of the stage of channel succession and is resilient and capable of recovering from natural and human disturbance in order to provide forage and cover, capture sediment, dissipate energy, and provide for ground water recharge.
Standard 3: Upland vegetation on each ecological site consists of plant communities appropriate for the site which are resilient, diverse, and able to recover from natural and human disturbance.
Standard 4: Rangelands are capable of sustaining viable populations and a diversity of native plant and animal species appropriate to the habitat. Habitats that support or could support threatened species, endangered species, species of special concern, or sensitive species will be maintained or enhanced.
Standard 5: Water quality meets State standards.
Standard 6: Air quality meets State standards.

Both the Lombard and Rock Springs allotments are currently not meeting Standard #2. Wild horses were considered a potential contributing factor for the Rock Springs allotment, along with livestock grazing, roads, mining activities, man-made adjustments to stream channels, and a number of other impacts. Considering all of the activities impacting streams within this allotment, wild horses are likely a minor contributing factor. Wild horse impacts were not listed as a contributing factor for the Lombard allotment. Furthermore, only a small portion of this allotment is within the White Mountain HMA.

Considering all factors (including the condition of the rangeland, forage needs at the proposed AML and estimated available forage) the AML of 205 – 300 wild horses under this alternative is appropriate for this HMA.

Alternative B

Because neither the AML nor the boundary of this HMA changes under this alternative, the analysis for Alternative A applies to this section as well.

Alternative D

Under this alternative the White Mountain HMA would revert to HA status and be managed for zero wild horses. As a result, there is no AML analysis associated with this alternative.

Tier 3

This analysis determines if the herd size proposed for this HMA is adequate to maintain the genetic diversity of the herd. A genetic report was prepared for the White Mountain HMA in 2012. The report described genetic diversity as follows:

> "Genetic variability of this herd in general is on the high side but there is a high percentage of variation that is at risk and individual heterozygosity is below average by a small amount. The patterns seen here are very similar to what was seen in 2000 based upon blood typing. It was suggested then that there may be some gene flow into the population and that is consistent with the current data. The very high allelic diversity but high proportion of alleles at low frequency is just what would be expected if there was a small influx of horses into the herd at different times. It is possible there is introgression from the two neighboring HMAs with Salt Wells being the more probable based upon level of differentiation. Genetic similarity results suggest a herd with mixed ancestry.
>
> RECOMMENDATIONS
> Current variability levels are high enough that no action is needed at this point but the herd should be monitored closely due to the high proportion of rare alleles. This is especially true if it is known that the herd size has seen a recent decline." (Cothran 2012b).

Based on the results of the 2012 genetic analysis current genetic diversity is adequate. Following is an analysis of the anticipated genetic diversity for each alternative. The Wild Horses and Burros Management Handbook (H-4700-1) states that "to avoid inbreeding depression in wild horse populations, a minimum herd size of 50 effective breeding animals (a total population size of about 150 – 200 animals) is recommended." The following analysis will be based on this presumption.

Alternative A (No Action)

Under this alternative AML would be 205 – 300 wild horses. This AML would ensure that low AML would be 55 animals over the recommended 150 to maintain adequate genetic diversity. This AML is anticipated to provide for adequate genetic diversity.

Alternative B

Since AML is the same as Alternative A, the discussion on genetic diversity in that section applies to Alternative B as well.

Alternative D

Under this alternative the White Mountain HMA would revert to HA status and be managed for zero wild horses. As a result, there is no AML analysis associated with this alternative. Consideration was given to managing wild horses within this HMA without the use of the Checkerboard lands. If this were

to occur then approximately 110,000 acres would be available for wild horse use within this HMA. A proportional reduction in herd size would make the AML 41 – 85 wild horses. A low AML of 41 would be 109 animals less than the recommended 150 to maintain adequate genetic diversity. If this were to occur, genetic diversity would need to be monitored closely, and active management actions would need to be implemented to address any potential concerns. If wild horses in this HMA intermingled with the Little Colorado HMA herd, this may reduce the potential risk to genetic diversity.

References:

BLM 2010. BLM Handbook 4700-1, Wild Free-Roaming Horse and Burro Management Handbook. Release 4-116, dated 7/7/2010. Washington D.C.: GPO.

Cothran, E. Gus 2011a. "Genetic Analysis of the Adobe Town HMA, WY." Department of Veterinary Integrative Bioscience, Texas A&M University. College Station, TX. 9pp. Report to BLM.

Cothran, E. Gus 2011b. "Genetic Analysis of the Salt Wells Creek HMA, Manuel Gap subgroup, WY." Department of Veterinary Integrative Bioscience, Texas A&M University. College Station, TX. 9pp. Report to BLM.

Cothran, E. Gus 2011c. "Genetic Analysis of the Salt Wells Creek HMA, Miller Mountain Trap, WY." Department of Veterinary Integrative Bioscience, Texas A&M University. College Station, TX. 8pp. Report to BLM.

Cothran, E. Gus 2012a. "Genetic Analysis of the Great Divide Basin HMA, WY." Department of Veterinary Integrative Bioscience, Texas A&M University. College Station, TX. 9pp. Report to BLM.

Cothran, E. Gus 2012b. "Genetic Analysis of the White Mountain HMA, WY." Department of Veterinary Integrative Bioscience, Texas A&M University. College Station, TX. 9pp. Report to BLM.

Appendix B

Impacts of Fertility Control Methods on Wild Horses

Contents

Immuno-contraception

Porcine Zone Pellucida (PZP) Vaccine

PZP vaccines have been used on dozens of horse herds by the National Park Service, US Forest Service, Bureau of Land Management, and Native American tribes and its use is approved for free-ranging wild horse herds. 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 (NRC 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 (NRC 2013), and in feral burros on Caribbean islands (Turner et al. 1996, French et al. 2017). PZP is relatively inexpensive, meets BLM requirements for safety to mares and the environment, and is produced as ZonaStat-H, an EPA-registered commercial 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). 'Native' PZP proteins can be purified from pig ovaries (Liu et al. 1989). Native PZP produced at different times or in different laboratories may vary in the strength of immune response they elicit (Turner 2018). Recombinant ZP proteins may be produced with molecular techniques (Gupta and Minhas 2017, Joonè et al. 2017a, Nolan et al. 2018). It can easily be remotely administered in the field in cases where mares are relatively approachable. Use of remotely delivered (dart-delivered) vaccine is generally limited to populations where individual animals can be accurately identified and repeatedly approached within 50 m (BLM 2010).

The BLM currently uses two PZP formulations for fertility control of wild horse mares, ZonaStat-H (PZP Native) and PZP-22. As other formulations are approved for use by BLM, they may be applied through future gathers or darting activities. For the purpose of this management plan, field or remote darting refers to applying the vaccine using a dart. Darting can be implemented when animals are gathered into corrals or opportunistically by applicators near water sources or along main WH&B trails out on the range. Blinds may be used to camouflage applicators to allow efficient treatment of as many mares as possible. PZP can also be applied via hand injections using plastic syringes when animals are gathered into corrals and chutes. Native PZP (or currently most effective formulation) would be administered by PZP certified and trained applicators in the one year liquid dose inoculations by field darting the mares.

When applying native PZP (i.e., ZonaStat-H), first the primer with modified Freund's Complete adjuvant is given and then the booster with Freund's Incomplete adjuvant is given 2-6 weeks later. Preferably, the timing of the booster dose is at least 1-2 weeks prior to the onset of breeding activity. Following the initial 2 inoculations, only annual boosters are required. For maximum effectiveness, PZP would be administered within the December to February timeframe. For the PZP-22 formulation administered during gathers, each released mare would receive a single dose of the two-year PZP contraceptive vaccine at the same time as a dose of the liquid PZP vaccine with modified Freund's Complete adjuvant. The pellets are applied to the mare with a large gauge needle and jab-stick into the hip. Although PZP-22 pellets have been delivered via darting in trial studies (Rutberg et al 2017), BLM does not plan to use darting for PZP-22 delivery until there is more demonstration that PZP-22 can be reliably delivered via dart. Therefore, the wild horses must be gathered for each application of this formulation.

PZP Direct Effects

The historically accepted hypothesis explaining PZP vaccine effectiveness posits that when injected as an antigen in vaccines, PZP causes the mare's immune system to produce antibodies that are specific to zona pellucida proteins on the surface of that mare's eggs. The antibodies bind to the mare's eggs' surface proteins (Liu et al. 1989), and effectively block sperm binding and fertilization (Zoo Montana, 2000). Because treated mares do not become pregnant but other ovarian functions remain generally unchanged, PZP can cause a mare to continue having regular estrus cycles throughout the breeding season. More

recent observations support a complementary hypothesis, which posits that PZP vaccination causes reductions in ovary size and function (Mask et al. 2015, Joonè et al. 2017b, Joonè et al. 2017c, Nolan et al. 2018b). Antibodies specific to PZP protein do not crossreact with tissues outside of the reproductive system (Barber and Fayrer-Hosken 2000).

Research has demonstrated that contraceptive efficacy of an injected liquid PZP vaccine, such as ZonaStat-H, is approximately 90% or more for mares treated twice in one year (Turner and Kirkpatrick 2002, Turner et al. 2008). The highest success for fertility control has been reported when the vaccine has been applied November through February. High contraceptive rates of 90% or more can be maintained in horses that are boostered annually (Kirkpatrick et al. 1992). Approximately 60% to 85% of mares are successfully contracepted for one year when treated simultaneously with a liquid primer and PZP-22 pellets (Rutberg et al. 2017). Application of PZP for fertility control would reduce fertility in a large percentage of mares for at least one year (Ransom et al. 2011).

The contraceptive result for a single application of the liquid PZP vaccine primer dose along with PZP vaccine pellets (PZP-22), based on winter applications, can be expected to fall in the approximate efficacy ranges as follows (based on figure 2 in Rutberg et al. 2017). Below, the approximate efficacy is measured as the relative decrease in foaling rate for treated mares, compared to control mares:

Year 1	Year 2	Year 3
0 (developing fetuses come to term)	~30-75%	~20-50%

If mares that have been treated with PZP-22 vaccine pellets subsequently receive a booster dose of either the liquid PZP vaccine or the PZP-22 vaccine pellets, the subsequent contraceptive effect is apparently more pronounced and long-lasting. The approximate efficacy following a booster dose can be expected to be in the following ranges (based on figure 3 in Rutberg et al. 2017).

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

The fraction of mares treated in a herd can have a large effect on the realized change in growth rate due to PZP contraception, with an extremely high portion of mares required to be treated to prevent population-level growth (e.g., Turner and Kirkpatrick 2002). Gather efficiency would likely not exceed 85% via helicopter, and may be less with bait and water trapping, so there could 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 would continue to foal normally (in those herds managed as reproducing), unless other sterilization techniques were also used.

Reversibility and Effects on Ovaries

In most cases, PZP contraception appears to be temporary and reversible, with most treated mares returning to fertility over time (Kirkpatrick and Turner 2002). The ZonaStat-H formulation of the vaccine tends to confer only one year of efficacy per dose. Some studies have found that a PZP vaccine in long-lasting pellets (PZP-22) can confer multiple years of contraception (Turner et al. 2007), particularly when boostered with subsequent PZP vaccination (Rutberg et al. 2017). Other trial data indicate that the pelleted vaccine may only be effective for one year (J. Turner, University of Toledo, Personal Communication).

The purposes of applying PZP treatment is to prevent mares from conceiving foals, but BLM acknowledges that long-term infertility or permanent sterility could be a result for some number of wild horses receiving PZP vaccinations. The rate of long-term or permanent sterility following vaccinations with PZP is hard to predict for individual horses, but that outcome appears to increase in likelihood as the number of doses increases (Kirkpatrick and Turner 2002). Permanent sterility for mares treated consecutively 5-7 years was observed by Nuñez et al. (2010, 2017). In a graduate thesis, Knight (2014) suggested that repeated treatment with as few as three to four years of PZP treatment may lead to longer-term sterility, and that sterility may result from PZP treatment before puberty. Repeated treatment with PZP led to long-term infertility in Przewalski's horses receiving as few as one PZP booster dose (Feh 2012). However, even if some number of mares become sterile as a result of PZP treatment, that potential result would be consistent with the contraceptive purpose that motivates the BLM's use of the vaccine.

In some mares, PZP vaccination may cause direct effects on ovaries (Gray and Cameron 2010, Joonè et al. 2017b, Joonè et al. 2017c, Joonè et al. 2017d). Joonè et al. (2017a) noted reversible effects on ovaries in mares treated with one primer dose and booster dose. Joonè et al. (2017c) documented decreased anti-Mullerian hormone (AMH) levels in mares treated with native or recombinant PZP vaccines; AMH levels are thought to be an indicator of ovarian function. Bechert et al. (2013) found that ovarian function was affected by the SpayVac PZP vaccination, but that there were no effects on other organ systems. Mask et al. (2015) demonstrated that equine antibodies that resulted from SpayVac immunization could bind to oocytes, ZP proteins, follicular tissues, and ovarian tissues. It is possible that result is specific to the immune response to SpayVac, which may have lower PZP purity than ZonaStat or PZP-22 (Hall et al. 2016). However, in studies with native ZP proteins and recombinant ZP proteins, Joonè et al. (2017a) found transient effects on ovaries after PZP vaccination in some treated mares; normal estrus cycling had resumed 10 months after the last treatment. SpayVac is a patented formulation of PZP in liposomes that led to multiple years of infertility in some breeding trials (Killian et al. 2008, Roelle et al. 2017, Bechert and Fraker 2018), but unacceptably poor efficacy in a subsequent trial (Kane 2018). Kirkpatrick et al. (1992) noted effects on horse ovaries after three years of treatment with PZP. Observations at Assateague Island National Seashore 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 eventually 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).

Effects on Existing Pregnancies, Foals, and Birth Phenology

If a mare is already pregnant, the PZP vaccine has not been shown to affect normal development of the fetus or foal, or the hormonal health of the mare with relation to pregnancy (Kirkpatrick and Turner 2003). It is possible that there may be transitory effects on foals born to mares treated with PZP. In mice, Sacco et al. (1981) found that antibodies specific to PZP can pass from mother mouse to pup via the placenta or colostrum, but that did not apparently cause any innate immune response in the offspring: the level of those antibodies were undetectable by 116 days after birth. There was no indication in that study that the fertility or ovarian function of those mouse pups was compromised, nor is BLM aware of any such results in horses or burros. Unsubstantiated speculative connections between PZP treatment and 'foal stealing' has not been published in a peer-reviewed study and thus cannot be verified. 'Foal stealing,' where a near-term pregnant mare steals a neonate foal from a weaker mare, is unlikely to be a common behavioral result of including spayed mares in a wild horse herd. McDonnell (2012) noted that "foal stealing is rarely observed in horses, except under crowded conditions and synchronization of foaling," such as in horse feed lots. Those conditions are not likely in the wild, where pregnant mares will be widely distributed across the landscape, and where the expectation is that parturition dates would be distributed across the normal foaling season. Similarly, although Nettles (1997) noted reported stillbirths

after PZP treatments in cynomolgus monkeys, those results have not been observed in equids despite extensive use in horses and burros.

On-range observations from 20 years of application to wild horses indicate that PZP application in wild mares does not generally cause mares to give birth to foals out of season or late in the year (Kirkpatrick and Turner 2003). Nuñez's (2010) research showed that a small number of mares that had previously been treated with PZP foaled later than untreated mares and expressed the concern that this late foaling "may" impact foal survivorship and decrease band stability, or that higher levels of attention from stallions on PZP-treated mares might harm those mares. However, that paper provided no evidence that such impacts on foal survival or mare well-being actually occurred. Rubenstein (1981) called attention to a number of unique ecological features of horse herds on Atlantic barrier islands, 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. Results from Ransom et al. (2013), however, showed that over 81% of the documented births in this study were between March 1 and June 21, i.e., within the normal, peak, spring foaling season. 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. Furthermore, Ransom et al. (2013) found no negative impacts on foal survival even with an extended birthing season. If there are shifts in birth phenology, though, it is reasonable to assume that some negative effects on foal survival might result from particularly severe weather events (Nuñez et al. 2018).

Effects of Marking and Injection

Standard practices for PZP treatment require that immunocontraceptive-treated animals be readily identifiable, either via brand marks or unique coloration (BLM 2010). Some level of transient stress is likely to result in newly captured mares that do not have markings associated with previous fertility control treatments. Handling may include freeze-marking, for the purpose of identifying that mare and identifying her PZP vaccine treatment history. Under past management practices, captured mares experienced increased stress levels from handling (Ashley and Holcombe 2001). Markings may also be used into the future to determine the approximate fraction of mares in a herd that have been previously treated, and could provide additional insight regarding gather efficiency.

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, French et al. 2017), 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. (2017a) found that injection site reactions had healed in most mares within 3 months after the booster dose, and that they did not affect movement or cause fever. 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

PZP treatment may increase mare survival rates, leading to longer potential lifespan (Turner and

Kirkpatrick 2002, Ransom et al. 2014a) that may be by as much as 5-10 years (NPS 2008). To the extent that this happens, changes in lifespan and decreased foaling rates could combine to cause changes in overall age structure in a treated herd (i.e., Turner and Kirkpatrick 2002, Roelle et al. 2010), with a greater prevalence of older mares in the herd (Gross 2000, NPS 2008). Observations of mares treated in past gathers showed that many of the treated mares were larger than, maintained higher body condition than, and had larger healthy foals than untreated mares. Should PZP booster 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. While it is conceivable that widespread and continued treatment with PZP could reduce the birth rates of the population to such a point that birth is consistently below mortality, that outcome is not likely unless a very high fraction of the mares present are all treated in almost every year.

Behavioral Effects

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. Nuñez (2010) found that PZP-treated mares had higher body condition than control mares in another population, presumably because energy expenditure was reduced by the absence of pregnancy and lactation. Knight (2014) found that PZP-treated mares had better body condition, lived longer and switched harems more frequently, while mares that foaled spent more time concentrating on grazing and lactation and had lower overall body condition. Studies on Assateague Island (Kirkpatrick and Turner 2002) showed that once 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 Nuñez 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, Duncan et al. 2017). There was no evidence, though, that mare welfare was affected by the increased level of herding by stallions noted in Ransom et al. (2010). Nuñez's later analysis (2017) noted no difference in mare reproductive behavior as a function of contraception history.

Ransom et al. (2010) found that control mares were herded by stallions more frequently than PZP- treated mares, and Nuñez et al. (2009, 2014, 2017, 2018) found that PZP-treated mares exhibited higher infidelity to their band stallion during the non-breeding season than control mares. Madosky et al. (2010) and Knight (2014) found this infidelity was also evident during the breeding season in the same population that Nuñez et al. (2009, 2010, 2014, 2017, 2018) studied. Nuñez et al. (2014, 2017, 2018) concluded that PZP-treated mares changing bands more frequently than control mares could lead to band instability. Nuñez et al. (2009), though, cautioned against generalizing from that island population to other herds. 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. Nuñez et al. 2014 wrote that these effects "…may be of limited concern when population reduction is an urgent priority." Nuñez (2018) noted (based on unpublished results) that band stallions of mares that have received PZP treatment can exhibit changes in behavior and physiology. Nuñez (2018) cautioned that PZP use may limit the ability of mares to return to fertility, but also noted that, "such aggressive treatments may be necessary when rapid reductions in animal numbers are of paramount importance…If

the primary management goal is to reduce population size, it is unlikely (and perhaps less important) that managers achieve a balance between population control and the maintenance of more typical feral horse behavior and physiology." 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 overall, long-term welfare or well-being have been established in these studies.

The National Research Council (2013) found that harem changing was not likely to result in serious adverse effects for treated mares:

> "The studies on Shackleford Banks (Nuñez et al., 2009; Madosky et al., 2010) suggest that there is an interaction between pregnancy and social cohesion. The importance of harem stability to mare well-being is not clear, but considering the relatively large number of free-ranging mares that have been treated with liquid PZP in a variety of ecological settings, the likelihood of serious adverse effects seem low."

Nuñez (2010) stated that not all populations will respond similarly to PZP treatment. Differences in habitat, resource availability, and demography among conspecific populations will undoubtedly affect their physiological and behavioral responses to PZP contraception, and 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."

Gonadotropin Releasing Hormone (GnRH) Vaccine

The National Research Council concluded in their 2013 report that GonaCon-B (which is produced under the trade name GonaCon-Equine for use in feral horses and burros) was one of the most preferable available methods for contraception in wild horses and burros (NRC 2013), in terms of delivery method, availability, efficacy, and side effects. GonaCon-Equine is approved for use in free-ranging wild horse herds by authorized federal, state, tribal, public and private personnel, for application to wild and feral equids in the United States (EPA 2013, 2015). GonaCon-Equine has been used on feral horses in Theodore Roosevelt National Park and on wild horses by BLM (BLM 2015). GonaCon-Equine can be remotely administered in the field in cases where mares are relatively approachable, using a customized pneumatic dart (McCann et al. 2017). Use of remotely delivered (dart-delivered) vaccine is generally limited to populations where individual animals can be accurately identified and repeatedly approached within 50 m (BLM 2010).

GonaCon is another immunocontraceptive vaccine which has been shown to provide multiple years of infertility in several wild ungulate species, including horses (Killian et al., 2008; Gray et al., 2010). GonaCon uses the gonadotropin-releasing hormone (GnRH), a small neuropeptide that performs an obligatory role in mammalian reproduction, as the vaccine antigen. When combined with an adjuvant, the GnRH vaccine stimulates a persistent immune response resulting in prolonged antibody production against GnRH, the carrier protein, and the adjuvant (Miller et al., 2008). The most direct result of successful GnRH vaccination is that it has the effect of decreasing the level of GnRH signaling in the body, as evidenced by a drop in luteinizing hormone levels, and a cessation of ovulation. The lack of estrus cycling that results from successful GonaCon vaccination has been compared to typical winter period of anoestrus in open mares. As anti-GnRH antibodies decline over time, concentrations of available endogenous GnRH increase and treated animals usually regain fertility (Power et al., 2011).

The long-term goal of GonaCon-Equine use is to reduce or eliminate the need for gathers and removals (NRC 2013). The intended effect of the vaccine is as a contraceptive. GonaCon is produced as a pharmaceutical-grade vaccine, including aseptic manufacturing technique to deliver a sterile vaccine

product (Miller et al. 2013).

GonaCon-Equine vaccine is an EPA-approved pesticide (EPA, 2009a) that is relatively inexpensive, meets BLM requirements for safety to mares and the environment, and is produced in a USDA-APHIS laboratory. Miller et al. (2013) reviewed the vaccine environmental safety and toxicity. When advisories on the product label (EPA 2015) are followed, the product is safe for users and the environment (EPA 2009b). EPA waived a number of tests prior to registering the vaccine, because GonaCon was deemed to pose low risks to the environment, so long as the product label is followed (Wang-Cahill et al., *in press*).

GonaCon-Equine can safely be reapplied as necessary to control the population growth rate; booster dose effects may lead to increased effectiveness of contraception, which is generally the intent. Even with one booster treatment of GonaCon-Equine, it is expected that most, if not all, mares would return to fertility at some point, although the average duration of effect after booster doses has not yet been quantified. Although it is unknown what would be the expected rate for the return to fertility rate in mares boosted more than once with GonaCon-Equine, a prolonged return to fertility would be consistent with the desired effect of using GonaCon (e.g., effective contraception). Once the herd size in the project area is at AML and population growth seems to be stabilized, BLM could make a determination as to the required frequency of new mare treatments and mare re-treatments with GonaCon, to maintain the number of horses within AML.

Direct Effects of GnRH Vaccine

GonaCon-Equine is one of several vaccines that have been engineered to create an immune response to the gonadotropin releasing hormone peptide (GnRH). GnRH is a small peptide that plays an important role in signaling the production of other hormones involved in reproduction in both sexes. GnRH is highly conserved across mammalian taxa, so some inferences about the mechanism and effects of GonaCon-Equine in horses can be made from studies that used different anti-GnRH vaccines, in horses and other taxa. Other commercially available anti-GnRH vaccines include: Improvac (Imboden et al. 2006, Botha et al. 2008, Janett et al. 2009a, Janett et al. 2009b, Schulman et al. 2013, Dalmau et al. 2015), made in South Africa; Equity (Elhay et al. 2007), made in Australia; Improvest, for use in swine (Bohrer et al. 2014); Repro-BLOC (Boedeker et al. 2011); and Bopriva, for use in cows (Balet et al. 2014). Of these, GonaCon-Equine, Improvac, and Equity are specifically intended for horses. Other anti-GnRH vaccine formulations have also been tested, but did not become trademarked products (e.g., Goodloe 1991, Dalin et al 2002, Stout et al. 2003, Donovan et al. 2013, Schaut et al. 2018, Yao et al. 2018). The effectiveness and side-effects of these various anti-GnRH vaccines may not be the same as would be expected from GonaCon-Equine use in horses. Results could differ as a result of differences in the preparation of the GnRH antigen, and the choice of adjuvant used to stimulate the immune response. While GonaCon-Equine can be administered as a single dose, most other anti-GnRH vaccines require a primer dose and at least one booster dose to be effective.

GonaCon has been produced by USDA-APHIS (Fort Collins, Colorado) in several different formulations, the history of which is reviewed by Miller et al. (2013). In any vaccine, the antigen is the stimulant to which the body responds by making antigen-specific antibodies. Those antibodies then signal to the body that a foreign molecule is present, initiating an immune response that removes the molecule or cell. GonaCon vaccines present the recipient with hundreds of copies of GnRH as peptides on the surface of a linked protein that is naturally antigenic because it comes from invertebrate hemocyanin (Miller et al 2013). Early GonaCon formulations linked many copies of GnRH to a protein from the keyhole limpet (GonaCon-KHL), but more recently produced formulations where the GnRH antigen is linked to a protein from the blue mussel (GonaCon-B) proved less expensive and more effective (Miller et al. 2008). GonaCon-Equine is in the category of GonaCon-B vaccines.

Adjuvants are included in vaccines to elevate the level of immune response, inciting recruitment of lymphocytes and other immune cells which foster a long-lasting immune response that is specific to the

antigen. For some formulations of anti-GnRH vaccines, a booster dose is required to elicit a contraceptive response, though GonaCon can cause short-term contraception in a fraction of treated animals from one dose (Powers et al. 2011, Gionfriddo et al. 2011a, Baker et al. 2013, Miller et al 2013). The adjuvant used in GonaCon, Adjuvac, generally leads to a milder reaction than Freund's Complete Adjuvant (Powers et al. 2011). Adjuvac contains a small number of killed *Mycobacterium avium* cells (Miller et al. 2008, Miller et al. 2013). The antigen and adjuvant are emulsified in mineral oil, such that they are not all presented to the immune system right after injection. It is thought that the mineral oil emulsion leads to a 'depot effect' that is associated with slow or sustained release of the antigen, and a resulting longer-lasting immune response (Miller et al. 2013). Miller et al. (2008, 2013) have speculated that, in cases where memory-B leukocytes are protected in immune complexes in the lymphatic system, it can lead to years of immune response. Increased doses of vaccine may lead to stronger immune reactions, but only to a certain point; when Yoder and Miller (2010) tested varying doses of GonaCon in prairie dogs, antibody responses to the 200μg and 400μg doses were equal to each other but were both higher than in response to a 100μg dose.

The most direct result of successful GnRH vaccination is that it has the effect of decreasing the level of GnRH signaling in the body, as evidenced by a drop in luteinizing hormone levels, and a cessation of ovulation. Antibody titer measurements are proximate measures of the antibody concentration in the blood specific to a given antigen. Anti-GnRH titers generally correlate with a suppressed reproduction system (Gionfriddo et al. 2011a, Powers et al. 2011). Various studies have attempted to identify a relationship between anti-GnRH titer levels and infertility, but that relationship has not been universally predictable or consistent. The time length that titer levels stay high appears to correlate with the length of suppressed reproduction (Dalin et al. 2002, Levy et al. 2011, Donovan et al. 2013, Powers et al. 2011). For example, Goodloe (1991) noted that mares did produce elevated titers and had suppressed follicular development for 11-13 weeks after treatment, but that all treated mares ovulated after the titer levels declined. Similarly, Elhay (2007) found that high initial titers correlated with longer-lasting ovarian and behavioral anoestrus. However, Powers et al. (2011) did not identify a threshold level of titer that was consistently indicative of suppressed reproduction despite seeing a strong correlation between antibody concentration and infertility, nor did Schulman et al. (2013) find a clear relationship between titer levels and mare acyclicity.

In many cases, young animals appear to have higher immune responses, and stronger contraceptive effects of anti-GnRH vaccines than older animals (Brown et al. 1994, Curtis et al. 2001, Stout et al. 2003, Schulman et al. 2013). Vaccinating with GonaCon at too young an age, though, may prevent effectiveness; Gionfriddo et al. (2011a) observed weak effects in 3-4 month old fawns. It has not been possible to predict which individuals of a given age class will have long-lasting immune responses to the GonaCon vaccine. Gray (2010) noted that mares in poor body condition tended to have lower contraceptive efficacy in response to GonaCon-B. Miller et al. (2013) suggested that higher parasite loads might have explained a lower immune response in free-roaming horses than had been observed in a captive trial. At this time it is unclear what the most important factors affecting efficacy are.

Females that are successfully contracepted by GnRH vaccination enter a state similar to anestrus, have a lack of or incomplete follicle maturation, and no ovarian cycling (Botha et al. 2008). A leading hypothesis is that anti-GnRH antibodies bind GnRH in the hypothalamus – pituitary 'portal vessels,' preventing GnRH from binding to GnRH-specific binding sites on gonadotroph cells in the pituitary, thereby limiting the production of gonadotropin hormones, particularly luteinizing hormone (LH) and, to a lesser degree, follicle-stimulating hormone (FSH) (Powers et al. 2011, NRC 2013). This reduction in LH (and FSH), and a corresponding lack of ovulation, has been measured in response to treatment with anti-GnRH vaccines (Boedeker et al. 2011, Garza et al. 1986).

Females successfully treated with anti-GnRH vaccines have reduced progesterone levels (Garza et al. 1986, Stout et al. 2003, Imboden et al. 2006, Elhay 2007, Botha et al. 2008, Killian et al. 2008, Miller et

al. 2008, Janett et al. 2009, Schulman et al. 2013, Balet et al 2014, Dalmau et al. 2015) and β-17 estradiol levels (Elhay et al. 2007), but no great decrease in estrogen levels (Balet et al. 2014). Reductions in progesterone do not occur immediately after the primer dose, but can take several weeks or months to develop (Elhay et al. 2007, Botha et al. 2008, Schulman et al. 2013, Dalmau et al. 2015). This indicates that ovulation is not occurring and corpora lutea, formed from post-ovulation follicular tissue, are not being established.

Changes in hormones associated with anti-GnRH vaccination lead to measurable changes in ovarian structure and function. The volume of ovaries reduced in response to treatment (Garza et al. 1986, Dalin et al. 2002, Imboden et al. 2006, Elhay et al. 2007, Botha et al. 2008, Gionfriddo 2011a, Dalmau et al. 2015). Treatment with an anti-GnRH vaccine changes follicle development (Garza et al. 1986, Stout et al. 2003, Imboden et al. 2006, Elhay et al. 2007, Donovan et al. 2013, Powers et al. 2011, Balet et al. 2014), with the result that ovulation does not occur. A related result is that the ovaries can exhibit less activity and cycle with less regularity or not at all in anti-GnRH vaccine treated females (Goodloe 1991, Dalin et al. 2002, Imboden et al. 2006, Elhay et al. 2007, Janett et al. 2009a, Powers et al. 2011, Donovan et al. 2013). In studies where the vaccine required a booster, hormonal and associated results were generally observed within several weeks after delivery of the booster dose.

Contraceptive Effects of GnRH

The NRC (2013) review pointed out that single doses of GonaCon-Equine do not lead to high rates of initial effectiveness, or long duration. Initial effectiveness of one dose of GonaCon-Equine vaccine appears to be lower than for a combined primer plus booster dose of the PZP vaccine Zonastat-H (Kirkpatrick et al. 2011), and the initial effect of a single GonaCon dose can be limited to as little as one breeding season. However, preliminary results on the effects of boostered doses of GonaCon-Equine indicate that it can have high efficacy and longer-lasting effects in free-roaming horses (Baker et al. 2017) than the one-year effect that is generally expected from a single booster of Zonastat-H.

GonaCon and other anti-GnRH vaccines can be injected while a female is pregnant (Miller et al. 2000, Powers et al. 2011, Baker et al. 2013) – in such a case, a successfully contracepted mare will be expected to give birth during the following foaling season, but to be infertile during the same year's breeding season. Thus, a mare injected in November of 2018 would not show the contraceptive effect (i.e., no new foal) until spring of 2020.

Too few studies have reported on the various formulations of anti-GnRH vaccines to make generalizations about differences between products, but GonaCon formulations were consistently good at causing loss of fertility in a statistically significant fraction of treated mares for at least one year (Killian et al. 2009, Gray et al. 2010, Baker et al. 2013, 2017). With few exceptions (e.g., Goodloe 1991), anti-GnRH treated mares gave birth to fewer foals in the first season when there would be an expected contraceptive effect (Botha et al. 2008, Killian et al. 2009, Gray et al. 2010, Baker et al. 2013). Goodloe (1991) used an anti-GnRH-KHL vaccine with a triple adjuvant, in some cases attempting to deliver the vaccine to horses with a hollow-tipped 'biobullet,'but concluded that the vaccine was not an effective immunocontraceptive in that study.

Not all mares should be expected to respond to the GonaCon-equine vaccine; some number should be expected to continue to become pregnant and give birth to foals. In studies where mares were exposed to stallions, the fraction of treated mares that are effectively contracepted in the year after anti-GnRH vaccination varied from study to study, ranging from ~50% (Baker et al. 2017), to 61% (Gray et al. 2010), to ~90% (Killian et al. 2006, 2008, 2009). Miller et al. (2013) noted lower effectiveness in free-ranging mares (Gray et al. 2010) than captive mares (Killian et al. 2009). Some of these rates are lower than the high rate of effectiveness typically reported for the first year after PZP vaccine treatment (Kirkpatrick et al. 2011). In the one study that tested for a difference, darts and hand-injected GonaCon doses were equally effective in terms of fertility outcome (McCann et al. 2017).

In studies where mares were not exposed to stallions, the duration of effectiveness also varied. A primer and booster dose of Equity led to anoestrus for at least 3 months (Elhay et al. 2007). A primer and booster dose of Improvac also led to loss of ovarian cycling for all mares in the short term (Imboden et al. 2006). It is worth repeating that those vaccines do not have the same formulation as GonaCon. Results from horses (Baker et al. 2017) and other species (Curtis et al. 2001) suggest that providing a booster dose of GonaCon-Equine will increase the fraction of temporarily infertile animals to higher levels than would a single vaccine dose alone.

Longer-term infertility has been observed in some mares treated with anti-GnRH vaccines, including GonaCon-Equine. In a single-dose mare captive trial with an initial year effectiveness of 94%, Killian et al. (2008) noted infertility rates of 64%, 57%, and 43% in treated mares during the following three years, while control mares in those years had infertility rates of 25%, 12%, and 0% in those years. GonaCon effectiveness in free-roaming populations was lower, with infertility rates consistently near 60% for three years after a single dose in one study (Gray et al. 2010) and annual infertility rates decreasing over time from 55% to 30% to 0% in another study with one dose (Baker et al. 2017). Similarly, gradually increasing fertility rates were observed after single dose treatment with GonaCon in elk (Powers et al. 2011) and deer (Gionfriddo et al. 2011a).

Baker et al. (2017) observed a return to fertility over 4 years in mares treated once with GonaCon, but then noted extremely low fertility rates of 0% and 16% in the two years after the same mares were given a booster dose four years after the primer dose. Four of nine mares treated with primer and booster doses of Improvac did not return to ovulation within 2 years of the primer dose (Imboden et al. 2006), though one should probably not make conclusions about the long-term effects of GonaCon-Equine based on results from Improvac.

It is difficult to predict which females will exhibit strong or long-term immune responses to anti-GnRH vaccines (Killian et al. 2006, Miller et al. 2008, Levy et al. 2011). A number of factors may influence responses to vaccination, including age, body condition, nutrition, prior immune responses, and genetics (Cooper and Herbert 2001, Curtis et al. 2001, Powers et al. 2011). One apparent trend is that animals that are treated at a younger age, especially before puberty, may have stronger and longer-lasting responses (Brown et al. 1994, Curtis et al. 2001, Stout et al. 2003, Schulman et al. 2013). It is plausible that giving ConaGon-Equine to prepubertal mares will lead to long-lasting infertility, but that has not yet been tested.

To date, short term evaluation of anti-GnRH vaccines, show contraception appears to be temporary and reversible. Killian et al. noted long-term effects of GonaCon in some captive mares (2009). However, Baker et al. (2017) observed horses treated with GonaCon-B return to fertility after they were treated with a single primer dose; after four years, the fertility rate was indistinguishable between treated and control mares. It appears that a single dose of GonaCon results in reversible infertility. Although it is unknown whether long-term treatment would result in permanent infertility, such permanent infertility would be consistent with the desired effect of using GonaCon (e.g., effective contraception).

Other anti-GnRH vaccines also have had reversible effects in mares. Elhay (2007) noted a return to ovary functioning over the course of 34 weeks for 10 of 16 mares treated with Equity. That study ended at 34 weeks, so it is not clear when the other six mares would have returned to fertility. Donovan et al. (2013) found that half of mares treated with an anti-GnRH vaccine intended for dogs had returned to fertility after 40 weeks, at which point the study ended. In a study of mares treated with a primer and booster dose of Improvac, 47 of 51 treated mares had returned to ovarian cyclicity within 2 years; younger mares appeared to have longer-lasting effects than older mares (Schulman et al. 2013). Joonè et al. (2017) analyzed samples from the Schulman et al. (2013) study, and found no significant decrease in anti-Mullerian hormone (AMH) levels in mares treated with GnRH vaccine. AMH levels are thought to be an indicator of ovarian function, so results from Joonè et al. (2017) support the general view that the anoestrus resulting from GnRH vaccination is physiologically similar to typical winter anoestrus. In a small study with a non-commercial anti-GnRH vaccine (Stout et al. 2003), three of seven treated mares

had returned to cyclicity within 8 weeks after delivery of the primer dose, while four others were still suppressed for 12 or more weeks. In elk, Powers et al. (2011) noted that contraception after one dose of GonaCon was reversible. In white-tailed deer, single doses of GonaCon appeared to confer two years of contraception (Miller et al. 2000). Ten of 30 domestic cows treated became pregnant within 30 weeks after the first dose of Bopriva (Balet et al. 2014).

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

In summary, based on the above results related to fertility effects of GonaCon and other anti-GnRH vaccines, application of a single dose of GonaCon-Equine to gathered or remotely-darted wild horses could be expected to prevent pregnancy in perhaps 30%-60% of mares for one year. Some smaller number of wild mares should be expected to have persistent contraception for a second year, and less still for a third year. Applying one booster dose of GonaCon to previously-treated mares should lead to two or more years with relatively high rates (80+%) of additional infertility expected, with the potential that some as-yet-unknown fraction of boostered mares may be infertile for several to many years. There is no data to support speculation regarding efficacy of multiple boosters of GonaCon-Equine; however, given it is formulated as a highly immunogenic long-lasting vaccine, it is reasonable to hypothesize that additional boosters would increase the effectiveness and duration o of the vaccine.

GonaCon-Equine only affects the fertility of treated animals; untreated animals would still be expected to give birth. Even under favorable circumstances for population growth suppression, gather efficiency might not exceed 85% via helicopter, and may be less with bait and water trapping. Similarly, not all animals may be approachable for darting. The uncaptured or undarted portion of the female population would still be expected to have normally high fertility rates in any given year, though those rates could go up slightly if contraception in other mares increases forage and water availability.

Effects of GnRH Vaccine on Other Organ Systems

Mares that receive any vaccine as part of a gather operation would experience slightly increased stress levels associated with handling while being vaccinated and freeze-marked, and potentially microchipped. 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 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, and the timing of treatments required into the future. 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 immunocontraceptive treatments are possible in treated mares (Roelle and Ransom 2009). Whether injection is by hand or via darting, GonaCon-Equine is associated with some degree of inflammation, swelling, and the potential for abscesses at the injection site (Baker et al. 2013). Swelling or local reactions at the injection site are generally expected to be minor in nature, but some may develop into draining abscesses. When PZP vaccine was delivered via dart it led to more severe swelling and injection site reactions (Roelle and Ransom 2009), but that was not observed with dart-delivered GonaCon (McCann et al. 2017). Mares treated with one formulation of GnRH-KHL vaccine developed pyogenic abscesses (Goodloe 1991). Miller et al. (2008) noted that the water and oil

emulsion in GonaCon will often cause cysts, granulomas, or sterile abscesses at injection sites; in some cases, a sterile abscess may develop into a draining abscess. In elk treated with GonaCon, Powers et al. (2011) noted up to 35% of treated elk had an abscess form, despite the injection sites first being clipped and swabbed with alcohol. Even in studies where swelling and visible abscesses followed GonaCon immunization, the longer term nodules observed did not appear to change any animal's range of movement or locomotor patterns (Powers et al. 2013, Baker et al. 2017).

The result that other formulations of anti-GnRH vaccine may be associated with less notable injection site reactions in horses may indicate that the adjuvant formulation in GonaCon leads a single dose to cause a stronger immune reaction than the adjuvants used in other anti-GnRH vaccines. Despite that, a booster dose of GonaCon-Equine appears to be more effective than a primer dose alone (Baker et al. 2017). Horses injected in the hip with Improvac showed only transient reactions that disappeared within 6 days in one study (Botha et al. 2008), but stiffness and swelling that lasted 5 days were noted in another study where horses received Improvac in the neck (Imboden et al. 2006). Equity led to transient reactions that resolved within a week in some treated animals (Elhay et al. 2007). Donovan et al. noted no reactions to the canine anti-GnRH vaccine (2013). In cows treated with Bopriva there was a mildly elevated body temperature and mild swelling at injection sites that subsided within 2 weeks (Balet et al. 2014).

Several studies have monitored animal health after immunization against GnRH. GonaCon treated mares did not have any measurable difference in uterine edema (Killian 2006, 2008). Powers et al. (2011, 2013) noted no differences in blood chemistry except a mildly elevated fibrinogen level in some GonaCon treated elk. In that study, one sham-treated elk and one GonaCon treated elk each developed leukocytosis, suggesting that there may have been a causal link between the adjuvant and the effect. Curtis et al. (2008) found persistent granulomas at GonaCon-KHL injection sites three years after injection, and reduced ovary weights in treated females. Yoder and Miller (2010) found no difference in blood chemistry between GonaCon treated and control prairie dogs. One of 15 GonaCon treated cats died without explanation, and with no determination about cause of death possible based on necropsy or histology (Levy et al. 2011). Other anti-GnRH vaccine formulations have led to no detectable adverse effects (in elephants; Boedeker et al. 2011), though Imboden et al. (2006) speculated that young treated animals might conceivably have impaired hypothalamic or pituitary function.

Kirkpatrick et al. (2011) raised concerns that anti-GnRH vaccines could lead to adverse effects in other organ systems outside the reproductive system. GnRH receptors have been identified in tissues outside of the pituitary system, including in the testes and placenta (Khodr and Siler-Khodr 1980), ovary (Hsueh and Erickson 1979), bladder (Coit et al. 2009), heart (Dong et al. 2011), and central nervous system, so it is plausible that reductions in circulating GnRH levels could inhibit physiological processes in those organ systems. Kirkpatrick et al. (2011) noted elevated cardiological risks to human patients taking GnRH agonists (such as leuprolide), but the National Academy of Sciences (2013) concluded that the mechanism and results of GnRH agonists would be expected to be different from that of anti-GnRH antibodies; the former flood GnRH receptors, while the latter deprive receptors of GnRH.

GnRH Vaccine Effects on Fetus and Foal

GonaCon had no apparent effect on pregnancies in progress, foaling success, or the health of offspring, in horses that were immunized in October (Baker et al. 2013), elk immunized 80-100 days into gestation (Powers et al. 2011, 2013), or deer immunized in February (Miller et al. 2000). Kirkpatrick et al. (2011) noted that anti-GnRH immunization is not expected to cause hormonal changes that would lead to abortion in the horse, but this may not be true for the first 6 weeks of pregnancy (NRC 2013). Curtis et al. (2011) noted that GonaCon-KHL treated white tailed deer had lower twinning rates than controls, but speculated that the difference could be due to poorer sperm quality late in the breeding season, when the treated does did become pregnant. Goodloe (1991) found no difference in foal production between treated and control animals.

Offspring of anti-GnRH vaccine treated mothers could exhibit an immune response to GnRH (Khodr and Siler-Khodr 1980), as antibodies from the mother could pass to the offspring through the placenta or colostrum. In the most extensive study of long-term effects of GonaCon immunization on offspring, Powers et al. (2012) monitored 15 elk fawns born to GonaCon treated cows. Of those, 5 had low titers at birth and 10 had high titer levels at birth. All 15 were of normal weight at birth, and developed normal endocrine profiles, hypothalamic GnRH content, pituitary gonadotropin content, gonad structure, and gametogenesis. All the females became pregnant in their second reproductive season, as is typical. All males showed normal development of secondary sexual characteristics. Powers et al. (2012) concluded that suppressing GnRH in the neonatal period did not alter long-term reproductive function in either male or female offspring. Miller et al. (2013) report elevated anti-GnRH antibody titers in fawns born to treated white tailed deer, but those dropped to normal levels in 11 of 12 of those fawns, which came into breeding condition; the remaining fawn was infertile for three years.

Direct effects on foal survival are equivocal in the literature. Goodloe (1991), reported lower foal survival for a small sample of foals born to anti-GnRH treated mares, but she did not assess other possible explanatory factors such as mare social status, age, body condition, or habitat in her analysis (NRC 2013). Gray et al. (2010) found no difference in foal survival in foals born to free-roaming mares treated with GonaCon.

There is little empirical information available to evaluate the effects of GnRH vaccination on foaling phenology. Curtis et al. (2001) did observe a slightly later fawning date for GonaCon treated deer in the second year after treatment, when some does regained fertility late in the breeding season. In anti-GnRH vaccine trials in free-roaming horses, there were no published differences in mean date of foal production (Goodloe 1991, Gray et al. 2010). Unpublished results from an ongoing study of GonaCon treated free-roaming mares indicate that some degree of aseasonal foaling is possible (D. Baker, Colorado State University, personal communication to Paul Griffin, BLM WH&B Research Coordinator).

Indirect Effects of GnRH Vaccination

Body condition of anti-GnRH-treated females was equal to or better than that of control females in published studies. Ransom et al. (2014b) observed no difference in mean body condition between GonaCon-B treated mares and controls. Goodloe (1991) found that GnRH-KHL treated mares had higher survival rates than untreated controls. In other species, treated deer had better body condition than controls (Gionfriddo et al. 2011b), treated cats gained more weight than controls (Levy et al. 2011), as did treated young female pigs (Bohrer et al. 2014). Should GonaCon-Equine treatment, including booster doses, continue into the future, with treatments given on a schedule to maintain a lowered level of fertility in the herd, the chronic cycle of overpopulation and large gathers and removals might no longer occur, but instead a consistent abundance of wild horses could be maintained, resulting in continued improvement of overall habitat conditions and animal health. While it is conceivable that widespread and continued treatment with GonaCon-Equine could reduce the birth rates of the population to such a point that birth is consistently below mortality, that outcome is not likely unless a very high fraction of the mares present are all treated with primer and booster doses, and perhaps repeated booster doses.

Behavioral Effects of GnRH Vaccination

Behavioral differences should be considered as potential consequences of contraception with GonaCon. The NRC (2013) noted that all successful fertility suppression has effects on mare behavior, mostly as a result of the lack of pregnancy and foaling, and concluded that GonaCon was a good choice for use in the program. The result that GonaCon treated mares may have suppressed estrous cycles throughout the breeding season can lead treated mares to behave in ways that are functionally similar to pregnant mares.

While successful in mares, GonaCon and other anti-GnRH vaccines are expected to induce fewer estrous cycles when compared to non-pregnant control mares. This has been observed in many studies (Garza et al. 1986, Curtis et al. 2001, Dalin et al. 2002, Killian et al. 2006, Dalmau et al. 2015). In contrast, PZP

vaccine is generally expected to lead mares to have more estrous cycles per breeding season, as they continue to be receptive to mating while not pregnant. Females treated with GonaCon had fewer estrous cycles than control or PZP-treated mares (Killian et al. 2006) or deer (Curtis et al. 2001). Thus, concerns about PZP treated mares receiving more courting and breeding behaviors from stallions (Nuñez et al. 2009, Ransom et al. 2010) are not generally expected to be a concern for mares treated with anti-GnRH vaccines (Botha et al. 2008).

Ransom et al. (2014b) found that GonaCon treated mares had similar rates of reproductive behaviors that were similar to those of pregnant mares. Among other potential causes, the reduction in progesterone levels in treated females may lead to a reduction in behaviors associated with reproduction. Despite this, some females treated with GonaCon or other anti-GnRH vaccines did continue to exhibit reproductive behaviors, albeit at irregular intervals and durations (Dalin et al. 2002, Stout et al. 2003, Imboden et al. 2006), which is a result that is similar to spayed (ovariectomized) mares (Asa et al. 1980). Gray et al. (2009) found no difference in sexual behaviors in mares treated with GonaCon and untreated mares. When progesterone levels are low, small changes in estradiol concentration can foster reproductive estrous behaviors (Imboden et al. 2006). Owners of anti-GnRH vaccine treated mares reported a reduced number of estrous-related behaviors under saddle (Donovan et al. 2013). Treated mares may refrain from reproductive behavior even after ovaries return to cyclicity (Elhay et al. 2007). Studies in elk found that GonaCon treated cows had equal levels of precopulatory behaviors as controls (Powers et al. 2011), though bull elk paid more attention to treated cows late in the breeding season, after control cows were already pregnant (Powers et al. 2011).

Stallion herding of mares, and harem switching by mares are two behaviors related to reproduction that might change as a result of contraception. Ransom et al. (2014b) observed a 50% decrease in herding behavior by stallions after the free-roaming horse population at Theodore Roosevelt National Park was reduced via a gather, and mares there were treated with GonaCon-B. The increased harem tending behaviors by stallions were directed to both treated and control mores. It is difficult to separate any effect of GonaCon in this study from changes in horse density and forage following horse removals.

With respect to treatment with GonaCon or other anti-GnRH vaccines, it is probably less likely that treated mares will switch harems at higher rates than untreated animals, because treated mares are similar to pregnant mares in their behaviors (Ransom et al. 2014b). Indeed, Gray et al. (2009) found no difference in band fidelity in a free-roaming population of horses with GonaCon treated mares, despite differences in foal production between treated and untreated mares. Ransom et al. (2014b) actually found increased levels of band fidelity after treatment, though this may have been partially a result of changes in overall horse density and forage availability.

Even in cases where there may be changes in band fidelity, 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."

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."

The NRC (2013) provides a comprehensive review of the literature on the behavioral effects of contraception that puts Nuñez's (2009, 2010) research 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)."

Gray et al. (2009) and Ransom et al. (2014b) monitored non-reproductive behaviors in GonaCon treated populations of free-roaming horses. Gray et al. (2009) found no difference between treated and untreated mares in terms of activity budget, sexual behavior, proximity of mares to stallions, or aggression. Ransom et al. (2014b) found only minimal differences between treated and untreated mare time budgets, but those differences were consistent with differences in the metabolic demands of pregnancy and lactation in untreated mares, as opposed to non-pregnant treated mares.

Genetic Effects of Immunocontraception

Even if it is the case that booster treatment with either PZP or GonaCon 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 genetic markers that have been identified as unique or historically unusual (NRC 2013). 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 cases where all four of the following conditions are met: starting levels of genetic diversity are low, initial population size is 100 or less, 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 a hypothesis that lack of response to immunocontraceptives could be a heritable trait, and that the frequency of that trait will increase over time in a population of 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 immunocontraception 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).

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 at a large scale.

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. Correlations between immune response and physical factors such as age and body condition have been documented; it remains untested whether or not those factors play a larger role in determining immune response to immunocontraceptives than heritable traits. Several studies discussed above noted a relationship between the strength of individuals' immune responses after treatment with GonaCon or other anti-GnRH vaccines, and factors related to body condition. For example, age at immunization was a primary factor associated with different measures of immune response, with young animals tending to have stronger and longer-lasting responses (Stout et al. 2003, Schulman et al. 2013). It is also 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 (Gray 2009, NRC 2013). Miller et al. (2013) speculated that animals with high parasite loads also may have weaker immune reactions to GonaCon.

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 would be speculative at this point, with results likely to depend on several factors, including: the strength of the genetic predisposition to not respond to GonaCon-Equine; 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 GonaCon-Equine (which generally has a short-acting effect, if any); the number of mares treated with a booster dose of GonaCon-Equine (which appears to cause a longer-lasting effect); and the actual size of the genetically-interacting metapopulation of horses within which the GonaCon treatment takes place.

The NRC report (2013) provides a comprehensive review of the literature on the behavioral effects of contraception that puts research up to that date by Nuñez et al. (2009, 2010) into the broader context of all of the available scientific literature, and cautions, based on its extensive review of the literature that:

> ". . . in no case can the committee conclude from the published research that the behavior differences observed are due to a particular compound rather than to the fact that treated animals had no offspring during the study. That must be borne in mind particularly in interpreting long-term impacts of contraception (e.g., repeated years of reproductive "failure" due to contraception)."

Surgical Sterilization Techniques

Surgical sterilization techniques, while not reversible, may control horse reproduction without the kind of additional handling or darting that can be needed to administer contraceptive vaccines. In this sense, sterilization surgeries can be used to achieve herd management objectives with a relative minimum level of animal handling and management over the long term. In the Wild Horse Act, Congress specified that sterilization is an acceptable management action (16 USC §1333.b.1). Sterilization is not one of the clearly defined events that cause an animal to lose its status as a wild free-roaming horse (16 USC §1333.2.C.d). Several academics have offered their opinions about whether gelding a given stallion would lead to that individual effectively losing its status as a wild horse (Rutberg 2011, Kirkpatrick 2012, Nock 2017). Those opinions are based on a semantic and subjective definition of 'wild,' and not any definition

or criteria provided in the Wild Horse Act or implementing regulations. In addition, no studies have been conducted to analyze whether gelding wild stallions would cause them to become docile.

Ovariectomy via Colpotomy Procedure

Colpotomy is a surgical technique in which there is no external incision, reducing susceptibility to infection. For this reason, ovariectomy via colpotomy has been identified as a good choice for feral or wild horses (Rowland et al. 2018). Ovariectomy via colpotomy is a relatively short surgery, with a relatively quick expected recovery time. The ovariectomy via colpotomy procedure has been conducted for over 100 years, normally on non-pregnant, domestic mares. Removal of the ovaries is permanent and 100 percent effective, however the procedure is not without risk.

Ovariectomy via Flank Laparoscopy Procedure

Flank laparoscopy (Lee and Hendrickson 2008) is commonly used in domestic horses for application in mares due to its minimal invasiveness and full observation of the operative field. Ovariectomy via flank laparoscopy was seen as the lowest risk method considered by a panel of expert reviewers convened by USGS (Bowen 2015). In a review of unilateral and bilateral laparoscopic ovariectomy on 157 mares, Röcken et al. (2011) found that 10.8% of mares had minor post-surgical complications, and recorded no mortality. Mortality due to this type of surgery, or post-surgical complications, is not expected, but is a possibility. In two studies, ovariectomy by laparoscopy or endoscope-assisted colpotomy did not cause mares to lose weight, and there was no need for rescue analgesia following surgery (Pader et al. 2011, Bertin et al. 2013). This surgical approach entails three small incisions on the animal's flank, through which three cannulae (tubes) allow entry of narrow devices to enter the body cavity: these are the insufflator, endoscope, and surgical instrument. The surgical procedure involves the use of narrow instruments introduced into the abdomen via cannulas for the purpose of transecting the ovarian pedicle, but the insufflation should allow the veterinarian to navigate inside the abdomen without damaging other internal organs. The insufflator blows air into the cavity to increase the operating space between organs, and the endoscope provides a video feed to visualize the operation of the surgical instrument. This procedure can require a relatively long duration of surgery, but tends to lead to the lowest post-operative rates of complications. Flank laparoscopy may leave three small (<5 cm) visible scars on one side of the horse's flank, but even in performance horses these scars are considered minimal. It is expected that the tissues and musculature under the skin at the site of the incisions in the flank will heal quickly, leaving no long-lasting effects on horse health. Monitoring for up to two weeks at the facility where surgeries take place will allow for veterinary inspection of wound healing. The ovaries may be dropped into the abdomen, but this is not expected to cause any health problem; it is usually done in ovariectomies in cattle (e.g., the Willis Dropped Ovary Technique) and Shoemaker et al. (2014) found no problems with revascularization or necrosis in a study of young horses using this method.

Anticipated Effects of Surgery on a Pregnancy

The average mare gestation period ranges from 335 to 340 days (Evans et al. 1977, p. 373). There are few peer reviewed studies documenting the effects of ovariectomy on the success of pregnancy in a mare. A National Research Council (NRC) committee that reviewed research proposals in 2015 explained, "The mare's ovaries and their production of progesterone are required during the first 70 days of pregnancy to maintain the pregnancy" (NRC 2015). In female mammals, less progesterone is produced when ovaries are removed, but production does not cease (Webley and Johnson 1982). In 1977, Evans et al. stated that by 200 days, the secretion of progesterone by the corpora lutea is insignificant because removal of the ovaries does not result in abortion (p. 376). "If this procedure were performed in the first 120 days of pregnancy, the fetus would be resorbed or aborted by the mother. If performed after 120 days, the pregnancy should be maintained. The effect of ovary removal on a pregnancy at 90–120 days of gestation is unpredictable because it is during this stage of gestation that the transition from corpus luteum to placental support typically occurs" (NRC Proposal Review 2015). In 1979, Holtan et al. evaluated the

effects of bilateral ovariectomy at selected times between 25 and 210 days of gestation on 50 mature pony mares. Their results show that abortion (resorption) of the conceptus (fetus) occurred in all 14 mares ovariectomized before day 50 of gestation, that pregnancy was maintained in 11 of 20 mares after ovariectomy between days 50 and 70, and that pregnancy was not interrupted in any of 12 mares ovariectomized on days 140 to 210. Those results are similar to the suggestions of the NRC committee (2015).

For those pregnancies that are maintained following the procedure, likely those past approximately 120 days, the development of the foal is not expected to be affected. However, because this procedure is not commonly conducted on pregnant mares the rate of complications to the fetus has not yet been quantified. There is the possibility that entry to the abdominal cavity could cause premature births related to inflammation. However, after five months the placenta should hormonally support the pregnancy regardless of the presence or absence of ovaries. Gestation length was similar between ovariectomized and control mares (Holtan et al. 1979).

Anticipated Complications and Mortality Rates Associated with Ovariectomy via Colpotomy

Between 2009 and 2011, the Sheldon NWR in Nevada conducted ovariectomy via colpotomy surgeries (August through October) on 114 feral mares and released them back to the range with a mixture of sterilized stallions and untreated mares and stallions (Collins and Kasbohm 2016). Gestational stage was not recorded, but a majority of the mares were pregnant (Gail Collins, US Fish and Wildlife Service (USFWS), pers. comm.). Only a small number of mares were very close to full term. Those mares with late term pregnancies did not receive surgery as the veterinarian could not get good access to the ovaries due to the position of the foal (Gail Collins, USFWS, pers. comm.). After holding the mares for an average of 8 days after surgery for observation, they were returned to the range with other treated and untreated mares and stallions (Collins and Kasbohm 2016). During holding the only complications were observed within 2 days of surgery. The observed mortality rate for ovariectomized mares following the procedure was less than 2 percent (Collins and Kasbohm 2016, Pielstick pers. comm.).

During the Sheldon NWR ovariectomy study, mares generally walked out of the chute and started to eat; some would raise their tail and act as if they were defecating; however, in most mares one could not notice signs of discomfort (Bowen 2015). In their discussion of ovariectomy via colpotomy, McKinnon and Vasey (2007) considered the procedure safe and efficacious in many instances, able to be performed expediently by personnel experienced with examination of the female reproductive tract, and associated with a complication rate that is similar to or less than male castration. Nevertheless, all surgery is associated with some risk. Loesch et al. (2003) lists that following potential risks with colpotomy: pain and discomfort; injuries to the cervix, bladder, or a segment of bowel; delayed vaginal healing; eventration of the bowel; incisional site hematoma; intraabdominal adhesions to the vagina; and chronic lumbar or bilateral hind limb pain. Most horses, however, tolerate ovariectomy via colpotomy with very few complications, including feral horses (Collins and Kasbohm 2016). Evisceration is also a possibility, but these complications are considered rare (Prado and Schumacher, 2017). Mortality due to surgery or post-surgical complications is not anticipated, but it is a possibility and therefore every effort would be made to mitigate risks.

In September 2015, the BLM solicited the USGS to convene a panel of veterinary experts to assess the relative merits and drawbacks of several surgical ovariectomy techniques that are commonly used in domestic horses for potential application in wild horses. A table summarizing the various methods was sent to the BLM (Bowen 2015) and provides a concise comparison of several methods. Of these, ovariectomy via colpotomy was found to be relatively safe when practiced by an experienced surgeon and was associated with the shortest duration of potential complications after the operation. The panel discussed the potential for evisceration through the vaginal incision with this procedure. In marked contrast to a suggestion by the NRC Review (2013), this panel of veterinarians identified evisceration as

not being a probable risk associated with ovariectomy via colpotomy and "none of the panel participants had had this occur nor had heard of it actually occurring" (Bowen 2015).

Most spay surgeries on mares have low morbidity[1] and with the help of medications, pain and discomfort can be mitigated. Pain management is an important aspect of any ovariectomy (Rowland et al. 2018); according to surgical protocols that would be used, a long-lasting direct anesthetic would be applied to the ovarian pedicle, and systemic analgesics in the form of butorphanol and flunixin meglumine would be administered, as is compatible with accepted animal husbandry practices. In a study of the effects of bilateral ovariectomy via colpotomy on 23 mares, Hooper and others (1993) reported that post-operative problems were minimal (1 in 23, or 4%). Hooper et al. (1993) noted that four other mares were reported by owners as having some problems after surgery, but that evidence as to the role the surgery played in those subsequent problems was inconclusive. In contrast Röcken et al. (2011) noted a morbidity of 10.8% for mares that were ovariectomized via a flank laparoscopy. "Although 5 mares in our study had problems (repeated colic in 2 mares, signs of lumbar pain in 1 mare, signs of bilateral hind limb pain in 1 mare, and clinical signs of peritonitis in 1 mare) after surgery, evidence is inconclusive in each as to the role played by surgery" (Hooper et al. 1993). A recent study showed a 2.5% complication rate where one mare of 39 showed signs of moderate colic after laparoscopic ovariectomy (Devick 2018 personal communication).

Anticipated Effects on Mare Health and Behavior on the Range

Horses are anovulatory (do not ovulate/express estrous behavior) during the short days of late fall and early winter, beginning to ovulate as days lengthen and then cycling roughly every 21 days during the warmer months, with about 5 days of estrus (Asa et al. 1979, Crowell-Davis 2007). Estrus in mares is shown by increased frequency of proceptive behaviors: approaching and following the stallion, urinating, presenting the rear end, clitoral winking, and raising the tail towards the stallion (Asa et al. 1979, Crowell-Davis 2007). In most mammal species other thanprimates estrus behavior is not shown during the anovulatory period, and reproductive behavior is considered extinguished following spaying (Hart and Eckstein 1997). However mares may continue to demonstrate estrus behavior during the anovulatory period (Asa et al. 1980). Similarly, ovariectomized mares may also continue to exhibit estrous behavior (Scott and Kunze 1977, Kamm and Hendrickson 2007, Crabtree 2016), with one study finding that 30% of mares showed estrus signs at least once after surgery (Roessner et al 2015) and only 60 percent of ovariectomized mares cease estrous behavior following surgery (Loesch and Rodgerson 2003). Mares continue to show reproductive behavior following ovariectomy due to non-endocrine support of estrus behavior, specifically steroids from the adrenal cortex. Continuation of this behavior during the non-breeding season has the function of maintaining social cohesion within a horse group (Asa et al. 1980, Asa et al. 1984, NRC Review 2013). This may be a unique response of the horse (Bertin et al. 2013), as spaying usually greatly reduces female sexual behavior in companion animals (Hart and Eckstein 1997). In six ponies, mean monthly plasma luteinizing hormone[2] levels in ovariectomized mares were similar to intact mares during the anestrous season, and during the breeding season were similar to levels in intact mares at mid-estrus (Garcia and Ginther 1976).

The likely effects of spaying on mares' social interactions and group membership can be inferred from available literature, even though wild horses have rarely been spayed and released back into the wild, resulting in few studies that have investigated their behavior in free-roaming populations. Wild horses are instinctually herd-bound and this behavior is expected to continue. However, no study has documented the rate at which spayed mares will continue to remain with the stallion and band from which the mare

was most recently attached. Overall the BLM anticipates that some spayed mares may continue to exhibit estrus behavior which could foster band cohesion. If free-ranging ovariectomized mares show estrous behavior and occasionally allow copulation, interest of the stallion may be maintained, which could foster band cohesion (NRC Review 2013). This last statement could be validated by the observations of group associations on the Sheldon NWR where feral mares were ovariectomized via colpotomy and released back on to the range with untreated horses of both sexes (Collins and Kasbohm 2016). No data were collected on inter- or intra-band behavior (e.g. estrous display, increased tending by stallions, etc.), during multiple aerial surveys in years following treatment, all treated individuals appeared to maintain group associations, and there were no groups consisting only of treated males or only of treated females (Collins and Kasbohm 2016). In addition, of solitary animals documented during surveys, there were no observations of solitary treated females (Collins and Kasbohm 2016). These data help support the expectation that ovariectomized mares would not lose interest in or be cast out of the social dynamics of a wild horse herd. As noted by the NRC Review (2013), the ideal fertility control method would not eliminate sexual behavior or change social structure substantially.

A study conducted for 15 days in January 1978 (Asa et al. 1980), compared the sexual behavior in ovariectomized and seasonally anovulatory (intact) pony mares and found that there were no statistical differences between the two conditions for any measure of proceptivity or copulatory behavior, or days in estrous. This may explain why treated mares at Sheldon NWR continued to be accepted into harem bands; they may have been acting the same as a non-pregnant mare. Five to ten percent of pregnant mares exhibit estrous behavior (Crowell-Davis 2007). Although the physiological cause of this phenomenon is not fully understood (Crowell-Davis 2007), it is thought to be a bonding mechanism that assists in the maintenance of stable social groups of horses year round (Ransom et al. 2014b). The complexity of social behaviors among free-roaming horses is not entirely centered on reproductive receptivity, and fertility control treatments that suppress the reproductive system and reproductive behaviors should contribute to minimal changes to social behavior (Ransom et al. 2014b, Collins and Kasbohm 2016).

'Foal stealing,' where a near-term pregnant mare steals a neonate foal from a weaker mare, is unlikely to be a common behavioral result of including spayed mares in a wild horse herd. McDonnell (2012) noted that "foal stealing is rarely observed in horses, except under crowded conditions and synchronization of foaling," such as in horse feed lots. Those conditions are not likely in the wild, where pregnant mares will be widely distributed across the landscape, and where the expectation is that parturition dates would be distributed across the normal foaling season.

Movement, Body Condition and Survival of Ovariectomized Mares

In domestic animals spaying is often associated with weight gain and associated increase in body fat (Fettman et al 1997, Becket et al 2002, Jeusette et al. 2006, Belsito et al 2009, Reichler 2009, Camara et al. 2014). In wild horses, contracepted mares tend to be in better body condition that mares that are pregnant or that are nursing foals (Nuñez et al. 2010); the same improvement in body condition is likely to take place in spayed mares. In horses spaying has the potential to increase risk of equine metabolic syndrome (leading to obesity and laminitis), but both blood glucose and insulin levels were similar in mares before and after ovariectomy over the short-term (Bertin et al. 2013). In wild horses the quality and quantity of forage is unlikely to be sufficient to promote over-eating and obesity.

The likely effects of spaying on mares' home range and habitat use can also be surmised from available literature. Bands of horses tend to have distinct home ranges, varying in size depending on the habitat and varying by season, but always including a water source, forage, and places where horses can shelter from inclement weather or insects (King and Gurnell 2005). It is unlikely that spayed mares will change their spatial ecology, but being emancipated from constraints of lactation may mean they can spend more time

away from water sources and increase their home range size. Lactating mares need to drink every day, but during the winter when snow can fulfill water needs or when not lactating, horses can traverse a wider area (Feist & McCullough 1976, Salter 1979). During multiple aerial surveys in years following the mare ovariectomy study at the Sheldon NWR, it was documented that all treated individuals appeared to maintain group associations, no groups consisted only of treated females, and none of the solitary animals observed were treated females (Collins and Kasbohm 2016). Since treated females maintained group associations, this indicates that their movement patterns and distances may be unchanged.

Spaying wild horses does not change their status as wild horses under the Wild Horse Act. In terms of whether spayed mares would continue to exhibit the free-roaming behavior that defines wild horses, the BLM expects that spayed mares would continue to roam unhindered in their respective HMAs. Wild horse movements may be motivated by a number of biological impulses, including the search for forage, water, and social companionship that is not of a sexual nature. As such, a spayed animal would still be expected to have a number of internal reasons for moving across a landscape and, therefore, exhibiting 'free-roaming' behavior. Despite marginal uncertainty about subtle aspects of potential changes in habitat preference, there is no expectation that spaying wild horses will cause them to lose their free-roaming nature.

Spaying is not expected to reduce mare survival rates. Individuals receiving fertility control often have reduced mortality and increased longevity due to being released from the costs of reproduction (Kirkpatrick and Turner 2008). Similar to contraception studies, in other wildlife species a common trend has been higher survival of sterilized females (Twigg et al. 2000, Saunders et al. 2002, Ramsey 2005, Jacob et al. 2008, Seidler and Gese 2012). Observations from the Sheldon NWR provide some insight into long-term effects of ovariectomy on feral horse survival rates. The Sheldon NWR ovariectomized mares were returned to the range along with untreated mares. Between 2007 and 2014, mares were captured, a portion treated, and then recaptured. There was a minimum of 1 year between treatment and recapture; some mares were recaptured a year later and some were recaptured several years later. The long-term survival rate of treated wild mares appears to be the same as that of untreated mares (Collins and Kasbohm 2016). Recapture rates for released mares were similar for treated mares and untreated mares.

Bone Histology

The BLM knows of no scientific, peer-reviewed literature that documents bone density loss in mares following ovariectomy. A concern has been raised in an opinion article (Nock 2013) that ovary removal in mares could lead to bone density loss. That paper was neither peer reviewed nor was it based on research in wild or domestic horses. (Kitchell et al. 2015). Hypotheses forwarded in Nock (2013) appear to be based on analogies from modern humans leading sedentary lives. Post-menopausal women have a greater chance of osteoporosis (Scholz-Ahrens et al. 1996), but the BLM is not aware of any research examining bone loss in horses following ovariectomy. Bone loss in humans has been linked to reduced circulating estrogen. There have been conflicting results when researchers have attempted to test for an effect of reduced estrogen on animal bone loss ratesin animal models; all experiments have been on laboratory animals, rather than free-ranging wild animals. While some studies found changes in bone cell activity after ovariectomy leading to decreased bone strength (Jerome et al. 1997, Baldock et al. 1998, Huang et al. 2002, Sigrist et al. 2007), others found that changes were moderate and transient or minimal (Scholz-Ahrens et al. 1996, Lundon et al. 1994, Zhang et al. 2007), and even returned to normal after 4 months (Sigrist et al. 2007).

Consistent and strenuous use of bones, for instance using jaw bones by eating hard feed, or using leg bones by travelling large distances, may limit the negative effects of estrogen deficiency on micro-architecture (Mavropoulos et al. 2014). The effect of exercise on bone strength in animals has been known for many years and has been shown experimentally (Rubin et al. 2001). Dr. Simon Turner, Professor Emeritus of the Small Ruminant Comparative Orthopaedic Laboratory at Colorado State

University, conducted extensive bone density studies on ovariectomized sheep, as a model for human osteoporosis. During these studies, he did observe bone density loss on ovariectomized sheep, but those sheep were confined in captive conditions, fed twice a day, had shelter from inclement weather, and had very little distance to travel to get food and water (Simon Turner, Colorado State University Emeritus, written comm., 2015). Dr. Turner indicated that an estrogen deficiency (no ovaries) could potentially affect a horse's bone metabolism, just as it does in sheep and human females when they lead a sedentary lifestyle, but indicated that the constant weight bearing exercise, coupled with high exposure to sunlight ensuring high vitamin D levels, are expected to prevent bone density loss (Simon Turner, Colorado State University Emeritus, written comm., 2015).

Home range size of horses in the wild has been described as 4.2 to 30.2 square miles (Green and Green 1977) and 28.1 to 117 square miles (Miller 1983). A study of distances travelled by feral horses in "outback" Australia shows horses travelling between 5 and 17.5 miles per 24 hour period (Hampson et al. 2010a), travelling about 11 miles a day even in a very large paddock (Hampson et al. 2010b). Thus extensive movement patterns of wild horses are expected to help prevent bone loss. The expected daily movement distance would be far greater in the context of larger pastures typical of BLM long-term holding facilities in off-range pastures. A horse would have to stay on stall rest for years after removal of the ovaries in order to develop osteoporosis (Simon Turner, Colorado State University Emeritus, written comm., 2015) and that condition does not apply to any wild horses turned back to the range or any wild horses that go into off-range pastures.

Tubal Ligation

Tubal ligation has not been commonly performed on mares and the impacts of this procedure are not well known. It is a type of permanent birth control where the oviducts are cut or blocked to permanently prevent pregnancy. The only long term effects to the overall health of mares would be sterility. Pregnancy and the development of the foal would not be expected to be affected; however, as this procedure is relatively new, the outcome is not completely known. The BLM is currently planning to study the impacts of tubal ligation on wild horses.

Hysteroscopically-Guided Laser Ablation

This procedure is conducted to ablate the each oviduct opening and papilla. There is no risk of bleeding, sutures, or prolonged discomfort as the procedure does not involve incisions; however, there is the potential for mild, transient colic. The mares would continue to have an estrous cycle but would be unable to become pregnant, as the oviduct opening would have been ablated, essentially blocking the passage of the sperm. Because this procedure (on wild horses) is new, the effects are not completely known. The BLM is currently planning to study the impacts of this procedure on wild horses.

Gelding

Castration (the surgical removal of the testicles, also called gelding or neutering) is a surgical procedure for the horse sterilization that has been used for millenia. The procedure is fairly straight forward, and has a relatively low complication rate. Few studies have been conducted on techniques for reducing male fertility. Nelson (1980) and Garrott and Siniff (1992) modeled potential efficacy of male-oriented contraception as a population management tool, and both studies agreed that while slowing growth, sterilizing only dominant males (i.e., harem-holding stallions) would result in only marginal reduction in female fertility rates. Eagle et al. (1993) and Asa (1999) tested this hypothesis on herd management areas (HMAs) where dominant males were vasectomized. Their findings agreed with modeling results from previous studies, and they also concluded that sterilizing only dominant males would not provide the desired reduction in female fertility and overall population growth rate, assuming that the numbers of fertile females is not changed. While bands with vasectomized harem stallions tended to have fewer foals, breeding by bachelors and subordinate stallions meant that population growth still occurred – female

fertility was not dramatically reduced. Garrott and Siniff (1992) concluded from their modeling that male sterilization would effectively cause there to be zero population growth (the point where births roughly equal deaths) only if a large proportion of males (i.e., >85%) could be sterilized. In cases where the goal of harem stallion sterilization is to reduce population growth rates, success appears to be dependent on a stable group structure, as strong bonds between a stallion and mares reduce the probability of a mare mating an extra-group stallion (Nelson 1980, Garrott and Siniff 1992, Eagle et al. 1993, Asa 1999). Collins and Kasbohm (2016) demonstrated that there was a reduced fertility rate in a feral horse herd with both spayed and vasectomized horses – some geldings were also present in that herd.

Direct Effects of Gelding

Although gelding is a common surgical procedure, some level of minor complications after surgery may be expected (Getman 2009), and it is not always possible to predict when postoperative complications would occur. Fortunately, the most common complications are almost always self-limiting, resolving with time and exercise. Individual impacts to the stallions during and following the gelding process should be minimal and would mostly involve localized swelling and bleeding. Complications may include, but are not limited to: minor bleeding, swelling, inflammation, edema, infection, peritonitis, hydrocele, penile damage, excessive hemorrhage, and eventration (Schumacher 1996, Searle et al. 1999, Getman 2009). A small amount of bleeding is normal and generally subsides quickly, within 2-4 hours following the procedure. Some degree of swelling is normal, including swelling of the prepuce and scrotum, usually peaking between 3-6 days after surgery (Searle et al. 1999). Swelling should be minimized through the daily movements (exercise) of the horse during travel to and from foraging and watering areas. Most cases of minor swelling should be back to normal within 5-7 days, more serious cases of moderate to severe swelling are also self-limiting and are expected to resolve with exercise after one to 2 weeks. Older horses are reported to be at greater risk of post-operative edema, but daily exercise can prevent premature closure of the incision, and prevent fluid buildup (Getman 2009). In some cases, a hydrocele (accumulation of sterile fluid) may develop over months or years (Searle et al. 1999). Serious complications (eventration, anesthetic reaction, injuries during handling, etc.) that result in euthanasia or mortality during and following surgery are rare (e.g., eventration rate of 0.2% to 2.6% noted in Getman 2009, but eventration rate of 4.8% noted in Shoemaker et al. 2004) and vary according to the population of horses being treated (Getman 2009). Normally one would expect serious complications in less than 5% of horses operated under general anesthesia, but in some populations these rates have been as high as 12% (Shoemaker 2004). Serious complications are generally noted within 3 or 4 hours of surgery but may occur any time within the first week following surgery (Searle et al. 1999). If they occur, they would be treated with surgical intervention when possible, or with euthanasia when there is a poor prognosis for recovery. For intact stallions, testosterone levels appear to vary as a function of age, season, and harem size (Khalil et al 1998). It is expected that testosterone levels will decline over time after castration. Domestic geldings had a significant prolactin response to sexual stimulation, but lacked the cortisol response present in stallions (Colborn et al. 1991). Although libido and the ability to ejaculate tends to be gradually lost after castration (Thompson et al. 1980), some geldings continue to intromit (Rios and Houpt 1995, Schumacher 2006).

Indirect Effects of Gelding

Castration is not expected to reduce geldings' survival rates; rather, the procedure is thought to increase survival as males are released from the cost of reproduction (Jewell 1997). In Soay sheep castrates survived longer than rams in the same cohort (Jewell 1997), and Misaki horse geldings lived longer than intact males (Kaseda et al. 1997, Khalil and Murakami 1999). Moreover, it is unlikely that a reduced testosterone level would compromise gelding survival in the wild, considering that wild mares survive with low levels of testosterone. Consistent with geldings not expending as much energy toward in attempts to obtain or defend a harem, it is expected that wild geldings may have a better body condition that wild, fertile stallions.

For fertility control strategies where gelding is intended to reduce growth rates by virtue of sterile males defending harems, the National Academies of Sciences (NRC 2013) suggested that the effectiveness of gelding on overall reproductive rates may depend on the pre-castration social roles of those animals. Having a post-gather herd with some geldings and a lower fraction of fertile mares necessarily reduces the absolute number of foals born per year, compared to a herd that includes more fertile mares. An additional benefit is that geldings that would otherwise be permanently removed from the range (for adoption, sale or other disposition) may be released back onto the range where they can engage in free-roaming behaviors.

Behavioral Effects of Gelding

Gelding adult male horses is expected to result in reduced testosterone production, which is expected to directly influence reproductive behaviors (NRC 2013). However, testosterone levels alone are not a predictor of masculine behavior (Line et al. 1985, Schumacher 2006). In domestic geldings, 20-30% continued to show stallion-like behavior, whether castrated pre- or post-puberty (Line et al. 1985). Gelding of domestic horses most commonly takes place before or shortly after sexual maturity, and age-at-gelding can affect the degree to which stallion-like behavior is expressed later in life. In intact stallions, testosterone levels peak increase up to an age of ~4-6 years, and can be higher in harem stallions than bachelors (Khalil et al 1998). It is assumed that free roaming wild horse geldings would generally exhibit reduced aggression toward other horses, and reduced reproductive behaviors (NRC 2013). The behavior of wild horse geldings in the presence of intact stallions has not been well documented.

Despite livestock being managed by castrating males for millenia, there is relatively little published research on castrates' behaviors (Hart and Jones 1975). Stallion behaviors in wild or pasture settings are better documented than gelding behaviors, but it inferences about how the behaviors of geldings will change, how quickly any change will occur after surgery, or what effect gelding an adult stallion and releasing him back in to a wild horse population will have on his behavior and that of the wider population must be surmised from the existing literature. There is an ongoing BLM study in Utah focused on the individual and population-level effects of including some geldings in a free-roaming horse population (BLM 2016), but results from that study are not yet available. However, inferences about likely behavioral outcomes of gelding can be made based on available literature.

The effect of castration on aggression in horses has not often been quantified. One report has noted that high levels of aggression continued to be observed in domestic horse geldings who also exhibited sexual behaviors (Rios and Houpt 1995). Stallion-like behavior in domestic horse geldings is relatively common (Smith 1974, Schumacher 1996), being shown in 20-33% of cases whether the horse was castrated pre- or post-puberty (Line et al. 1985, Rios and Houpt 1995, Schumacher 2006). While some of these cases may be due to cryptorchidism or incomplete surgery, it appears that horses are less dependent on hormones than other mechanisms for the maintenance of sexual behaviors (Smith 1974). Domestic geldings exhibiting masculine behavior had no difference in testosterone concentrations than other geldings (Line et al. 1985, Schumacher 2006), and in some instances the behavior appeared context dependent (Borsberry 1980, Pearce 1980).

The likely effects of castration on geldings' social interactions and group membership can be inferred from available literature, even though wild horses are rarely gelded and released back into the wild, resulting in few studies that have investigated their behavior in free-roaming populations. In the western US – where ranges are much larger, intact stallions are present year-round, and population density varies – free-roaming gelding behaviors may differ somewhat from those noted below. In a pasture study of domestic horses, Van Dierendonk et al. (1995) found that social rank among geldings was directly correlated to the age at which the horse was castrated, suggesting that social experiences prior to sterilization may influence behavior afterward. Of the two geldings present in a study of semi-feral horses in England, one was dominant over the mares whereas a younger gelding was subordinate to older mares;

stallions were only present in this population during a short breeding season (Tyler 1972). A study of domestic geldings in Iceland held in a large pasture with mares and sub-adults of both sexes, but no mature stallions, found that geldings and sub-adults formed associations amongst each other that included interactions such as allo-grooming and play, and were defined by close proximity (Sigurjónsdóttir et al. 2003). These geldings and sub-adults tended to remain in a separate group from mares with foals, similar to castrated Soay sheep rams (Ovis aries) behaving like bachelors and grouping together, or remaining in their mother's group (Jewell 1997). In Japan, Kaseda et al. (1997) reported that young males dispersing from their natal harem and geldings moved to a different area than stallions and mares during the non-breeding season. Although the situation in Japan may be the equivalent of a bachelor group in natural populations, in Iceland this division between mares and the rest of the horses in the herd contradicts the dynamics typically observed in a population containing mature stallions. Sigurjónsdóttir et al. (2003) also noted that in the absence of a stallion, allo-grooming between adult females increased drastically. Other findings included increased social interaction among yearlings, display of stallion-like behaviors such as mounting by the adult females, and decreased association between females and their yearling offspring (Sigurjónsdóttir et al. 2003). In the same population in Iceland Van Dierendonck et al. (2004) concluded that the presence of geldings did not appear to affect the social behavior of mares or negatively influence parturition, mare-foal bonding, or subsequent maternal activities. Additionally, the welfare of broodmares and their foals was not affected by the presence of geldings in the herd (Van Dierendonck et al. 2004). These findings are important because treated geldings will be returned to the range in the presence of pregnant mares and mares with foals of the year.

The likely effects of castration on geldings' home range and habitat use can also be surmised from available literature. Bands of horses tend to have distinct home ranges, varying in size depending on the habitat and varying by season, but always including a water source, forage, and places where horses can shelter from inclement weather or insects (King and Gurnell 2005). By comparison, bachelor groups tend to be more transient, and can potentially use areas of good forage further from water sources, as they are not constrained by the needs of lactating mares in a group. The number of observations of gelded wild stallion behavior are still too few to make general predictions about whether a particular gelded stallion individuals will behave like a harem stallion, a bachelor, or form a group with geldings that may forage and water differently from fertile wild horses.

The BLM does expect that geldings would continue to roam unhindered in the HMAs where gelding may take place. Wild horse movements may be motivated by a number of biological impulses, including the search for forage, water, and social companionship that is not of a sexual nature. As such, a gelded animal would still be expected to have a number of internal reasons for moving across a landscape and, therefore, exhibiting 'free-roaming' behavior. Despite marginal uncertainty about subtle aspects of potential changes in habitat preference, there is no expectation that gelding wild horses would cause them to lose their free-roaming nature. BLM acknowledges that geldings may exhibit some behavioral differences after surgery, compared to intact stallions, but those differences would not be expected to remove the geldings' rebellious and feisty nature. While it may be that a gelded horse could have a different set of behavioral priorities than an intact stallion, the expectation is that geldings would choose to act upon their behavioral priorities in an unhindered way, just as is the case for an intact stallion. In this sense, a gelded male would be just as much 'wild' as defined by the Wild Horse Act as any intact stallion, even if his patterns of movement differ from those of an intact stallion.