

# Decision Record

## Zimmerman Mud Brome Treatment

JULY 2012

**BLM**

Worland Field Office, Wind River/Bighorn Basin District, Wyoming



The BLM's multiple-use mission is to sustain the health and productivity of the public lands for the use and enjoyment of present and future generations. The Bureau accomplishes this by managing such activities as outdoor recreation, livestock grazing, mineral development, and energy production, and by conserving natural, historical, cultural, and other resources on public lands.

DOI-BLM-WY-R010-2012-0073-EA

**DECISION RECORD**  
**Environmental Assessment**  
**DOI-BLM-WY-R010-2012-0073-EA**  
**Zimmerman Mud Brome Treatment**

**I. DECISION**

It is my decision to aeri ally treat with Plateau® (imazapic) pre-emergent herbicide portions of the Zimmerman Buttes, Zimmerman Springs, and Little Mud Creek allotments. The aerial application will occur in the late summer or early autumn of 2012, 2013, and/or 2014.

**Authorities:** The authority for this decision is found in H. R. 1904, The Healthy Forest Restoration Act, 2003. This is an act to improve the capacity of the Secretary of Agriculture and the Secretary of the Interior to conduct hazardous fuels reduction projects on National Forest System lands and Bureau of Land Management lands aimed at protecting communities, watersheds, and certain other at-risk lands from catastrophic wildfire, to enhance efforts to protect watersheds and address threats to forest and rangeland health, including catastrophic wildfire, across the landscape, and for other purposes.

**Compliance and Monitoring:** Changes in percent cover of annual bromes and perennial vegetation will be assessed following the treatment. The BLM Fuels Planner/Fire Ecologist will install four monitoring transects prior to treatment: two will be placed within the proposed treatment area and two in areas of similar soil type, precipitation, and livestock grazing that will not receive treatment. Line point-intercept data, photographs, and pounds per acre annual brome fuel load of all the monitoring transects will be collected prior to treatment then again in October one and three years following treatment. Fire Regime Condition Class of the treated area will also be calculated in October one and three years following treatment.

**Terms / Conditions / Stipulations:** All application would be from aerial support. Plateau® would be applied using the following best management practices and mitigation:

1. The applicator(s) would be State certified/licensed.
2. The applicator(s) would be required to read and understand the label and Material Data Safety Sheet for Plateau®.
3. Plateau® application would be in accordance to label requirements.
4. Applicator(s) would be required to wear personal protective equipment (PPE) as required on the Plateau® label.
5. Plateau® would be secured (under lock and key) at all times and transported according to safety requirements.
6. Plateau® would not be applied to water: a 200 foot buffer would be in place between water and application areas.
7. Plateau® would not be applied if local wind speed is > six mph and/or when there is a threat of rain or snow.
8. Daily pesticide application records (PAR) would be kept, the PAR would be maintained in the project file, and a comprehensive project file would be maintained.
9. Treatment areas would be posted with information signs to inform the public that Plateau® application is occurring.
10. The permittees would be notified of the date(s) of application.
11. Application of Plateau will be during working hours, and signs will be posted on roads around the treatment area to notify the public of the project.

**II. PLAN CONFORMANCE AND CONSISTENCY:**

The proposed action conforms to the Record of Decision and Approved Resource Management Plan for the Washakie Resource Area dated 1988. The decisions in the Washakie Resource Area Management Plan provide general management direction and allocation of uses and resources on the public lands in the area.

This plan has been reviewed to determine if the proposed action conforms to the land use plan as required by 43 CFR 1610.5.

The Soil and Water Management Resource Management Objectives of the Shoshone Resource Management Plan are "To protect resource values, property, and human life from loss due to wildfire, and to use prescribed fire to meet other resource management objectives." [Pg. 28]

### **III. ALTERNATIVES CONSIDERED**

The EA analyzed one Proposed and a No Action alternative. The No Action alternative was considered and analyzed to provide a baseline for comparison of the impacts of the one proposed action.

The following alternative was considered, but was not analyzed in detail because it was found to be inadequate and did not entirely fulfill the purpose and need for action objectives.

#### *Drill or aerial seeding with native plant seed*

Aerial or drill seeding treatments to the brome infested areas were considered, but it was determined that seeding is not a viable alternative when the terrain, slope, precipitation regime, and extent of brome cover present are considered. Drill seeding would not eliminate the brome seed present in the seed bank or reduce their germination rate, it would increase brome seed germination from the seed bank that is present in infested areas following soil disturbance. Aerial seeding is not a viable option because much of the area contains exposed rock outcrops where there is little to no chance for seed germination and plant establishment of native graminoids. Seeding would not reduce flame length or rate of fire movement in chains per hour if a wild fire were to occur on the proposed project area.

The No Action Alternative would have been no treatment.

### **IV. RATIONALE FOR DECISION**

The No Action Alternative would not provide for meeting the objective of reducing annual brome fuel load. The fuel load, wildfire flame length, and rate of spread would either not change from that of the present or increase without pre-emergent herbicide application.

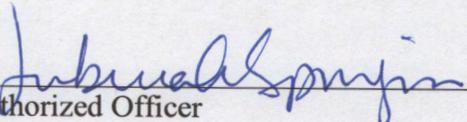
The public was notified of the NEPA process when listed on the NEPA Register 4 January 2012. No public comments were received following posting. Public announcement will be made in local newspapers prior to treatment.

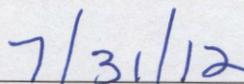
### **V. APPEALS**

This wildfire management decision is issued under 43 CFR 4190.1 and is effective immediately. The BLM has made the determination that vegetation, soil, or other resources on the public lands are at risk of wildfire due to drought, fuels buildup, or other reasons, or at immediate risk of erosion or other damage due to wildfire. Thus, notwithstanding the provisions of 43 CFR 4.21(a) (1), filing a notice of appeal under 43 CFR Part 4 does not automatically suspend the effect of the decision. The Interior Board of Land Appeals must decide an appeal of this decision within 60 days after all pleadings have been filed, and within 180 days after the appeal was filed. (43 CFR 4.416)

#### **Administration Review or Appeal Procedures**

Within 30 days of receipt of this decision, parties who are adversely affected and believe it is incorrect have the right to appeal to the Department of the Interior Board of Land Appeals, Office of the Secretary, in accordance with regulations at 43 CFR 4.4. Procedural information on "Taking Appeals to the Board of Land Appeals" can be obtained at the BLM, Worland Field Office, Worland, Wyoming. An appeal should be in writing and specify the reasons, clearly and concisely, as to why the decision is in error. The BLM does not accept appeals by facsimile or email. A copy of the Statement of Reasons must also be supplied to this office. Also within 30 days of receipt of the decision, appellants have a right to file a petition for a stay (suspension) of the decision together with an appeal, in accordance with the regulations at 43 CFR 4.21. The appellant has the burden of proof to demonstrate that a stay should be granted.

  
Authorized Officer

  
Date

**FONSI**

**Zimmerman Mud Brome Treatment**

**JULY 2012**

**BLM**

**Worland Field Office, Wind River/Bighorn Basin District, Wyoming**



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DOI-BLM-WY-R010-2012-0073-EA

**FINDING OF NO SIGNIFICANT IMPACT**  
**Environmental Assessment**  
**DOI-BLM-WY-R010-2012-0073-EA**  
***Zimmerman Mud Brome Treatment***

**INTRODUCTION:**

The Bureau of Land Management (BLM) has conducted an environmental analysis (DOI-BLM-WY-R010-2012-0073-EA) for a proposed action to address non-native bromes in the Nowater Fire Management Unit area in Washakie County. The project would reduce the fuel load of the area by inhibiting cheatgrass and common brome seed germination. The underlying need for the proposal would be met while accomplishing the following:

1. Reducing non-native brome density and distribution
2. Reducing wildfire flame length and rate of spread
3. Decreasing the Fire Regime Condition Class of treated acres

The Zimmerman Mud Brome project area is 4645 acres in size. EA# DOI-BLM-WY-R010-2012-0073-EA is attached for this Finding of No Significant Impact (FONSI). A no action alternative was analyzed in the EA.

**FINDING OF NO SIGNIFICANT IMPACT:**

Based upon a review of the EA and the supporting documents, I have determined that the project is not a major federal action and will not significantly affect the quality of the human environment, individually or cumulatively, with other actions in the general area. No environmental effects meet the definition of significance in context or intensity as defined in 40 CFR 1508.27 and do not exceed those effects described in the Washakie RMP/FEIS. Therefore, an environmental impact statement is not needed.

This finding is based on the context and intensity of the project as described:

**Context:** The project is a site-specific action directly involving approximately 4158 acres of BLM administered and private land that by itself does not have international, national, regional, or state-wide importance.

**Intensity:** The following discussion is organized around the Ten Significance Criteria described in 40 CFR 1508.27 and incorporated into resources and issues considered (includes supplemental authorities Appendix 1 H-1790-1) and supplemental Instruction Memorandum, Acts, regulations and Executive Orders.

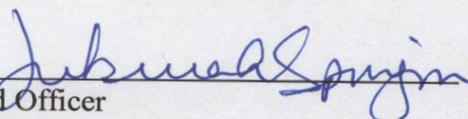
The following have been considered in evaluating intensity for this proposal:

1. **Impacts may be both beneficial and adverse.** The proposed action would impact resources as described in the EA. Mitigating measures to reduce impacts to ground water were incorporated in the design of the action alternatives by the application of buffer zones and application techniques. Blue grama grass and bluebunch wheatgrass may have suppressed seed production for two years following application but other native grasses in the area should not be affected deleteriously. None of the environmental effects discussed in detail in the EA and associated appendices are considered significant, nor do the effects exceed those described in the Washakie FEIS.
2. **The degree to which the selected alternative will affect public health or safety.** The proposed action is an aerial application of an herbicide designed to reduce the germination of annual bromes. The herbicide action inhibits the activity of an enzyme that is present only in plants and is of very low toxicity to animals. Applicator(s) would be required to wear personal protective equipment (PPE) as required on the herbicide label. Treatment areas would be posted with information signs to inform the public that herbicide application is occurring. Herbicide application would be during working hours to avoid times when human presence within the general area could be higher than usual.
3. **Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farm lands, wetlands, wilderness, wild and scenic rivers, or ecologically critical areas.** The following components of the Human Environment and Resource Issues are not affected because they are not present in the project area: Areas of Critical Environmental Concern; BLM Natural Areas; Greenhouse Gas Emissions; Environmental Justice; Prime or Unique Farmlands; Native American Religious Concerns; Socio-

economics; Threatened, Endangered, or Candidate Plant Species; Hazardous or solid wastes; Threatened, Endangered, or Candidate Animal Species; Wild and Scenic Rivers; Wilderness/WSA; Woodland/Forestry; Wild Horses and Burros; Areas with Wilderness Characteristics; Cultural Resources; Class I visual management areas; Class I Air sheds; Geological Resources; Paleontology; Flood Plains; and Wetlands/Riparian Zones. Five components of the Human Environment and Resource Issues were analyzed in detail in Chapter 4 of the EA. None of these would be significantly impacted because of the herbicide's mode of action, application timing, and the area's soil type.

4. **The degree to which the effects on the quality of the human environment are likely to be highly controversial.** There is no scientific controversy over the nature of the impacts.
5. **The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.** The project is not unique or unusual. The BLM has experience implementing the same action in allotments adjacent to the proposed project area. The environmental effects to the human environment are fully analyzed in the EA. There are no predicted effects on the human environment that are considered to be highly uncertain or involve unique or unknown risks.
6. **The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.** The actions considered in the selected alternative were considered by the interdisciplinary team within the context of past, present, and reasonably foreseeable future actions. Significant cumulative effects are not predicted. A complete analysis of the direct, indirect, and cumulative effects of the selected alternative and all other alternatives is described in Chapter 4 of the EA.
7. **Whether the action is related to other actions with individually insignificant but cumulatively significant impacts – which include connected actions regardless of land ownership.** The interdisciplinary team evaluated the possible actions in context of past, present and reasonably foreseeable actions. Significant cumulative effects are not predicted. A complete disclosure of the effects of the project is contained in Chapter 4 of the EA.
8. **The degree to which the action may adversely affect districts, sites, highways, structures, or other objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.** The project will not adversely affect districts, sites, highways, structures, or other objects listed in or eligible for listing in the National Register of Historic Places, nor will it cause loss or destruction of significant scientific, cultural, or historical resources.
9. **The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973, or the degree to which the action may adversely affect: 1) a proposed to be listed endangered or threatened species or its habitat, or 2) a species on BLM's sensitive species list.** Mitigating measures to reduce impacts to wildlife and fisheries have been incorporated into the design of the action alternatives. Although one candidate for listing species, Sage grouse, resides within the project boundary, it has been determined that they will not be negatively affected because the aerial application will be done at a time when sage grouse nesting and early brood rearing life cycles are completed; sage grouse young will be dispersed from the area; and the treatment does not cause ground disturbance of sage grouse habitat. No other threatened or endangered plants or animals are known to occur in the area.
10. **Whether the action threatens a violation of a federal, state, local, or tribal law, regulation or policy imposed for the protection of the environment, where non-federal requirements are consistent with federal requirements.** The project does not violate any known federal, state, local or tribal law or requirement imposed for the protection of the environment.

Authorized Officer



Date

7/31/12

**EA**

**Zimmerman Mud Brome Treatment**

**BLM**

Worland Field Office, Wind River/Bighorn Basin District, Wyoming

JULY 2012



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DOI-BLM-WY-R010-2012-0073-EA

**Zimmerman Mud Brome Treatment  
DOI-BLM-WY-R010-2012-0073-EA**

**Type of Project:** Chemical Treatment

**General Location of Proposed Action:** T 44 N, R 91 W, TR 37, Sections 7 and 18; T 44 N, R 92 W, Sections 3-5, 8, and 9; T44N R93W, Sections 10, 11, 13, 14, 15, 22, 23, and 24

**Name and Location of Preparing Office:**

Worland Field Office

101 S. 23<sup>rd</sup> St.

Worland, WY 82401

**Lease/Serial/Case File Number:** 015335

**Applicant Name:** BLM

**CHAPTER 1  
INTRODUCTION AND NEED FOR THE PROPOSED ACTION**

**INTRODUCTION**

This Environmental Assessment (EA) has been prepared to disclose and analyze the environmental consequences of the Zimmerman Mud Brome Treatment as proposed by the Bureau of Land Management (BLM) Worland Field Office. The EA is a site-specific analysis of potential impacts that could result with the implementation of a proposed action or an alternative to the proposed action. The EA assists the BLM in project planning, ensuring compliance with the National Environmental Policy Act (NEPA), and in making a determination as to whether any "significant" impacts could result from the analyzed actions. "Significance" is defined by NEPA and is found in regulation 40 CFR 1508.27. An EA provides evidence for determining whether to prepare an Environmental Impact Statement (EIS) or a statement of "Finding of No Significant Impact" (FONSI). If the decision maker determines that this project has "significant" impacts following the analysis in the EA, then an EIS would be prepared for the project. If not, a Decision Record (DR) may be signed for the EA approving the selected alternative, whether the proposed action or another alternative. A DR, including a FONSI statement, documents the reasons why implementation of the selected alternative would not result in "significant" environmental impacts (effects) beyond those already addressed in the Washakie Resource Management Plan (1988).

The Worland, Wyoming Bureau of Land Management proposes to treat a mix of BLM managed and private land with an aerial application of the pre-emergent herbicide Plateau® (imazapic) to decrease the seed germination and plant establishment of cheatgrass (*Bromus tectorum* L.) and field brome (*Bromus arvensis* L.). The proposed treatment area contains 430 acres of private and 3735 acres of BLM managed public land. The Omnibus Consolidated Appropriations Act of 1997, Wyden Amendment, Public Law 104-208, Section 124, as amended by Public Law 105-277, Section 136 (16 U.S.C. 1011(a)) provides authority for the Secretary of Interior to enter into cooperative agreements with other federal agencies, tribal, state, and local governments, private and nonprofit entities, and landowners for the protection, restoration, and enhancement of fish and wildlife habitat and other resources on public or private land. If the project is approved, Plateau® would be applied at a rate of eight ounces in eight gallons of water per acre in the late summer or early autumn of 2012, 2013, and/or 2014.

Fire Regime Condition Class (FRCC) is a tool that categorizes a landscape's potential degree of departure from its reference condition. It is a measure of ecological departure to describe resource conditions. While the concept is most widely used in the fire, fuels, and forestry programs, it is also consistent with the concepts of land health. The FRCC system uses two sets of descriptors that, when combined, can be used to diagnose the fire regime condition class. The first set of factors measures vegetation composition and structure changes. The second set measures possible changes in fire frequency and severity. FRCC classes are broken down into three categories: 1, 2, and 3. Landscapes determined to fall within the category of FRCC 1 contain vegetation, fuels, and disturbances characteristic of the natural regime; FRCC 2 landscapes are those that are moderately departed from the natural regime; and FRCC 3 landscapes reflect vegetation, fuels, and disturbances that are uncharacteristic of the natural regime. The area proposed for chemical treatment has 3221 of 4165 acres documented to have an FRCC of 3.

The treatment management objective would be to reduce the canopy cover of bromes within the treated area by at least 50 percent or greater over three years.

The resource management objective would be to decrease the FRCC of the treated area from 3 to 2 within five years.

#### **PURPOSE AND NEED FOR THE PROPOSED ACTION**

The purpose of the Proposed Action is to treat public and private lands with aerial application of the pre-emergent herbicide Plateau® (imazapic) to decrease the seed germination and plant establishment of cheatgrass (*Bromus tectorum* L.) and field brome (*Bromus arvensis* L.). These bromes are erect winter and/or spring annual grasses that are highly competitive with native perennial vegetation, have the ability to form a mono-culture, and are highly flammable once cured. The Proposed Action is needed at this time to reduce the fuel load of the acres that are in FRCC 3 by inhibiting cheatgrass and common brome seed germination. A reduction in the FRCC would contribute to protection of lives and property, increased fire fighter safety, and reduction of wildfire damage to the vegetation community. The proposed project area has been subjected to five wildfires within the past 17 years, the most recent wildfire on the Zimmerman Buttes allotment on July 13, 2012.

#### **Decision to be Made**

BLM must decide whether to approve the treatment, determine what mitigation measures to apply to the project, or deny the project.

#### **CONFORMANCE WITH BLM LAND USE PLAN(S)**

The proposed action conforms to the Record of Decision and Approved Resource Management Plan for the Washakie Resource Area dated 1988. The decisions in the Washakie Resource Management Plan provide general management direction and allocation of uses and resources on the public lands in the area.

The Soil and Water Management Resource Management Objectives of the Washakie Resource Management Plan are "To protect resource values, property, and human life from loss due to wildfire, and to use prescribed fire to meet other resource management objectives." [Pg. 28]

## **RELATIONSHIPS TO STATUTES, REGULATIONS AND OTHER PLANS**

The National Environmental Policy Act, 1969. This act requires the preparation of Environmental Impact Statements (EIS) for federal projects that may have a significant effect on the environment and systematic, interdisciplinary planning to ensure the integrated use of natural and social sciences and environmental design arts in making decisions about major federal actions that may have a significant effect on the environment.

Federal Land Policy and Management Act, 1976. Directs the BLM to “take any action necessary to prevent unnecessary and undue degradation of public land”.

Public Rangelands Improvement Act, 1978. Requires the BLM to manage, maintain, and improve the condition of the public rangelands so that they become as productive as feasible.

Federal Noxious Weed Act of 1974, as amended by Sec. 15, Management of Undesirable Plants on Federal Lands, 1990. This Act requires that each Federal Agency designate a lead office and person trained in the management of undesirable plants; establish and fund an undesirable plant management program; complete and implement cooperative agreements with State Agencies; and establish integrated management systems to control undesirable plant species.

Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management for the Public Lands Administered by the Bureau of Land Management in the State of Wyoming, 1997. The objectives of the rangeland health regulations are to promote healthy sustainable rangeland ecosystems; accelerate restoration and improvement of public rangelands to properly functioning conditions; and provide for the sustainability of the western livestock industry and communities that are dependent upon productive, healthy public rangelands.

Executive Order 13112, Invasive Species, 1999. This order directs federal agencies to prevent the introduction of invasive species and provide for their control, and to minimize the economic, ecological, and human health impacts that invasive species cause.

H. R. 1904- The Healthy Forest Restoration Act, 2003. An act to conduct hazardous fuels reduction projects on National Forest System lands and Bureau of Land Management lands aimed at protecting communities, watersheds, and certain other at-risk lands from catastrophic wildfire, to enhance efforts to protect watersheds and address threats to forest and rangeland health, including catastrophic wildfire, across the landscape, and for other purposes.

Vegetation Treatments in 17 Western States, Programmatic Report, BLM, 2007. This document addresses the general effects on the environment of using non-herbicide treatment methods, including mechanical, manual, and biological control methods.

Vegetation Treatments Using Herbicides in 17 Western States, Programmatic Environmental Impact Statement, Record of Decision, BLM, 2007. The Record of Decision approved the use of 18 herbicide active ingredients and a scientific protocol to guide the analytical methodology for consideration of the use or non-use of herbicides by the BLM.

The Omnibus Consolidated Appropriations Act of 1997, Wyden Amendment, Public Law 104-208, Section 124, as amended by Public Law 105-277, Section 136 (16 U.S.C. 1011(a)), 2009. This law provides authority for the Secretary of Interior to enter into cooperative agreements with other federal agencies, tribal, state, and local governments, private and nonprofit entities, and landowners for the protection, restoration, and enhancement of fish and wildlife habitat and other resources on public or private land.

Invasive Plant Management – Worland/Cody Field Office, Environmental Assessment, 2011 DOI-BLM-WY-R010-2010-0026-EA, 2011 FONSI. This document describes the types and methods of invasive plant management treatments that are done in the Worland and Cody Field Office land management areas and their effects.

### **Identification of Issues**

The proposed action was reviewed by an interdisciplinary team. Based on the size and nature of the proposed project, it was determined that external scoping was not necessary.

The following issues were identified by the ID team:

*Will treatment reduce brome establishment?*

*Will treatment reduce fuel load and wildfire flame length?*

*How would treatment affect non-native invasive and native plants?*

*Will treatment affect drinking, surface, and ground water?*

*Would treatment have an effect on soil resources by increasing erosion rates as vegetation transforms to a native plant community?*

### **Issues Considered and Eliminated from Further Analysis**

*Will treatment affect air quality?*

Plateau® does not volatilize even at high temperatures.

*Is the proposed project area a Land with Wilderness Characteristics?*

As mandated by FLPMA, Section 201, the BLM is required to maintain an inventory of BLM-administered public lands to determine whether they possess wilderness characteristics. Recent inventories found that no acres of the proposed project area contain wilderness characteristics.

## CHAPTER 2 DESCRIPTION OF ALTERNATIVES

### INTRODUCTION

Alternative treatments for reducing the brome fuel load on the Little Mud Creek and Zimmerman Springs allotments were discussed. Limitations of each were addressed in relation to the purpose and need for action. Two alternatives were considered: An aerial herbicide treatment as described in Proposed Action or no treatment.

### PROPOSED ACTION

The proposed treatment is aerial Plateau® pre-emergent herbicide application, by a contractor using helicopter bucket, to portions of the Little Mud Creek and Zimmerman Springs' allotments (see Appendix 1). Plateau® would be applied at a rate of eight ounces in eight gallons of water per acre in the late summer or early autumn of 2012, 2013, and/or 2014.

#### Design Features of the Proposed Action

**Terms / Conditions / Stipulations:** All application would be from aerial support. Plateau® would be applied using the following best management practices and mitigation:

1. The applicator(s) would be State certified/licensed.
2. The applicator(s) would be required to read and understand the label and Material Data Safety Sheet for Plateau®.
3. Plateau® application would be in accordance to label requirements.
4. Applicator(s) would be required to wear personal protective equipment (PPE) as required on the Plateau® label.
5. Plateau® would be secured (under lock and key) at all times and transported according to safety requirements.
6. Plateau® would not be applied to water: a 200 foot buffer would be in place between water and application areas.
7. Plateau® would not be applied if local wind speed is > six mph and/or when there is a threat of rain or snow.
8. Daily pesticide application records (PAR) would be kept, the PAR would be maintained in the project file, and a comprehensive project file would be maintained.
9. Treatment areas would be posted with information signs to inform the public that Plateau® application is occurring.
10. The permittees would be notified of the date(s) of application.
11. Application of Plateau will be during working hours, and signs will be posted on roads around the treatment area to notify the public of the project.

Changes in percent cover of annual bromes and perennial vegetation would be assessed following the treatment. The BLM Fuels Planner/Fire Ecologist would install four monitoring transects prior to treatment: two would be placed within the proposed treatment area and two in areas of similar soil type, precipitation, and livestock grazing that will not receive treatment. Line point-intercept data, photographs, and pounds per acre annual brome fuel load of all the

monitoring transects would be collected prior to treatment then again in October one and three years following treatment. FRCC of the treated area would also be calculated in October one and three years following treatment.

## **NO ACTION**

The No Action Alternative would be no pre-emergent herbicide application. No monitoring transects would be installed.

## **ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS**

### *Drill or aerial seeding with native plant seed*

Drill or aerial seeding treatments to the brome infested areas were considered, but it was determined that seeding is not a viable alternative when the terrain, slope, precipitation regime, and extent of brome cover present are considered. Seeding would not eliminate the brome seed present in the seed bank or reduce their germination rate. Drill seeding with soil disturbance would increase brome seed germination from the seed bank that is present in infested areas. Aerial seeding is not a viable option because much of the area contains exposed rock outcrops where there is little to no chance for seed germination and plant establishment of native graminoids. Seeding would not reduce flame length or rate of fire movement in chains per hour if a wild fire were to occur on the proposed project area.

## **CHAPTER 3 AFFECTED ENVIRONMENT**

### **INTRODUCTION AND GENERAL SETTING**

This chapter presents the existing environment (i.e., the physical, biological, social, and economic values and resources) of the proposed project area as presented in Chapter 1 of this assessment. This chapter provides the baseline for comparison of impacts/consequences described in Chapter 4.

The proposed treatment area is found within the Worland Field Office BLM within the Nowater Fire Management Unit, permitted as allotments #00193, named the Little Mud Creek allotment, #00591, named the Zimmerman Springs allotment, and #00571, the Zimmerman Buttes allotment. The Little Mud Creek allotment is situated in Township 44 North Range 91 West TR 37 and Sections 7 and 18. Zimmerman Springs allotment is located in Township 44 North Range 92 West Sections 3,4,5,8 and 9. Zimmerman Buttes allotment is situated in Township 44 North Range 93 West Sections 10, 11, 13, 14, 15, and 22 through 24. (See Appendix 2). The treatment area receives 10 to 14 inches of precipitation annually and has an elevation range from 4200 to 5000 feet.

### **Resources/Issues Brought Forward for Analysis**

Resources and features not present, and not discussed in this EA, include: Areas of Critical Environmental Concern; BLM Natural Areas; Greenhouse Gas Emissions; Environmental Justice; Prime or Unique Farmlands; Native American Religious Concerns; Socio-economics; Threatened, Endangered, or Candidate Plant Species; Hazardous or solid wastes; Threatened,

Endangered, or Candidate Animal Species; Wild and Scenic Rivers; Wilderness/WSA; Woodland/Forestry; Wild Horses and Burros; Areas with Wilderness Characteristics; Cultural Resources; Class I visual management areas; Class I Air sheds; Geological Resources; Paleontology; Flood Plains; and Wetlands/Riparian Zones.

### **Vegetation**

Four ecological sites are found in the proposed project area.

Loamy 10-14 inch pz.	(R032XY322WY)
Lowland 10-14 inch pz.	(R032XY328WY)
Saline Upland 10-14 inch pz.	(R032XY344WY)
Saline Lowland 10-14 inch pz.	(R032XY338WY)

A list of all the plants found in the area is in Appendix 3. Wyoming big sagebrush acts as a snow accumulator and rain interceptor in much of the area, concentrating water for uptake by perennial vegetation: Many of the native perennial grasses are growing under or in close proximity to the sagebrush canopies. Thousands of acres of Wyoming big sagebrush steppe in the proposed project area were reduced to non-native annual grass-dominated landscape following the wildfires of 1996.

### **Invasive vegetation**

Several species of designated noxious weeds have populations within the project area, especially in drainages and near reservoirs. The documented species include hardheads (a.k.a. Russian knapweed, *Acroptilon repens* (L.) DC.), whitetop (*Cardaria draba* (L.) Desv.), saltcedar (*Tamarix chinensis* Lour.), Canada thistle (*Cirsium arvense* (L.) Scop.), saltcedar (*Tamarix chinensis* Lour.), and musk thistle (*Cirsium vulgare* (Savi) Ten.).

### **Soils**

The soils along the drainage bottoms, where most of the treatments are planned, are deep and well drained with medium surface textures (very fine sandy loam and loam) and moderately fine textures (clay loam and silty clay loam) in the subsoil. Slopes across the treatment blocks range from 0 to 70 percent but are only 0 to 10 percent in the drainage bottoms. Clay content increases with depth and is often expressed as an argillic horizon on the older surfaces. The soil reaction is moderately alkaline to strongly alkaline (pH 7.9-9.0), becoming more alkaline with depth.

The soils are not prone to accelerated runoff and erosion as long as they are well vegetated. Runoff and erosion estimated by the US Forest Service web based Water Erosion Prediction Project (WEPP) show with disturbance a two percent probability of runoff and erosion for any given year. When averaged over a 50-year return interval there is virtually no erosion. WEPP only predicts runoff and erosion for a 50-year storm cycle with 0.46 inches of runoff and 0.01 tons per acre of erosion predicted.

The soils are not susceptible to wind erosion when vegetated.

## Hydrology

### Surface Water/Upland Hydrology Water Quality

The proposed action is located in Nowater Creek watershed (HUC# 1008000708). The Nowater watershed is located in the upper Bighorn region and, when flowing, confluences with the Bighorn River several miles northwest of the proposed project area. The main drainages in proximity to the proposed action are the main channel of Nowater Creek, Zimmerman Draw, and Mud Creek. The larger desert type drainages in the area have ephemeral or intermittent flow regimes, depending on climatic precipitation received during the year, with flow in the channel 10-80% of the year. Many smaller drainages are considered ephemeral with flow in the channel <10% of the year, as determined from a thirty year average by Hedman and Osterkamp, 1982. The larger drainages are considered to have a desert cottonwood type riparian community with a dominant over-story of cottonwood (*Populus* spp.) trees as seen along portions of Nowater Creek. These watersheds have a high drainage density that is indicative of low precipitation areas and are common in the Bighorn Basin. The watershed carries a very large amount of sediment load and has very turbid water during portions of the year.

### Groundwater Quality

The proposed project is situated in a highly erosive area with high amounts of runoff and very low soil permeability due to the presence of very fine grained geologic outcrops of Tertiary aged Willwood and Fort Union Formations. The overall slopes are less than five percent although some slopes at the watershed divide are 10 percent and steeper. These are wide-spread and composed primarily of sandstone beds inter-bedded with fine grained rocks such as shale, claystone, mudstone, or siltstone. The transmissivity of the aquifer is generally low with fair to poor water quality that is produced under unconfined conditions. There are no water wells within a one mile buffer of the proposed project area. Potential ground water contamination areas in the proposed project area have a medium sensitivity rating in upland areas and medium-high risk along Zimmerman Draw and Mud Creek due to potential shallow unconfined ground water conditions (Hamerlinck and Arneson, 1998).

The nearest available water quality data that is representative of the proposed project area is USGS station 06267400 located at the mouth of the East Fork of Nowater Creek in T 46N R 92W Sec 31. This station has a historic record of 45 different samples taken between 1977 and 1981. These samples were taken during the months of March through July and were analyzed for conductance, turbidity, a full suite of metals, and hardness: For a full detailed table visit Bartos et al, 2009. The data indicates that very large amounts of naturally occurring sediment are transported through the watershed especially following large flow rainstorm events. The amount of suspended sediment ranged from 18 tons per day in July of 1981 to 509,000 tons per day following a high flow event in April, 1978. The drainage is considered by the WY DEQ as a type 3B stream and supports aquatic insect life during portions of the year but does not support fisheries or other uses.

The USGS also conducted a region wide national water quality assessment program in 2001 to provide water quality information about the impacts of insecticides and herbicides in the Bighorn

Basin (May be accessed at: <http://pubs.usgs.gov/fs/FS-098-98/>). Several different compounds were tested at various locations throughout the basin. There were no herbicides found in the lower Tertiary aquifers near the project area. Nowater Creek is listed as impaired for fecal coliform throughout the segment.

### Fuels/Fire Management

The Fire Regime Condition Class (FRCC) of the proposed project area is 3221 acres in FRCC 3, an area that is entrenched in non-native bromes; 291 acres in FRCC 2, areas with brome invasion under greasewood (*Sarcobatus vermiculatus* (Hook.) Torr.) and sagebrush (*Artemisia* spp.) shrub canopies; and 582 acres in FRCC 1. Located within the proposed treatment area are 1225 acres of land that are designated as habitat in which to prioritize fire suppression activities for the benefit of sage grouse (See Appendix 2). The proposed treatment area has a 17 year fire history as shown in Table 2.

**Table 2. Wildfire history of Zimmerman Mud proposed project area**

Wildfire name	Wildfire Year	Number of acres burned
Banjo	1995	3
Zimmerman	1996	297
East Black Mountain	1996	4289
Pinky	2004	89
Mud Creek	2010	5
Zimmerman	2012	902
	Total Acres	5585

The fires listed above occurred as a result of lightning strikes that ignited cured non-native bromes that spread to shrub crowns. Non-native brome fuel load of the proposed project area was found to be 2.11 tons per acre on 6/5/2012.

## CHAPTER 4 ENVIRONMENTAL IMPACTS

### DIRECT AND INDIRECT IMPACTS

#### PROPOSED ACTION

This section analyzes the impacts of the proposed action to those resources described in the affected environment Chapter 3, above.

#### Vegetation

Imazapic kills plants by inhibiting the activity of the enzyme acetohydroxy acid synthase (ALS). ALS catalyzes the production of three branched-chain aliphatic amino acids, valine, leucine, and isoleucine, required for protein synthesis and cell growth. Only plants have ALS and produce these three amino acids, therefore Plateau® is of low toxicity to insects and vertebrate animals.

As a pre-emergent herbicide, seeds susceptible to the herbicide fail to germinate and/or seedlings fail to establish. The chemical properties of Plateau® are listed below in Table 1.

**Table 1. Properties of Plateau® (The Nature Conservancy, 2001)**

Herbicide	Water Solubility mg/l	Average Half-Life in water days	Average Half-Life in soil days	Potential for Surface Runoff	Potential for Leaching	Oral LD50 Mammals Rat model mg/kg	LD50 Bird Bobwhite quail model mg/kg	LC50 Fish Bluegill sunfish model mg/l	Dermal LD50 Mammals Rabbit model mg/kg
Plateau®	2,200	2	120	Low	Low	>5,000	>5,000	>100	>5,000

Plateau® herbicide is effective in reducing non-native brome germination, but many native plants found in the area appear to be tolerant to its effect (See Appendix 2). Blue grama and bluebunch wheatgrass may have suppressed seed production for two years following application.

Natural regeneration of Wyoming big sagebrush has not been documented since the 1996 wildfires, but plots of sagebrush planted in the area, through a joint project between the Wyoming Game and Fish Department and the Worland Field Office BLM, have established. The non-native bromes present under the canopies of planted sagebrush plots and sagebrush that were not burned in previous wildfires are at risk of being killed by future wildfires.

### **Invasive vegetation**

The application of Plateau® for this project is intended as a pre-emergent herbicide for suppression of non-native bromes. The timing, rate, and lack of spray adjuvant coupled with buffers around surface water will result in little to no effect on existing patches of noxious woody or broadleaf species, and another treatment would be required.

### **Soil**

Few impacts to the soil resource are anticipated as a result of the herbicide treatment. Assuming a successful treatment, the germination of the targeted annual species would be reduced, resulting in a slight reduction in ground cover. Only incremental changes to runoff and erosion are anticipated during this interim period between treatment and the establishment of perennial herbaceous species. Existing surface litter and standing litter from annual species would continue to protect the soil from the erosive forces of rain drop impact and overland flow. There is little potential for Plateau® to leach or be transported off-site by surface runoff or wind. This is due in part to the characteristics of the herbicide, but also to the limited potential for runoff and wind erosion. The potential for leaching would be further reduced by the clay content in the sub soils and low annual precipitation. The soils offer few limitations to overall project success. The clay content of the soils, particularly on the surface, is not so high as to bind the Plateau® to the soil particles, while at the same time the soil textures are not so coarse as to be prone to leaching following chemical application.

## **Hydrology**

### **Surface Water/Upland Hydrology Water Quality**

The treatment would be applied as outlined in chapter 2. The 200 foot buffer from Nowater Creek and the reservoirs would minimize the potential migration of Plateau® into the surface water even though undesirable effects would not be likely to occur if it did. The treatment would also occur in the summer or early fall when there historically is low or no flow in Nowater Creek. There would be a slight increase in surface runoff in the upland areas where vegetation is reduced until proper perennial grasses re-establish. The non-native bromes provide some protection from erosion but they are shallow rooted annual plants that do not provide for adequate infiltration to reduce surface runoff. The overall natural plant community in relation to surface water runoff would be enhanced as the non-native bromes are reduced in density and distribution.

### **Groundwater Quality**

A potential pathway for the transport of pesticides is through hydrologic systems which supply water for both humans and natural ecosystems. Water transport is one of the ways pesticides move from an application area to other locations in the environment. Pesticide contamination of ground water is a national issue because *ground water is used for drinking water* by about 50 percent of the nation's population (Go to <http://pubs.usgs.gov/fs/FS-098-98/>).

Assuming the specified buffers, application techniques, and rates are followed, there would be no impacts to ground water resources. There are no shallow water wells in the treatment area or within a one mile buffer. The chemical would effectively dissipate in the vadose zone and there would be no potential for residual ground water contamination.

### **Fuels/Fire Management**

A decrease in non-native brome establishment would be seen as a decrease in grass fuel load. Fuel management studies have shown that spread rate and flame length decrease as dry grass fuel loads decrease (Scott and Burgan, 2005). Reduced wildfire spread rate and flame length would contribute to protection of lives, property, and resources and fire fighter safety. FRCC would be reduced from 3 with less brome grass fuel load present on the proposed project area.

## **NO ACTION**

### **Vegetation**

Under this alternative there would be no herbicide application. Where they have established, non-native bromes would continue to dominate the plant communities. There is a risk of losing more shrubs to wildfire with an increase in brome density and distribution. Loss of shrubs to wildfire would result in decreases precipitation interception and stem flow to perennial grasses and forbs found under shrub canopies.

### **Invasive vegetation**

Noxious weeds and other invasive plant species would still need to be treated using other methods.

## **Soil**

Under this alternative there would be no herbicide application. Where they have established, non-native bromes would continue to dominate the plant communities. Wildfire frequency would continue or increase, and would not be restricted to the drainage bottoms. Following wildfire runoff and erosion would increase. WEPP estimates that during the time that the soil is bare there would be a 20 percent probability of runoff with a 16 percent probability of erosion. In the unlikely event of a 50-year storm cycle, WEPP predicts 2.63 inches of runoff with 1.26 tons per acre of erosion.

## **Hydrology**

### **Surface Water/Upland Hydrology Water Quality**

If no treatment is applied the continued expansion of brome into the uplands will decrease the overall infiltration rates of the area and produce high amounts of surface erosion along drainages and within the channels. This will lead to higher sediment loads and increased turbidity beyond natural conditions in surface waters downstream of the proposed project areas. The risk of misapplication of the herbicide would not exist and the potential to transport via surface water would not exist.

### **Groundwater Quality**

There would be no significant change in the ground water resources as a result of no action. The risk of misapplication of the herbicide would not exist.

## **Fuels/Fire Management**

Wildfire spread rate and flame length would either not change from that of the present or would increase. As the area's acres that are in FRCC 2 or 1 decreased to 3, chances for (a) severe wildfire event(s) would increase.

## **CUMULATIVE IMPACTS**

According to the Council on Environmental Quality (CEQ) NEPA regulations, "cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR 1508.7). The BLM Worland Field Office (WFO) queried its databases to determine past, present, and reasonably foreseeable future actions.

Vegetation data for the BLM WFO includes spatial ecological and vegetation layers created from remote-sensing imagery obtained at various points in time, which are verified using photo-imagery, on-the-ground- measurements, and tracking of vegetation-changing actions or events such as wildfires, vegetation removal for fence construction, or mechanical treatments to masticate shrubs or remove conifers from aspen stands.

## CUMULATIVE IMPACT ANALYSIS

### CUMULATIVE IMPACT AREA

Any cumulative impacts of past, the proposed action, or future actions would be geographically limited to the proposed project area. Effects to water quality, hydrology, vegetation, and soils would be contained within the Nowater watershed, particularly the main drainages in proximity to the proposed action. The effects of aerial herbicide treatment would initially be the noise of a helicopter in the area followed by the herbicide-water mix being applied. It is not possible to pre-determine the length of time the treatment will take, how long of a time period the sprayed vegetation and soil in the treatment area will be wet following application, or how far the mix will drift from the application site. The helicopter loading/mixing area will have ground surface disturbance from the weight of the aircraft and hoses used for filling the tank with the herbicide mixture. Mitigation measures as outlined in Chapter 2 will be used.

### PAST ACTIONS

A combination of actions/events affects the proposed project area ecosystem.

#### Wildfires

The proposed treatment area has a 17 year wildfire history that includes:

1995	Banjo	3 acres
1996	Zimmerman	297 acres
1996	East Black Mountain	4289 acres
2004	Pinky	89 acres
2010	Mud Creek	5 acres
2012	Zimmerman	910 acres

The wildfires listed above occurred as a result of lightning strikes that ignited annual bromes and the fire then spread to shrubs. Fire-fighting personnel and equipment probably traversed off of designated roads and two-tracks causing impacts to vegetation and soil. Vegetation returned to an earlier seral type following the wildfires and soils were initially hydrophobic, increasing precipitation runoff and sedimentation into water bodies. Annual bromes increased their density and distribution with a loss of approximately 3000 acres of Wyoming big sagebrush habitat.

#### Vegetation Treatments

The proposed treatment area had 30 acres of drill seeding done in 1997 one year after the East Black Mountain wildfire occurred on the Zimmerman Springs allotment. The seed mix consisted of Sandberg bluegrass, Wyoming big sagebrush, and four-wing saltbush. Seeding equipment and personnel probably traversed on designated roads and two-tracks to the area then impacts to soil occurred during the drilling. Seeding success was measured five years following treatment indicating 37% establishment of the seed mix. The establishment was assessed in 2011 showing an influx of annual bromes with a 12% residual four wing saltbush and 2% Wyoming big sagebrush residual.

Aerial Plateau® herbicide application was done on 4313 acres of the Lower Nowater allotment in August 2011. This allotment is due east of Zimmerman Springs and due west of Little Mud Creek. The vegetation, soils, and grazing history of this allotment is similar to that of the proposed project area.

### Livestock Grazing

The proposed project area is within the Little Mud Creek, Zimmerman Springs, and Zimmerman Buttes allotments. The permittees of the allotments are as follows: Little Mud Creek is leased to Mr. Vance Lungren. The allotment is currently used as an overnight trailing stop every spring and fall. Its permitted use is during pre-growing season. The Zimmerman Springs allotment is leased to Mr. Everett Jones. This allotment is permitted for livestock grazing only during the non-growing season. Zimmerman Butte allotment is leased to Jerry Johnson. It is permitted for a three pasture rotation.

### Recreation

The project area includes private and BLM managed acres. Recreation uses may include hiking, hunting, and off highway vehicle use. Any of those actions could impact the land by removal of wildlife and damage to vegetation and soils.

## **PRESENT ACTION**

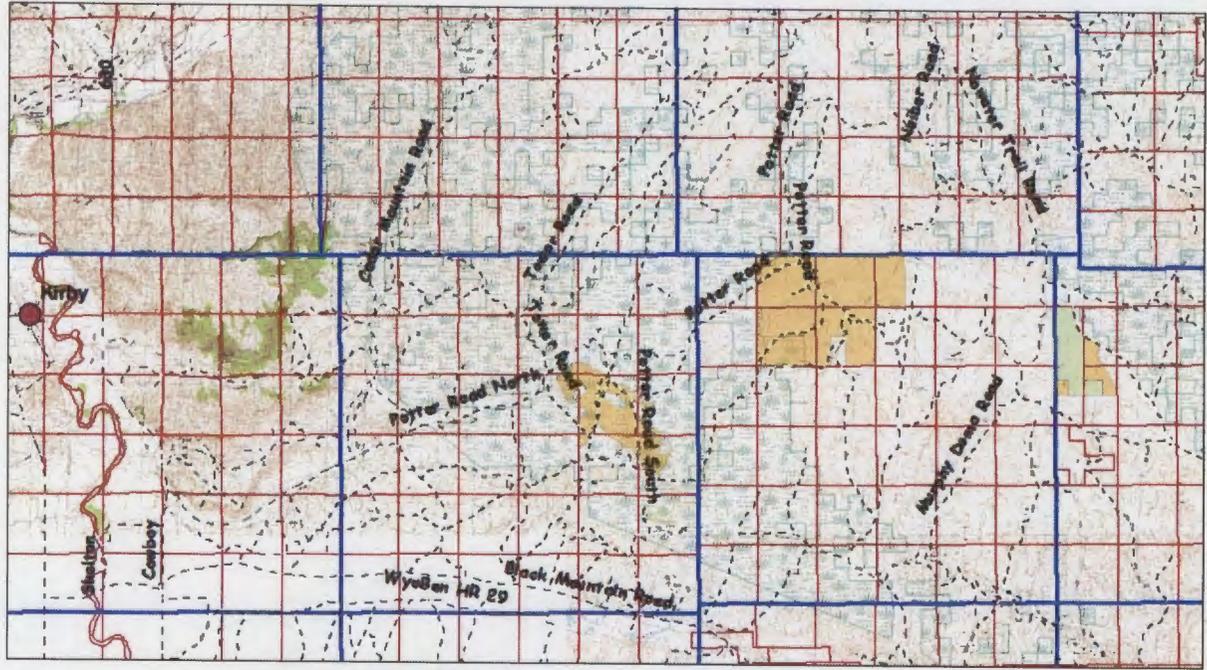
Cumulative effects for the proposed action are viewed as being potentially synergistic with those activities that are known to have occurred within 75 years of historical land management activities within the proposed project area. The proposed project area would receive a Plateau® aerial herbicide application on 4165 acres of a mix of public and private land. The proposed action will prompt a reversion of the present vegetation to an earlier seral stage that would present itself as a reduction in non-native annual bromes and a greater abundance of native annual and perennial grasses and forbs. Blue grama and bluebunch wheatgrass may have suppressed seed production for two years following the herbicide application. Livestock grazing impacts would be two years of non-growing season use in the Zimmerman Butte allotment. Recreationists would be notified of aerial application via announcement in local newspapers and with signage on major roads near the application area. None of the actions required to perform this project would have deleterious synergistic effects with past or foreseeable future activities.

## **REASONABLY FORESEEABLE FUTURE ACTIONS**

There are no cumulative impacts to grazing because after the two years of non-growing season use of the Zimmerman Butte allotment, grazing in it will continue as authorized. No projects that manipulate vegetation mechanically or by fire use are planned for the future in this area. Chemical treatments of herbicides to the area may take place if federal, state, or Washakie County listed noxious weeds are found.

# APPENDICES

## APPENDIX 1



0 0.75 1.5 3 4.5 6 Miles

- CYFO\_WFO\_Town\_Points
- Road
- BLM
- Private
- Sage grouse key habitat for fire protection

**Proposed Zimmerman Mud  
Brome Treatment for 2012-2014**  
T44N R91W Sec 7,18,TR 37  
T44N R92W Sec 3, 4, 5, 8, 9  
T44N R93W Sec 10,11,13,14,15,22-24  
Y. Warren 07/17/2012



Geographic Projection:  
North American Datum 1983  
Wyoming West Central

## APPENDIX 2

### NATIVE GRASS TOLERANCE TO PLATEAU®



**Tolerance of established grass to Plateau® herbicide, 8 to 12 oz/acre, fall applied.<sup>a</sup>**

Grass Species	Tolerant	Suppressed <sup>b</sup>	Not Tolerant	Unknown
Bermudagrass	X			
Bluegrass, Kentucky		X		
Bluestem, big	X			
Bluestem, bushy	X			
Bluestem, King Ranch	X			
Bluestem, little	X			
Bluestem, silver beard	X			
Bromegrass, smooth		X		
Broomsedge	X			
Buffalograss	X	X		
Cheatgrass			X	
Creeping foxtail, Garrison				X
Downey brome			X	
Fescue, Idaho	X			
Fescue, tall			X	
Gamagrass, eastern		X		
Grams, blue	X	X		
Grams, sidecoats	X	X		
Indiangrass	X			
Medusahead			X	
Needleandthread	X			
Needlegrass, green	X			
Orchardgrass		X		
Prairie cordgrass		X		
Prairie dropseed				X
Prairie sandreed	X			
Prairie threeawn	X			
Quackgrass		X		
Redtop		X	X	
Reed canary grass		X	X	
Rhodes grass/Fingergress	X			
Rye, annual or Italian			X	
Rye, perennial		X	X	
Switchgrass		X	X	
Timothy			X	
Wheatgrass, bluebunch	X	X		
Wheatgrass, crested	X	X		
Wheatgrass, intermediate	X	X		
Wheatgrass, pubescent	X	X		
Wheatgrass, slender	X	X		
Wheatgrass, stream bank	X	X		
Wheatgrass, western	X	X		
Wild ryegrass, Canada		X		
Wild ryegrass, Virginia		X		

- a. Species with more than one X mean tolerance will vary depending on variety, use rate and environmental conditions.  
 b. Suppression may be expressed as reduction in number of seedheads, seedhead height suppression or foliage height reduction; however, results have shown an increase in forage quality and full recovery of the pasture grass.

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 APN #03-16-126-0092

### APPENDIX 3

#### Plants found in the proposed Zimmerman Mud Brome Treatment area sorted by growth habit

Common name	Scientific name
<b>Graminoids</b>	
alkali sacaton	<i>Distichlis spicata</i> (L.) Greene
bluebunch wheatgrass	<i>Pseudoroegneria spicata</i> (Pursh) A. Löve ssp. <i>spicata</i>
blue grama	<i>Bouteloua gracilis</i> (Willd. ex Kunth) Lag. ex Griffith
Canada wildrye	<i>Elymus canadensis</i> L.
Indian rice grass	<i>Achnatherum hymenoides</i> (Roem. & Schult.) Barkworth
needle and thread	<i>Hesperostipa comata</i> (Trin. & Rupr.) Barkworth ssp. <i>comata</i>
Sandberg bluegrass	<i>Poa secunda</i> J. Presl.
squirreltail	<i>Elymus elymoides</i> (Raf.) Swezey ssp. <i>elymoides</i>
western wheatgrass	<i>Pascopyrum smithii</i> (Rydb.) A. Löve
threadleaf sedge	<i>Carex filifolia</i> Nutt.
<b>Forbs</b>	
textile onion	<i>Allium textile</i> A. Nels. & J.F. Macbr.
white locoweed	<i>Oxytropis sericea</i> Nutt. var. <i>sericea</i>
pale bastard toadflax	<i>Comandra umbellata</i> (L.) Nutt. ssp. <i>pallida</i> (A. DC.) Piehl
leafy wildparsley	<i>Musineon divaricatum</i> (Pursh) Raf.
showy milkweed	<i>Asclepias speciosa</i> Torr.
smooth woody aster	<i>Xylorhiza glabriuscula</i> Nutt.
scarlet globemallow	<i>Sphaeralcea coccinea</i> (Nutt.) Rydb.
yellow salsify	<i>Tragopogon dubius</i> Scop
<b>Shrubs</b>	
basin big sagebrush	<i>Artemisia tridentata</i> Nutt. ssp. <i>tridentata</i>
birdfoot sage	<i>Artemisia pedatifida</i> Nutt.
bud sagebrush	<i>Picrothamnus desertorum</i> Nutt.
Gardner's saltbush	<i>Atriplex gardneri</i> (Moq.) D. Dietr.
greasewood	<i>Sarcobatus vermiculatus</i> (Hook.) Torr.
Wyoming big sagebrush	<i>Artemisia tridentata</i> Nutt. ssp. <i>wyomingensis</i> Beetle & Young

## APPENDIX 4

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