Montana Fish, Wildlife & Parks

1400 South 19th Avenue
Bozeman, MT 59718

September 17, 2013

To: Governor's Office, Sheena Wilson, State Capitol, Room 204, P.O. Box 200801, Helena, MT 59620-0801
Environmental Quality Council, State Capitol, Room 106, P.O. Box 201704, Helena, MT 59620-1704
Dept. of Environmental Quality, Metcalf Building, P.O. Box 200901, Helena, MT 59620-0901
Dept. of Natural Resources & Conservation, P.O. Box 201601, Helena, MT 59620-1601
Montana Fish, Wildlife & Parks:

Director's Office	Parks Division	Lands Section	FWP Commissioners
Fisheries Division	Legal Unit	Wildlife Division	Design & Construction

MT Historical Society, State Historic Preservation Office, P.O. Box 201202, Helena, MT 59620-1202
MT State Parks Association, P.O. Box 699, Billings, MT 59103
MT State Library, 1515 E. Sixth Ave., P.O. Box 201800, Helena, MT 59620
James Jensen, Montana Environmental Information Center, P.O. Box 1184, Helena, MT 59624
Janet Ellis, Montana Audubon Council, P.O. Box 595, Helena, MT 59624
George Ochenski, P.O. Box 689, Helena, MT 59624
Jerry DiMarco, P.O. Box 1571, Bozeman, MT 59771
Montana Wildlife Federation, P.O. Box 1175, Helena, MT 59624
Wayne Hurst, P.O. Box 728, Libby, MT 59923
Jack Jones, 3014 Irene St., Butte, MT 59701

Ladies and Gentlemen:

The enclosed Environmental Assessment (EA) has been prepared for the proposed release of bighorn sheep at either of two identified locations in the Madison mountain range (Indian Creek or Wolf Creek). This project proposes to trap and transplant sheep from occupied sites within the mountain range, or from other source herds, and release them winter of 2013-2014 or thereafter at either of these two sites. The EA provides for subsequent transplants if necessary. Both release locations were once occupied bighorn habitat in the years before the all-age die-offs the herd experienced during the 1980's and 1990's. The benefit and purpose is to improve bighorn population size throughout the Madison mountain range by allowing appropriate habitats to be used. It will also help meet statewide bighorn goals, as per the 2010 Bighorn Conservation Strategy, in creating at least 1 new herd unit. This site should host 100-150 bighorn in the future, and will provide for the benefit and enjoyment of wildlife-watchers, photographers, and hunters. It should also improve the herd genetic potential.

Montana Fish, Wildlife & Parks invites you to comment on the attached proposal. The public comment period will be accepted until 5:00 p.m. October 16, 2013. Comments should be sent to the following:

Julie Cunningham
Bozeman Area Biologist
1400 S. 19th Ave
Bozeman MT 59718

Or e-mail to juliecunningham@mt.gov

Sincerely,

Patrick J. Flowers
Region Three Supervisor

Attachment

Draft Environmental Assessment

For the Potential Reintroduction of Bighorn Sheep

Into Indian or Wolf Creek, Madison Mountain Range, Southwest Montana

Montana Fish, Wildlife & Parks

September 2013

Table of Contents

List of Figures 4

List of Tables 4

Chapter I: Project Proposal 5

A. Proposed Action 5
B. Purpose, Need and Benefits 6
C. Location, Size, and Scope of the Proposed Action 7
D. Agency Authority for Proposed Action 10
E. Anticipated Schedule 10
F. Public Outreach and Contacts 10
G. Purpose of the Draft EA 11
H. Environmental Impact Statement Determination 11

Chapter II: Issues and Alternatives and How They Were Identified 12

A. Issues and Concerns 12

Issue #1: Competition with livestock 12

Issue #2: Competition with other wildlife 14

Issue #3: Would transplanted bighorn just return to their former home range? 15

Issue #4: Agency accountability 16

Issue #5: Will the number of predators in the area keep the proposal from succeeding? 17

B. Alternatives 18

Alternative A (No Action) 18

Alternative B – Release at Indian Creek (preferred alternative) 18

Alternative C – Release at Wolf Creek 18

C. Comparison of Alternatives with Respect to Effects 19

Chapter III: The Affected Environment 20

A. Soil 20
B. Water 20
C. Vegetation 21

Habitat Types 21

Species of Concern 21

D. Other Wildlife Species 22

Other Ungulates 22

Predators 22

Species of Concern 23
E. Social Issues 24
Motorized Travel 24
Recreational Activities 24
Livestock Grazing 24
Houses, Subdivisions, and People 25
Cultural resources 25
Chapter IV: Environmental Consequences 26
A. Soil 26
B. Water 26
C. Vegetation 27
Habitat Types 27
Species of Concern 27
D. Other Wildlife Species 28
Other Ungulates 28
Predators 29
Species of Concern 29
E. Social Issues 31
Recreational Activities 31
Livestock Grazing 31
Houses, Subdivisions, and People 32
F. Cumulative Effects 33
List of EA Preparers 34
List of Individuals Consulted 34
References Cited 34
Appendix A – Transplant Site Assessment Form 38

List of Figures

Figure 1: Map of the bighorn sheep habitat in the Madison Valley showing current sheep observations, and the proposed relocation sites. 8
Figure 2: Focal area of the bighorn sheep release proposal. Boundaries are the habitat break to the north and known bighorn sheep habitat to the south. 9
Figure 3: GPS locations from one year of activity of 44 cow elk captured in 2005 and 2006 overlaid on projected bighorn habitat. 15

List of Tables

Table 1: Comparison of alternatives relative to the issues identified during scoping. 19
Table 2: Plant species of concern in the bighorn reintroduction areas 22
Table 3: Animal species of concern in the bighorn reintroduction areas 23
Table 4: Comparison of alternatives relative to the affected environment. 34
Table 5: Habitat analysis summary for bighorn sheep at the Indian Creek study area release site. 40

Chapter I: Project Proposal

A. Proposed Action

The proposed action is to reintroduce bighorn sheep into a currently-unoccupied winter range in the Madison Mountains at Indian Creek or Wolf Creek (Figure 1). Both areas once served as wintering habitat with residents recalling sheep sightings prior to the die-off events of the 1980's (Boltz, Hudson, McGuinness, pers. communication). From habitat models, the area may support about 100-150 bighorn sheep at the Rocky Mountain density of 1.47 sheep/km^2 with escape terrain as the limiting factor (Appendix A – Transplant Site Assessment Form).

If this EA were approved, the preferred source herd would be from within the sheep range coming from their southernmost wintering area by Quake Lake. Other Montana source populations may also be considered. Capture methods could include using a drop net over a bait station, helicopter net-gunning, helicopter darting, or ground darting. Medications will be administered including an antibiotic to reduce the possibility of infection, ivermectine for parasite control, and a selenium supplement (Aune 1994). At the time of capture, source animals will be tested to determine their health status for statewide bighorn health monitoring efforts. Testing of 11 bighorn from the herd during winter 2011-2012 resulted in no *Mycoplasma* or *Manheimia* pathogens, but all were positive for Anaplasmosis, a tick-born disease which infects red blood cells in the infected animal. Many infections are subclinical, and clinical disease has rarely been confirmed in the wild (J. Ramsey DVM, MFWP internal communication 2012).

Prior to release, a portion of the sheep will be marked with radio transmitters to determine movements and distribution. Additional capture and handling recommendations adapted from the 2nd Annual North American Wild Sheep Conference are listed in MFWP 2010 (pg 31) and include: transplant sites should have the potential to support at least 100 sheep, potential transplant sites should be fully evaluated, including habitat, predator abundance, and the potential for livestock and other wildlife ungulate competition, initial transplants should include at least 30 animals, test source herds for diseases and do not transplant herds with recent histories of pneumonia, and monitor transplanted sheep for at least 1 year using mortality-sensing collars. The issue of connectivity between metapopulations is addressed in Section B and in the Transplant Site Assessment Form (Appendix A). The proposed transplant may provide some improved chance of interconnectivity between the proposed Indian Creek or Wolf Creek population and the existing Madison bighorn sheep populations behind Moose and Squaw Creeks 9-10 miles to the south and the Slide Inn bighorn population 21-23 miles to the south. Interconnectivity between small bighorn populations is biologically desirable for gene flow.

The Indian Creek release site is at the divide between bighorn hunting districts 301 (Spanish Peaks) and 302 (Hilgards); the Wolf Creek release site is within 302. If approved, hunting season regulations would be altered to protect the newly-released population until it becomes established and increases in number. FWP biologists will recommend if and when recreational hunting will begin based on ground and aerial counts and observations. Establishing recreational

hunting seasons is an action objective of most bighorn sheep transplant projects. One of the protocols for recently transplanted sheep is not to hunt them until they have reached 80% of a Minimum Viable Population (N=125) (i.e., 100 sheep) and there is sufficient annual recruitment to maintain herd growth while allowing for the anticipated harvest MFWP 2010; pg. 65. Sheep hunting seasons and harvest quotas are approved by the FWP Commission.

B. Purpose, Need and Benefits

Bighorn sheep were extirpated throughout much of the west around the turn of the century due to a variety of reasons including disease, over-hunting, and competition for forage from other grazers, often domestic livestock. The dramatic increase in bighorn sheep numbers and distribution in Montana since the 1940s is largely the result of a very purposeful and successful bighorn sheep transplant program (MFWP 2010). Between 1942 and 2009, FWP captured and released 2,028 bighorn sheep in 55 different locations across Montana. Restoring bighorn sheep to suitable habitats was the number one issue identified by the public during the scoping process for the Montana Bighorn Sheep Conservation Strategy (MFWP 2010; pg. 6). One of the statewide bighorn management objectives is to "Establish five new viable and huntable populations over the course of the next 10 years and augment existing populations where appropriate".

Recent die-offs and population declines have occurred in Montana and have increased the need for establishing and promoting healthy populations. From a conservation perspective, increasing the number and distribution of viable populations has a long-term survival benefit for the species. A collection of interacting populations of the same species is called a metapopulation (Akçakaya et al. 1999). Metapopulations are important to bighorn sheep management. Depending on distance and amount of interchange, they may increase the genetic health of surrounding populations through gene flow via dispersing individuals. Metapopulations may also help a population survive a die-off event if the event occurs on a distinct winter range. For example, the Quake Lake sub-population may have a die-off but the potential Indian Creek sub-population may be less affected. However, if the amount of interchange between subpopulations is high, metapopulations can all be affected in a die-off event. Either proposed transplant site may add to the metapopulation structure of the Madison sheep herd with some interchange possible with the Moose/Squaw wintering unit (9-10 miles south of Indian Creek; 3-4 miles south of Wolf Creek), the Quake Lake wintering unit (17-20 miles south of Indian Creek; 11-14 miles south of Wolf Creek), and possibly the Spanish Peaks wintering unit (17-18 miles northeast of Indian Creek; 22-23 miles northeast of Wolf Creek). The Spanish Peaks unit is separated by large areas of non-habitat.

The purpose of the proposed action is to reintroduce bighorn sheep into another area of the Madison mountain range with the goal of establishing a viable long-term population. A viable population would provide significant new recreational opportunities to include sport hunting and wildlife viewing. Bighorn sheep hunting in Montana generates a great deal of public interest

within the state and around the world. Hunting and wildlife viewing are economic engines that contribute to Montana's local and statewide economies. Hunting generates approximately $13.7 million dollars in Madison County per year (Fischer 2011), and bighorn sheep hunters generate more *per capita* revenue than any other hunter (Brooks and King 2012). Increasing recreational opportunities near Bozeman and Ennis, outdoor-oriented communities in southwest Montana, would be desirable to many people and businesses.

C. Location, Size, and Scope of the Proposed Action

Although bighorn sheep habitat exists throughout the Madison mountain range, we defined an analysis area bounded by an obvious break in habitat continuity to the north and occupied habitat to the south (Figure 2). East and west boundaries are naturally defined by non-habitat (i.e., lands without proximate escape terrain). The project area lies roughly between the southern end of Bear Creek Wildlife Management area and existing bighorn sheep range near Expedition Pass. The analysis area is about 100 mi^2. Of this, about 92% of the land is in public ownership (MFWP, State of Montana DNRC, Bureau of Land Management, or U.S. Forest Service). The remaining 8% of land is in mixed-use private ownership. Some of this land is grazed with cattle or horses, and some is in subdivision.

Bighorn sheep are not likely to occur throughout the entire project area. Like other wildlife species, bighorn will occupy and use only a small portion of the area. Exactly where and when bighorn sheep will occur will be decided by them as they explore available seasonal habitats and get to know the area. Their distribution will be most restricted during the winter followed by potential longer distance movements and wider distribution in the summer and fall. It may take several years for bighorn to adjust to their new habitat. Once the population becomes established, bighorn sheep, like most wild ungulates, show a remarkable degree of fidelity to specific seasonal habitats year after year.

Like most mountain ranges in southwest Montana, the Madison range is a complex mix of habitat types depending on elevation, aspect, moisture, amount of exposed rock, and topography. A GIS analysis and description of the habitat area can be found in Appendix A – Transplant Site Assessment Form.

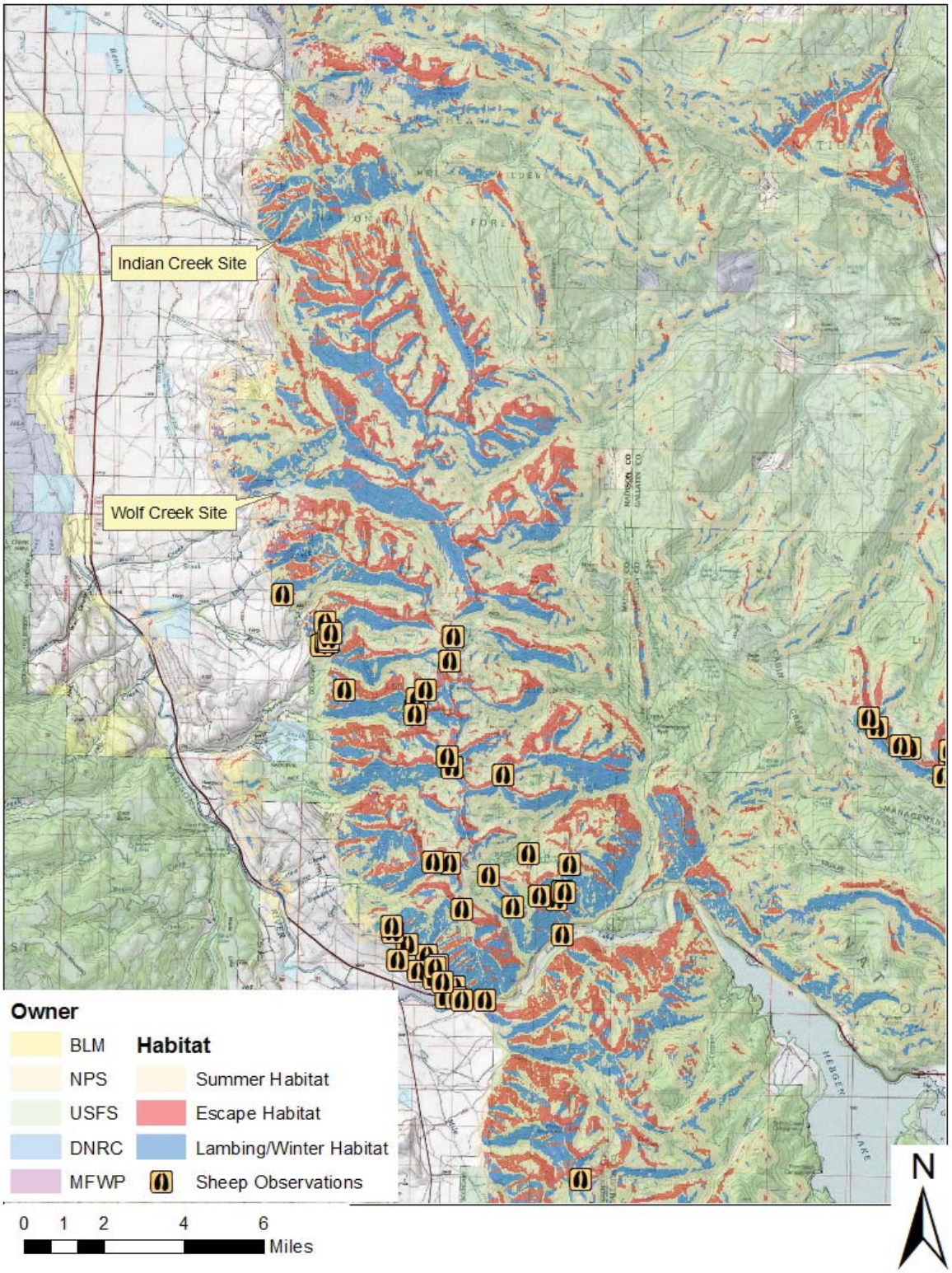

Figure 1: Map of the bighorn sheep habitat in the Madison Valley showing current sheep observations and the proposed relocation sites.

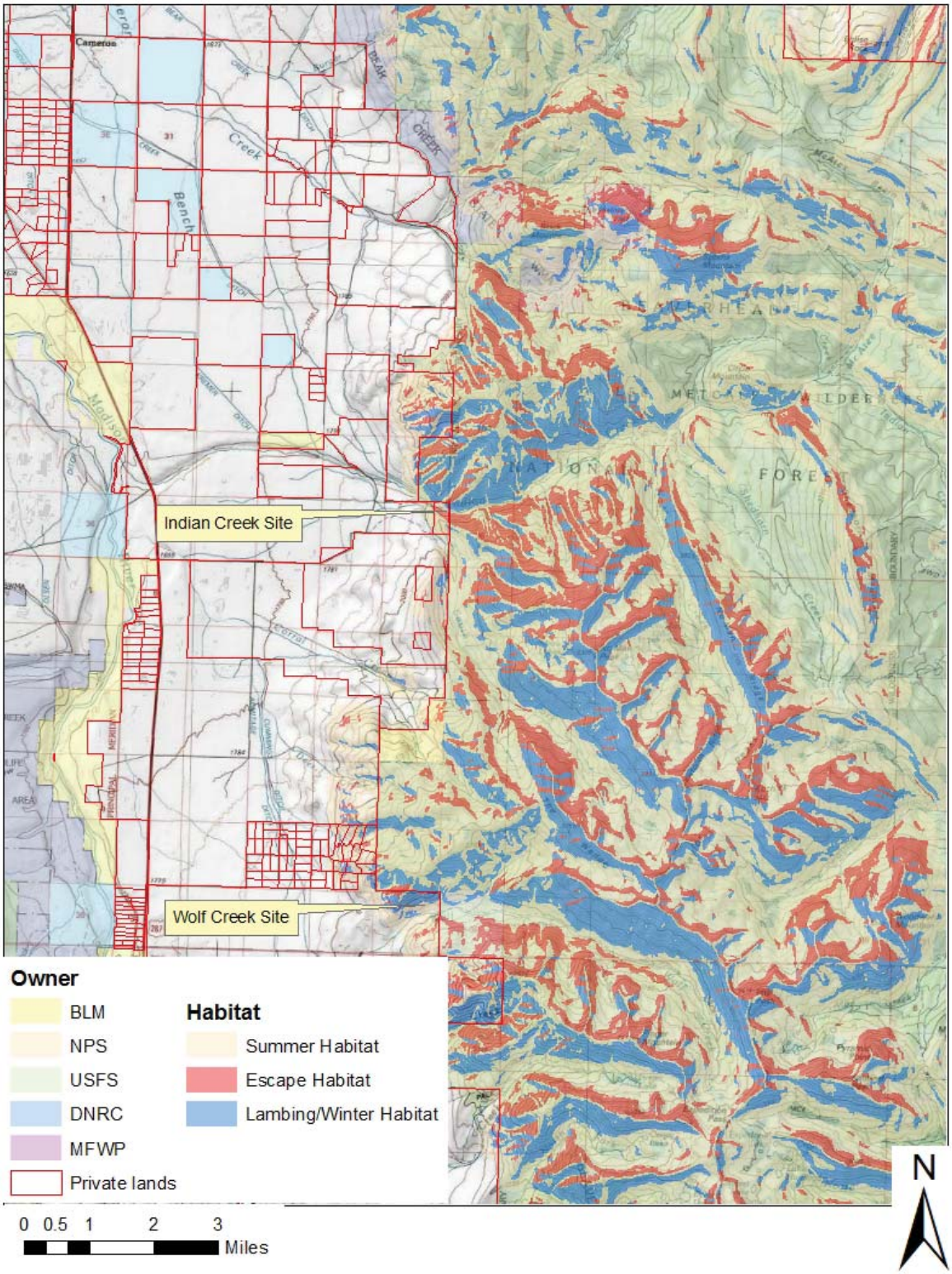

Figure 2: Focal area of the bighorn sheep release proposal. Boundaries are the habitat break to the north and known bighorn sheep habitat to the south.

D. Agency Authority for Proposed Action

FWP policies and guidelines are directed by state laws (MCA 87-5-701 to -721) which provide for the importation, introduction, and transplantation of wildlife. Specifically Montana Code Ann. § 87-5-711(2) provides that transplantation or introduction of any wildlife is prohibited unless the FWP Commission "determines, based upon scientific investigation and after a public hearing, that a species of wildlife poses no threat of harm to native wildlife and plants or to agricultural production and that the transplantation or introduction of a species has significant benefits".

Transplantation is defined as the "release of or attempt to release, intentional or otherwise, wildlife from one place within the state into another part of the state" (MCA 87-5-702(11)).

E. Anticipated Schedule

FWP will accept public comment on this draft EA beginning September 17, 2013. FWP will provide news releases to area newspapers and mail information cards about the EA to area landowners. Between September 16 and October 11, FWP will host a public meeting to accept public comment. By October 16, the public comment will conclude, the draft EA will be revised based on these comments, and the final EA will be written. The decision notice will be authored and finalized. The final EA and the decision notice will be completed by submitted to FWP commissioners October 25 for hearing at the November 14 Commission meeting where public comment will also be accepted.

If the project is approved, bighorn transplants could occur between December 2013 and February 2014. Bighorn transplants typically occur during the winter or early spring. Best results occur when source sheep are captured on their home winter range and released on suitable winter range habitat at the new transplant site as soon as possible. Subsequent windows of opportunity could occur December 2014 through February 2015 or later if further augmentation is necessary.

F. Public Outreach and Contacts

FWP has made an effort to contact and inform potentially affected and interested agencies, groups, landowners, and individuals about this project and will continue to do so throughout the EA process. The Beaverhead-Deerlodge National Forest (U.S. Forest Service) manages virtually all of the public land within the project area, and the project has been discussed with the Ennis forest biologist, district ranger, and range resource assistant. Contacts have also been made with the Natural Resource Conservation Service (NRCS), the Bureau of Land Management (BLM), and the Madison County Commissioners. The Department of Livestock, Department of Transportation, Department of Agriculture, and Department of Public Health and Human Services will also be contacted.

FWP identified and contacted private landowners in the analysis area about the project. We attempted to contact all landowners with at least 40 acres in or adjacent to bighorn sheep habitat area (Figure 2). Contacts were made in person and by phone. Additional contacts were

suggested by the Madison County Commissioners. We did not attempt personal contact with all homeowners in the Rising Sun Estates (a.k.a. Pearson Lane Subdivision). This area contains about 60 properties of about 20 acres each. These small lots are not in agricultural production. We contacted the homeowners' association with intent to distribute information about the project through EA notification. In addition, addresses of these landowners were compiled for an informational EA mailing. They will receive postcards with the date, time, and location of the public meeting, the timing of the comment period, and the web address where the draft EA will be posted.

G. Purpose of the Draft EA

The purpose of this draft EA is to describe the proposed project, list and discuss in detail major issues and concerns that have been identified up to this point, stimulate further public input and discussion of the issues, and identify additional issues. The draft EA will be the focus of a public meeting and will be distributed to interested parties as well as being available upon request. At the end of a public comment period, any new public input will be summarized and incorporated into a Final EA. Both the Draft and Final EA are documents that will provide the Decision Maker with the best available information to assist in evaluating the project and deciding whether to approve, not approve, or modify the proposed action in a Final Decision Notice. In this case, the decision making authority is the FWP Region 3 Supervisor.

H. Environmental Impact Statement Determination

Based on the analysis completed in this EA, FWP has determined an EA is the appropriate level of analysis because the proposed action is anticipated to have few to no impacts to the existing environment such as soil, water, vegetation, wildlife and social resources. Anticipated impacts may be minor, manageable, or mitigable.

Chapter II: Issues and Alternatives and How They Were Identified

A. Issues and Concerns

Landowners, sportsmen, FWP internal discussions, and discussions with other agency personnel identified five issues relevant to the success and impacts of this bighorn sheep transplant in the Madison Range at Indian Creek or Wolf Creek. These issues appear below in no specific order along with an attempt to provide the best possible current information available on the issue. Notably, there is little concern regarding two major issues for bighorn transplants elsewhere: disease transmission and roadside conflicts. Domestic sheep (and goats, to some extent) are host to pathogens for which bighorn have little or no immunity, but disease transmission risk is low here because most domestic flocks are at significant distances (>23km as recommended in MFWP 2010) and/or across several habitat barriers (Appendix A). There is also low potential for roadside conflicts at this site. Such conflicts arise where bighorn congregate in winter along major highways resulting in hazards for passing motorists. The nearest highway is about 4.5 miles away and across unfavorable habitat. A local county road will be less affected by bighorn, even if a congregation should occur, as speed limits are slower and the road is generally closed by snowfall during winter and not maintained.

Issue #1: Competition with livestock

Competition between species is predicated on three conditions: 1) big game and domestic animals are using the same area, 2) they are using the same forage plants (or dietary overlap), and 3) these forage plants are in short supply (Holechek et al. 2001). Below, we evaluate these three conditions.

<u>1) Spatial overlap between bighorn and livestock.</u> Some of the private lands (8% of expected bighorn habitat) graze horses and cattle. On the public lands (92% of expected habitat), there is at least partial overlap with three local cattle allotments. There are no nearby sheep or horse allotments. Bighorn will spatially overlap to some extent with livestock on both private and public lands, but overlap may be mitigated by bighorn sheep's necessary link with steep escape terrain. Bighorn sheep, especially ewes, are generally found within 100 to 300 meters from escape terrain (Douglas and Leslie 1999, Smith et al. 1991, Erickson 1972, Oldemeyer 1971). Escape terrain is comprised of slopes 60% or greater with occasional rock outcroppings. Bighorn prefer rugged steep habitats, and their ability to feed in areas far from standing water separates them from areas normally grazed by livestock.

<u>2) Dietary overlap.</u> The role of grasses, forbs, and browse in bighorn diet in the northern Rockies may be variable depending on location, habitat, weather conditions, time of year, and even by sex (Wagner and Peek 2006, Hobbs et al. 1983, Shank 1982, Tilton and Willard 1981). A comparison of four studies in the northern Rockies revealed the percentages of grass in diet varied from 36%-72%, shrubs from 22%-52%, and forbs from 4%-21% (Tilton and Willard 1981). These studies reported bighorn use, to differing degrees, of the following species or

genera: sedges (*Caryx sp.*), grasses (*Koeleria sp., Festuca sp., Pseudoroegneria spicata*), yarrow (*Achilea sp.*), mountain maple (*Acer glabrum*), serviceberry (*Amelanchier alnifolia*), Douglas fir (*Pseudotsuga menzesii*), juniper (*Juniperus scopulorum*), *Ceanothus sp*., bitterbrush (*Purshia tridentata*), and mountain mahogany (*Cercocarpus ledifolius*; Wagner and Peek 2002, Rominger et al. 1988, Kasworm et al. 1984, Shank 1982, Tilton and Willard 1981). The difference in diets reported in these publications demonstrates the challenges with predicting what would be the limiting type or species (if any) in this study area. However, this also demonstrates that bighorn sheep have adaptable dietary habits, and may adjust their feeding behaviors as needed to fit the environment.

3) Forage is in short supply. One measure of rangeland use by livestock has been the "Animal Unit Month" or AUM. One AUM would be the forage needed to sustain one cow-calf pair for one month (Society for Range Management 1989). Although AUMs are not easily converted between species due to differences in diet and behavior, in general bighorn sheep would approximate 1/5 of one AUM (Frisina, personal communication 2011; Pratt and Rasmussen 2001). With a recovery goal of 100-150 bighorn sheep, this would approximate 20-30 AUM. There are three cattle allotments on U.S. Forest Service land in the area. At Bear Creek (northern end), there are 68 cow-calf pairs allowed from July 1 to October 15. At South Indian Creek (central and the most proximate), there are 52 cow-calf pairs allowed from June 26 to September 30. At Squaw and Moose Creeks (southern end), 1,000 yearlings (600 AUM) are allowed July 1 to October 1. The USFS reviewed all allotments in the Madison Range in 2005 when allotment plans were updated. The analysis showed all the vegetation in good health (K. Suzuki, U.S. Forest Service communication 2013).

In summary, there are many reasons to expect that bighorn and livestock overlap will not result in a deleterious competitive relationship. First, vegetation is in good health across the majority of expected habitat overlap between bighorn and livestock. Second, the proposal will result in relatively low bighorn sheep numbers compared to cattle (20-30 AUM compared to 720 AUM). Third, bighorn are more likely to use steep escape terrain, placing them away from areas where livestock generally feed. Fourth, bighorn are expected to disperse away from livestock during much of the year using the higher mountain elevations.

Nonetheless, it is important to realize that some level of mutual use or competition for forage between wild ungulates and domestic livestock occurs across Montana all the time. In Montana, wildlife populations such as deer, elk, antelope, and bighorn are free ranging and have access to suitable habitat on both public and private land. In many cases, domestic livestock (e.g., cattle, horses, and sheep) and wild ungulates do eat the same forage to survive. Where livestock and wildlife overlap, some level of mutual use or competition occurs. In most cases there is sufficient forage for both species, however in some cases conflicts with livestock occur. This natural relationship is recognized in Montana law (MCA 87-1-225) and FWP wildlife management policy. If landowners believe that wildlife impacts become unreasonable, they can

contact FWP and pursue a solution see *Issue #4: Agency Accountability*, and ARM Game Damage Rules 12.9.802).

Issue #2: Competition with other wildlife

The occurrence of 100-150 bighorn at Indian Creek or Wolf Creek may result in some level of competition between introduced bighorn sheep, mule deer, elk, and mountain goats. All are possible competitors with bighorn sheep, but literature evaluating competition between these species presents varied conclusions. Hobbs et al. (1983) suggests that mule deer, elk, and bighorn will consume different foods but that individual variation and plasticity of diet choices may complicate understanding the relationships between the species. Singer and Norland (1994) found some evidence for competition for forage and niche overlap between elk and bighorn but less for mule deer and bighorn. Constan (1972) suggested spatial and dietary overlap between mule deer and bighorn was possible, especially in Douglas fir habitat types. Bighorn diets are reviewed more extensively in *Issue #1*: *Competition with livestock* (above).

Landowner concerns were specific to the number of elk in the area as potential competitors for a limited forage base. Elk counts in the area have ranged from approximately 3,400 to 6,100 over the last 10 years with a peak population in 2008. During the last four years, the population has been at a plateau of about 4,100 counted elk. Indian Creek divides elk hunting districts 360 and 362. Wolf Creek is in HD 362. Elk numbers in HD 360 are generally much lower than elk in HD 362 although elk cross Indian Creek frequently. Many landowners in the Valley have been concerned about elk competition with forage for cattle, elk-related damage to fences or crops, and disease risk (Brucellosis) from elk.

Elk numbers and distribution in the Valley received detailed study during an MSU/FWP collaborative research effort 2005-2007 (Grigg 2007) when 44 cow elk were marked with GPS collars which took exact location data every half hour for a full year. These data show elk use and distribution through the Valley. Related to the two introduction sites, the Indian Creek site shows much less elk use than the Wolf Creek site, so physical overlap of the species would be reduced on the Indian Creek bighorn winter range (Figure 3).

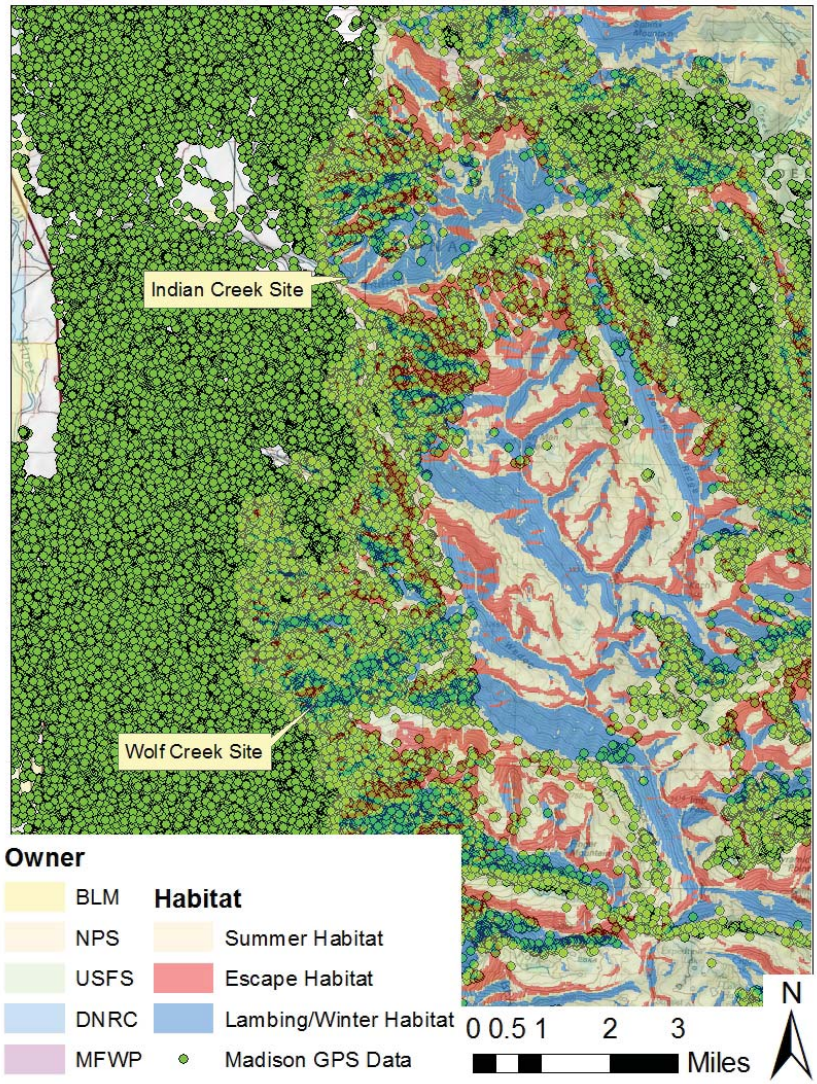

Figure 3: GPS locations from one year of activity of 44 cow elk captured in 2005 and 2006 overlaid on projected bighorn habitat.

Issue #3: Would transplanted bighorn just return to their former home range?

The proposed capture site is 18-20 air miles south of the Indian Creek release site and 10-12 air miles south of the Wolf Creek release site. The physical distances involved would be much longer as bighorn would have to traverse several major drainages with complex topography. During wintertime, such movement would be highly unlikely as snowpack can get deep in these mountain drainages. Bighorn habitat models show the area as a mosaic of continuous bighorn sheep habitats (winter range, escape terrain, and summer terrain). During summertime, the high-elevation range would be somewhat more continuous and some exchange is possible. Such exchange may actually be beneficial to the herd through maintaining gene flow. Sheep released

at Wolf Creek would have a higher likelihood of exchange on summer range as the head of the Wolf Creek drainage is at Expedition Pass and within a mile of current bighorn range.

We plan mitigations to prevent transplanted animals from returning to the capture site. First, we would use a drop-net to capture family groups. Sheep are social animals, and if the transplant consists of social groups, they may be less likely to wander. Second, transplant would occur in winter when sheep would be physically less able to return to the capture site.

A cost-benefit comparison would suggest this project to be a beneficial investment for the small risk that sheep would return to the capture site. Using the drop-net is a cost effective and safe method of animal capture when compared to helicopter capture. Helicopter captures are estimated to cost an estimated $700-$900 per animal due to high hourly rates for helicopter crews and jet fuel. Drop-net operations cost only the time of department and agency employees plus the costs in fuel to drive to the site. Using native animals to the mountain range would encourage survival as they will be familiar with the general ecosystem compared with transplants from other areas of the state. Using native animals would also decrease potential costs in disease transmission compared with using animals from another source which may have had different disease exposures. If the transplanted animals succeed in establishing in the winter range, the whole herd numbers would increase which would prevent inbreeding through small population sizes and increase the genetic health of the herd.

Funding will come from sheep auction license dollars for capture costs and to place VHF radio-collars on the transplanted sheep. These collars range in cost from $200-$500 apiece and will allow us to monitor the movement and survival of a sample of the transplanted sheep. Several collars may already be available for this purpose within the agency. Monitoring will help quantify the success of the transplant. If successful, it could be a new model for sheep transplants or augmentations in the state and elsewhere. If unsuccessful, we learned about the home-range fidelity of bighorns with a relatively inexpensive and low-risk “experiment” and can export this knowledge.

Issue #4: Agency accountability

Several landowners and the Madison County Commission discussed a generalized mistrust of government agency action. In addition to concerns with FWP (specifically regarding elk management, wolf management, communication flow, and local and statewide bison plans), landowners specifically mentioned problems with the U.S. Fish and Wildlife Service (wolf reintroduction), the U.S. Forest Service (access agreements), and unspecified conflicts with the BLM. Landowners expressed that government biologists may promise something one year, then several years later things change and they cannot deliver. Changes may come from unexpected animal behavior or political action.

Landowners and County Commissioners desire to see a well thought out plan, and our intent is to deliver that in this EA. Cooperative agreement documents suggested by the Sheep Plan (FWP

2010) outline expected responsibilities between FWP and landowners. Among these include FWP's responsibility to:

- Develop a population objective for bighorns that is consistent with available habitat, landowner tolerance, and other land uses that occur in the area.
- Address proactively any negative impacts to agricultural production by bighorn sheep.
- Manage the population through the use of hunting and/or trapping and transplanting sheep to other areas to stay within objectives for this population. This may include some limited ewe hunting.
- Assume the risk of transplant failure holding no landowner responsible.

Regarding future management concerns, wildlife management in the State of Montana is influenced by the state legislature (a publicly elected body) and the Fish and Wildlife Commission (appointed by the governor). Their actions can result in changes to state statute (Montana Code Annotated; MCA) or operating rules (Administrated Rules of the state of Montana; ARM) which FWP must abide. We propose the project under authorities listed in Chapter 1, Section D above, and under current game damage statute and rules (ARM Game Damage Rules 12-9-802). Such authority may change due to future legislative or commission action, but these are fully public processes.

Issue #5: Will the number of predators in the area keep the proposal from succeeding?

The Madison range supports a full suite of mid- to large-sized predators: grizzly bears (*Ursus arctos*), black bears (*Ursus americanus*), grey wolves (*Canis lupus*), coyotes (*Canis latrans*), wolverines (*Gulo gulo*), mountain lions (*Puma concolor*), and bobcats (*Lynx rufus*). Canada lynx (*Lynx canadensis*) may occasionally move through the area, but presence has not been verified in Madison County (Montana Natural Heritage Program 2013). Hunters and trappers can and do pursue and harvest black bears, grey wolves, coyotes, mountain lions, and bobcats in the Madison Range under established FWP seasons and regulations.

Mountain lions are expected to be the major predator on bighorn sheep. Wolf, black bear, and grizzly bear may opportunistically predate on sheep. Coyote, wolverine, and bobcat predation is possible but likely very rare. A literature review of predator diets in the northern Rocky Mountains reflected low bighorn predation by grizzly bears, black bears, and wolves. In the Yellowstone area, no bighorn were documented as bear kills 2007-2009 (Fortin et al. 2013), and Stone's sheep, a related species, were a minor (1-7%) portion of the diet of grizzly bears studied in British Columbia (Milakovic and Parker 2013). Wolves in the Greater Yellowstone mainly predate on elk (Hamlin and Cunningham 2009, Smith 2005), and bighorn sheep are extremely rare in their diet. In a 10-year study of wolf predation inside Yellowstone National Park, out of several hundred predation events wolves killed only 1 bighorn sheep (Smith 2005). Wolves have not seemed to have an impact on bighorn sheep in the Northern Yellowstone (White et al. 2008).

Mountain lion diet may be varied by age, sex, and individual preference. Key diet items are most often deer and elk but can include bighorn and moose (White et al. 2011, Knopff et al. 2010, Rominger et al. 2004). Mountain lions can suppress bighorn populations including translocated or introduced bighorn (McKinney et al. 2006, Rominger et al. 2004, Wehausen 1996). In such instances, special high-quota mountain lion areas can be established (e.g., Spanish Peaks Portion of HD 311 with quota of 7 lions). Localized lion removal for promoting bighorn survival is also discussed in McKinney et al. (2006).

Predator populations at Indian Creek and Wolf Creek are not expected to be different than at the Moose/Squaw or Quake Lake wintering areas. Mountain lions, wolves, and bears have been observed in all of these areas. Bighorn have survived at both other locations and would be expected to survive at Indian Creek or Wolf Creek as well. The Indian Creek drainage holds public access at a nearby trailhead. Several houndsmen hunt the drainage specifically for mountain lions. Black bear hunters use the area in spring and fall bear seasons. Wolf hunters also comb the area. Wolf Creek may see less mountain lion, wolf, and bear hunting. Without a trailhead, access to surrounding public land is more restricted.

B. Alternatives

Alternative A (No Action)

Under the no action alternative, bighorn sheep would not be reintroduced to Indian Creek or immediate vicinity at this time. Alternative A represents the current baseline condition and responds to those who oppose the bighorn sheep reintroduction including respondents wishing to postpone any release of bighorns at this time.

Alternative B – Release at Indian Creek (preferred alternative)

Alternative B represents the preferred alternative for transplanting bighorn sheep to the Indian Creek area of the Madison mountain range with the objective of establishing a sustainable population. Under this alternative, 40-50 bighorn sheep would be released on winter range in Indian Creek and monitored following protocols outlined in the Montana Bighorn Sheep Conservation Strategy (MFWP 2010). A follow-up augmentation release of 30-40 bighorns within 3-5 years is also possible. The release schedule depends on statewide transplant priorities, availability of sheep, and time availability of the capture crews needed for the operation.

Alternative C – Release at Wolf Creek

Alternative C was derived from informal scoping of Madison County area landowners. This alternative was proposed by a local resident who remembered bighorn sheep in Wolf Creek historically. FWP contacted both a board member of the Rising Sun Estates Homeowners' Association and the Sun Ranch, who both hold access to the site. Both parties were verbally amenable to this alternative. Logistics of the release would be as described above using the same timeline and number of bighorn for release. Only the location would differ.

C. Comparison of Alternatives with Respect to Effects

Under Alternative A, no sheep would be released and everything would stay the same. Under Alternatives B and C, sheep would be released as soon as source sheep became available, likely Winter 2013-2014 or Winter 2014-2015. Both release sites are in the same approximate block of currently-unoccupied bighorn habitat.

We compared the alternatives relative to the issues identified during the informal scoping (Table 1). Alternatives B and C are equal relative to competition with livestock, agency accountability, and likelihood that predators will impact the population. However as Wolf Creek does not have a publicly accessible trailhead, hunters may have a harder time accessing mountain lion, wolf, and black bear should predation become an issue for the bighorn. Alternative B is less likely to see competition with elk and less likely to see bighorn return to their capture site.

Table 1: Comparison of alternatives relative to the issues identified during scoping.

Issue	Alternative B – Indian Creek	Alternative C – Wolf Creek
Competition with livestock	Equal	Equal
Competition with wildlife (elk)	Less likely	More likely
Return to capture site	Less likely	More likely
Agency accountability	Equal	Equal
Predators	Equal	Equal

Chapter III: The Affected Environment

The purpose of Chapter III is to briefly describe components of the environment that could be affected by implementation of the proposed action. The chapter contains a general description of basic natural resources found in the project area. Resources related to project issues identified earlier are also described.

The proposed reintroduction area is in Madison County and encompasses about 100 mi^2 of the Madison mountain range south east of Cameron at Indian Creek and Wolf Creek. Projected bighorn habitat is approximately 92% public and 8% private lands. Potential bighorn habitat spreads across the Gallatin/Madison watershed divide. Habitat and population modeling efforts estimate this area may eventually support 100-150 bighorn; a minimum viable population size is about 125 (Appendix A).

Brief descriptions of existing natural resources within the analysis area appear under the below headings: Soil, Water, Vegetation, Other Wildlife, Social Issues, and Cultural Resources.

A. Soil

The soils at the Indian Creek and Wolf Creek reintroduction sites include Rochester-Rock outcrop complex and Shadow complex, 35 to 70% percent slopes (Greene 2008, USDA 2013). Wolf Creek also includes Sebud-Hapgood and Garlet-Como rock outcrop complexes. Rochester-Rock has parent material of colluvium derived from granite and gneiss, with organic matter content in the surface horizon of about 90%. The shadow component is on moraines and mountainsides. The parent material consists of gravelly alluvium and/or colluvium and/or till. Organic matter content in the surface horizon is about 4%. Sebud-Hapgood Rock Complex is generally moraine and mountain side and has parent material of colluvium, gravelly argillite colluvium, metaquartzite, igneous and metamorphic till. Garlet-Como Rock Outcrop Complex is generally valley, glacial valley walls of 30-80% slope, and has a parent material of colluvium derived from gneiss (Greene 2008, USDA 2013). Predicted bighorn sheep summer ranges are dominated by rock, rubble, and scree with shallow soil development occurring in some areas. Much of the summer range was influenced and created by montane glaciations (Greene 2008, USDA 2013). Detailed soil descriptions can also be found at: http://websoilsurvey.sc.egov.usda.gov.

B. Water

Hydrologically, both release sites flow to the Madison River. Other nearby streams to the north and south also drain into the Madison. Continuous bighorn sheep habitat does occur over the Madison/Gallatin Divide. Should sheep move significantly east during summer, they would occur in the Taylor Fork drainage of the Gallatin River watershed. Most water bodies in the analysis area are small perennial and ephemeral streams. The source of flowing water is primarily the snowpack that accumulates at high elevations during winter and spring months and slowly discharges to lower elevations during the year. Surface water is not a likely limiting factor in the proposed reintroduction of bighorn sheep.

C. Vegetation

Habitat Types

The Madison mountain range is within the southern mountains ecological region where bighorn populations may have complex migratory movements between seasonal habitats (MFWP 2010; pg 69). Summer precipitation, snowpack, vegetation, and overall habitat types will vary based on topography and elevation. Topography varies from rolling hills to sheer mountain canyons, and elevations range from 4,500 feet to over 12,000 feet. Along a low-to-high elevation gradient, the analysis area includes montane grasslands and agricultural use at low elevations, sagebrush steppe in the foothills and transition zones, dry (xeric) conifer forests on the hillsides transitioning to subalpine and alpine environments. Conifer species mainly include lodgepole pine, Douglas fir, subalpine fir, limber pine, and whitebark pine. Much of the predicted summer range occurs in higher elevation thinly forested areas with numerous small meadows and grassy parks. Aspen may be scattered in small patches throughout the habitat. The predicted bighorn sheep winter range is characterized by Idaho fescue/western wheatgrass and Idaho fescue/bluebunch wheatgrass grassland habitat types and big sagebrush/Idaho fescue, mountain mahogany/Idaho fescue, and bitterbrush/Idaho fescue shrubland types. The Wolf Creek release site has more montane sagebrush steppe component. Some winter ranges have experienced conifer colonization reducing the productivity of some sites. Riparian areas contain cottonwood, aspen, willow, dogwood, and hawthorn. There are six sensitive plant species reported on the Montana Natural Heritage databases for the areas, as described by their Townships Species of Concern

There are 5 plant species of concern in Indian Creek area, and 1 in the Wolf Creek area (Table 2). None are at high or very high risk of extinction in the state, as all are ranked S2S3 or S3.

Table 2A major change occurring in forested habitats, particularly in the lodgepole pine zone, is the impact of the pine bark beetle resulting in significant tree mortality. In the long term, these beetle affected areas may become more open and could benefit bighorn sheep that prefer open habitats that offer good visibility.

Species of Concern

There are 5 plant species of concern in Indian Creek area, and 1 in the Wolf Creek area (Table 2). None are at high or very high risk of extinction in the state, as all are ranked S2S3 or S3.

Table 2: Plant species of concern in the bighorn reintroduction areas http://mtnhp.org/SpeciesOfConcern/

Site	Species	Ranking	Habitat Characteristic
Indian Creek	*Carex stenoptila* (small-winged sedge)	S2S3	Grasslands (Montane)
	Aquilegia formosa (sitka columbine)	S3	Forest (Mesic)
	Draba crassa (thick-leaf whitlow-grass)	S2S3	Alpine
	Draba globosa (round-fruited draba)	S2S3	Alpine
	Draba porsildii (Porsild's draba)	S2S3	Alpine
Wolf Creek	*Pleiacanthus spinosus* (spiny skeletonweed)	S2S3	Grasslands (Low)

D. Other Wildlife Species

Other Ungulates

The predicted bighorn sheep summer and winter range will overlap with existing elk, mule deer, and mountain goat habitats. The west face of the Madison mountain range is surveyed annually for elk and mule deer, and every 4-5 years for mountain goats. Below we summarize the population status of each species in the area.

Elk. Elk counts have ranged from approximately 3,400 to 6,100 over the last 10 years with a peak population in 2008. During the last 4 years, the population has stabilized to an average of about 4,100 counted elk. Indian Creek divides elk hunting districts 360 and 362. Elk numbers in HD 360 are generally much lower than elk in HD 362, although elk cross Indian Creek frequently. Many landowners in the Valley have been concerned about elk competition with forage for cattle, elk-related damage to fences or crops, and disease risk (Brucellosis) from elk.

Mule deer. Mule deer numbers appear to be increasing after a recent decline. Since 1997, the maximum mule deer count was over 1,400, but counts were below 1,000 from 2008-2012. In 2013, a count of 1,022 suggests some recovery. The Indian Creek area is an important spot for mule deer in particular. In some years, concentrations of up to 50 deer in one group have been observed.

Mountain goat. At the time of writing, the most recent mountain goat surveys available are 2003, 2004, and 2009. We expect to fly another survey this year. Projected bighorn habitat will overlap 2 mountain goat hunting units: 325 and 326. Goat surveys are notoriously fraught with error due to difficult observation conditions if weather is too warm or if recent snowfall impedes visibility. Mountain goat surveys in 325 (north of Indian Creek) have enumerated 20-25 goats. Mountain goat surveys in 326 (south of Indian Creek) have enumerated 13-24 goats.

Predators

The Madison range supports the full complement of mid- to large-sized predators found in southwest Montana: grizzly bears, black bears, grey wolves, coyotes, wolverines, mountain lions, and bobcats. Canada lynx (*Lynx canadensis*) may occasionally move through the area, but presence has not been verified in Madison County (Montana Natural Heritage Program 2013). Hunters and trappers can and do pursue and harvest black bears, grey wolves, coyotes, mountain

lions, and bobcats in the Madison Range under established FWP seasons and regulations. The effects of predators on bighorn sheep are reviewed more thoroughly in Chapter II, Section A, Issue #5.

Species of Concern

There are 2 mammal species of concern in the area. Grizzly bears are listed as threatened by the U.S. Fish and Wildlife Service. The U.S. Fish and Wildlife Service is currently evaluating a proposal to add wolverine to the Federal List of Endangered and Threatened Wildlife with an expected notice within a year. Neither grizzly bears nor wolverines should be negatively affected by bighorn. There are 8 bird species of concern in the area, 7 of which are not at high or very high risk for extinction, as their ranks are S3. The Caspian Tern may be most at risk with a rank of S2B indicating concern during the breeding season.

Table 3: Animal species of concern in the bighorn reintroduction areas http://mtnhp.org/SpeciesOfConcern/

Site	Species	Rank	Habitat Characteristic
Indian & Wolf	Grizzly Bear (*Ursus arctos*)	S2S3	Conifer forest
	Wolverine (*Gulo gulo*)	S3	Boreal forest & alpine
	Clark's Nutcracker (*Nucifraga columbiana*)	S3	Conifer forest
Indian only	Clark's Grebe (*Aechmorphous clarkia*)	S3B	Lakes, ponds
	Bobolink (Dolichonyx oryzivorus)	S3B	Moist grasslands
	Caspian Tern (*Hydropogne caspia*)	S2B	Large rivers, lakes
	Great Blue Heron (*Ardea herodias*)	S3	Riparian forest
	Long-billed Curlew (*Numenius americanus*)	S3B	Grasslands
	American White Pelican (*Pelecanus erythrorhynchos*)	S3B	Lakes, ponds,
	Common Tern (*Sterna hirundo*)	S3B	Large rivers, lakes
Wolf only	Ferruginous Hawk (*Buteo regalis*)	S3B	Sagebrush grassland
	McCown's Longspur (*Rhynchopheanes mccownii*)	S3B	Grasslands
	Cassin's Finch (*Haemorhous cassinii*)	S3	Drier conifer forest

E. Social Issues

Motorized Travel

Motorized travel will not be impacted by either reintroduction site. At Indian Creek, the nearest highway is 4.5 miles away through non-habitat. There is a local county road, but the road is not maintained through winter when the sheep will be in the vicinity. At Wolf Creek, the nearest highway is similarly about 4 miles away through non-habitat, and there is only private rural road access to the reintroduction site. At both sites, the majority of the expected habitat falls into a wilderness designation by the U.S. Forest Service meaning there is no motorized travel in the area. The trails at each reintroduction site are for foot or horseback use only. Motorized travel is managed through travel planning efforts in the Beaverhead-Deerlodge National Forest. No further discussion of this topic will occur in Chapter IV.

Recreational Activities

Recreation in the project area includes hunting, hiking, fishing, camping, backpacking, trail-running, bird watching, horse riding, wildlife viewing, back country skiing, cross-country skiing, and snowshoeing. The Beaverhead-Deerlodge National Forest manages and regulates many of these activities on public land. There are 5 public-land outfitters who run day trip and/or hunting operations in the area. The project area is about half-hour south of Ennis, and about 1 ½ hours south and west of Bozeman. These are outdoor-oriented communities known for diverse recreational opportunities.

Livestock Grazing

There are no domestic sheep or horse grazing allotments on public land (Beaverhead-Deerlodge National Forest) in the project area. The USFS manages 3 cattle grazing allotments in the area, and livestock (cattle and horses) grazing also occurs on a portion of the private land which comprises 8% of the project area (see Chapter II, Section A, Issue #1). Potential bighorn winter and summer ranges overlap with some existing public grazing allotments and private grazing lands in the project area. On public land in the National Forest, bighorn summer range is generally at higher elevations, outside of grazing allotments, or in more rugged topography than is usually used by livestock. Bighorn sheep grazing within existing cattle allotments is likely to occur in areas less negotiable by domestic livestock. The same may be true on private grazing lands where overlap may occur. Domestic livestock prefer flat ground or gentle slopes and require frequent easy access to freestanding water, often provided by ranchers. Bighorn prefer more rugged steep landscapes near effective escape terrain (60% slopes with rock outcroppings) and do not need frequent access to standing water. Bighorn sheep are often found within 300 meters of steep escape cover (Smith et al. 1991).

Houses, Subdivisions, and People

Wild ungulates, including bighorn sheep, may use and create conflicts in rural subdivisions. A few conflicts with bighorns have occurred in western Montana where subdivisions border bighorn sheep winter range habitat in close proximity to escape terrain. Conflicts include grazing and browsing in yards, interactions with family dogs, minor property damage, and human safety/vehicle collision concerns. Bighorn-livestock conflicts are evaluated separately (Chapter II, Section A, Issue #1; Chapter III, Section E; and Chapter IV, Section E).

With at least one large ranch in the area for sale, FWP contacted the realtor of this property to learn about how bighorn sheep reintroduction could affect the sale of the ranch. The realtor suggested that in general and over time, established wildlife populations will increase the value of a property. He did note that in the short term, any controversies surrounding a reintroduction may, via reality or perception, result in difficulties for the current owner or potential buyer.

Cultural resources

The action alternative does not involve any ground disturbing activities. This proposed project will have no effect on cultural resources. No further discussion of this topic will occur in Chapter IV.

Chapter IV: Environmental Consequences

The purpose of Chapter IV is to describe and compare the potential consequences of implementing each of the alternatives under consideration. The emphasis is on resources connected with issues described in Chapter II. Resource discussions are presented in the same order as they appear in Chapter III. With any wildlife reintroduction there are several unknowns. Until bighorn sheep become established and use seasonal habitats in a traditional manner, some of the environmental effects can only be anticipated based on expected bighorn sheep behavior and habitat preferences.

A. Soil

Effects of implementing Alternative A:

Because bighorn sheep would not be released under the no action alternative, soils would remain unaffected.

Effects of implementing Alternative B or C:

Bighorn sheep at projected numbers of 100-150 animals are expected to have little impact on soils. Minor isolated natural erosion may occur in areas of repeated hoofed traffic. Any impact on soils by reintroduced bighorns would be less than impacts of much larger populations of cattle, elk, mule deer, and mountain goats which at their current numbers are not creating any significant known soil-related problems. There are no known natural mineral or salt licks in the area.

B. Water

Effects of implementing Alternative A:

Because bighorn sheep would not be released under the no action alternative, water resources would remain unaffected.

Effects of implementing Alternative B or C:

Water quality is not expected to be impacted by a population of 100-150 introduced bighorn. In northern latitudes, bighorns obtain most of their water from feeding on vegetation and snow (Lawson and Johnson 1982). Bighorn do not spend a significant amount of time foraging in wet densely vegetated riparian areas but instead feed primarily on upland grasses and forbs in open more dry habitats. If minor isolated erosion were caused by bighorn sheep, it would likely be of too small a magnitude to impact water quality.

C. Vegetation

Habitat Types

Effects of implementing Alternative A:

Because bighorn sheep would not be released under the no action alternative, winter range habitat would remain unaffected.

Effects of implementing Alternative B or C:

At the predicted range of 100-150 bighorns, there are no expected significant impacts on plant communities or range conditions. This area currently supports large healthy big game and livestock populations without long-term negative impacts to vegetation. The addition of a small population of 100-150 bighorn sheep, which were once native to the area and that specialize in grazing in rugged steep and dry habitat, should have little impact on plant communities or habitat types. The existing habitat types have evolved and prospered while being grazed by a number of native and introduced ungulate species.

Species of Concern

Effects of implementing Alternative A:

Because bighorn sheep would not be released under the no action alternative, sensitive plant species would remain unaffected.

Effects of implementing Alternative B or C:

There are no known threatened or "high risk" (S1 or S2) plant species in either area (Species of Concern

There are 5 plant species of concern in Indian Creek area, and 1 in the Wolf Creek area (Table 2). None are at high or very high risk of extinction in the state, as all are ranked S2S3 or S3.

Table 2), but there are six S2S3 or S3 rated sensitive plants. Of these plants, the three *Draba sp*. may overlap with bighorn habitat as they occur at high-elevation habitats. For these species, there are no obvious threats, and distribution and abundance are likely to be underestimated due to the inaccessibility of the sites where it grows. Given these factors, it will be difficult to determine whether or how bighorn would interact with this species.

Aquilegia formosa, or the Sitka columbine, is an S3 species occurring in mesic forest and is known in several areas of southwest Montana. More common species of columbine, such as *Aquilegia flavescens*, have not been documented in sheep diets in several studies (Wagner and Peek 2006, Rominger et al. 1988, Kasworm et al. 1984, Shank et al. 1982, Tilton and Willard 1981). Bighorn are not anticipated to negatively affect this species. *Pleiacanthus spinosus*, or Spiny skeletonweed, is found in low-elevation grasslands where bighorn are not likely to occur.

Lastly, *Carex stenoptila*, or small-winged sedge, is globally rare but known to occur in 7 Montana counties, and there is little information about this species. The species occurs in montane grasslands so may be in physical overlap with bighorn sheep. There are more than 130 species of sedges (*Caryx sp.*) native to Montana, and *Carex* species in general are known to be in bighorn diets (Rominger et al. 1988, Kasworm et al. 1984, Shank et al. 1982, Tilton and Willard 1981, but not Wagner and Peek 2006). Given the diverse diet of bighorn sheep, and the small total number of sheep involved, severe impacts on a population of *Carex stenoptila* would be unlikely.

D. Other Wildlife Species

Other Ungulates

Effects of implementing Alternative A:

Because bighorn sheep would not be released under the no action alternative, big game resources would remain unaffected.

Effects of implementing Alternative B or C:

The occurrence of 100-150 bighorn at Indian Creek or Wolf Creek may result in some level of competition between introduced bighorn sheep, mule deer, elk, and mountain goats. All are possible competitors with bighorn sheep, but literature evaluating competition between these species presents varied conclusions. Hobbs et al. (1983) suggests that mule deer, elk, and bighorn will consume different foods, but that individual variation and plasticity of diet choices may complicate understanding the relationships between the species. Singer and Norland (1994) found some evidence for competition for forage and niche overlap between elk and bighorn, but less for mule deer and bighorn. Constan (1972) suggested spatial and dietary overlap between mule deer and bighorn was possible, especially in Douglas fir habitat types. Bighorn diets are reviewed more extensively in Chapter II Section A, Issue #1.

An extensive literature review of field studies and modeling efforts regarding bighorn sheep and mountain goat resource and interference competition is summarized in Garrott et al. 2010. Salient results from this work include:

- Mountain goats and bighorn sheep may spatially overlap on summer or winter range.
- There is a real potential for dietary overlap between the species, but scale is important when measuring and considering resource use similarities/differences.
- Mountain goats may be dominant over bighorn sheep, resulting in competitive displacement.
- Mountain goats may be hosts for parasites and pathogens that may infect bighorn sheep.
- Variation in studies and study areas is common: competitive trends are not the same in all places, and there can be seasonal differences in fine-scale resource use.
- There is a lack of empirical data for sympatric populations, obfuscating interpretation from studies.

The impacts of these competitive relationships are poorly understood and difficult to predict. In some mountain ranges these species occur sympatrically with no ill effects while in other areas competitive issues may occur. We recognize that competition between these species may occur, but based on the best available information we cannot at this time predict the impacts. Bighorn and mountain goats seem to co-exist through their current range in the Hilgards and are often seen in proximity during survey flights.

Predators

<u>Effects of implementing Alternative A:</u>

Because bighorn sheep would not be released under the no action alternative, predators would remain unaffected.

<u>Effects of implementing Alternative B:</u>

The occurrence of 100-150 bighorn sheep at Indian Creek or Wolf Creek is not expected to have a major impact on the seven species of mid- to large-sized predators that occur or potentially occur therein (see Chapter III, Section D). Under certain circumstances all of these predators mentioned could potentially prey on young or adult bighorn sheep, but mountain lions are the primary predator on bighorns in Montana and elsewhere (see Chapter II, Section A, Issue #5). Bighorns would become a new prey source for mountain lions and some of the other mid- to large-sized predators. At predicted numbers, it seems unlikely that bighorns would become a major prey item for any single predator. The degree to which mountain lions shift to a new prey species (bighorns) may have a minor positive impact on the prey population that lions shifted from, in this case mule deer or elk.

Species of Concern

Effects of implementing Alternative A:

Because bighorn sheep would not be released under the no action alternative, sensitive wildlife species would remain unaffected.

Effects of implementing Alternative B or C:

The occurrence of 100-150 bighorn sheep at Indian Creek or Wolf Creek is expected to have little impact on the 2 species of threatened or sensitive mammals, the grizzly bear and wolverine. Either may occasionally or opportunistically predate on bighorn sheep, but bighorn are not expected to be large elements in their diets. The 10 sensitive bird species have generally different habitats from bighorn, so it is unlikely that bighorn sheep would overlap or cause any measurable effect on these (Table 3).

E. Social Issues

Recreational Activities

Effects of implementing Alternative A:

Because bighorn sheep would not be released under the no action alternative, existing access and activity restrictions would remain the same.

Effects of implementing Alternative B or C:

FWP is not making any requests for changes to public access, use, or recreational activities on the Beaverhead-Deerlodge National Forest for this bighorn transplant. The Beaverhead-Deerlodge National Forest permits 5 outfitters for day and/or hunting activities on the forest in the area. They do not anticipate any effects of bighorn on these activities. Recreation involving wildlife watching and hunting may benefit from this alternative as more opportunities will be provided. Any future changes regarding access and recreation on the Beaverhead-Deerlodge National Forest would be subject to the established Forest Service public planning and comment process. FWP has concluded that current levels of public access and recreation are compatible with a successful bighorn sheep transplant.

Livestock Grazing

Effects of implementing Alternative A:

Because bighorn sheep would not be released under the no action alternative, there would be no possible forage competition with livestock.

Effects of implementing Alternative B or C:

The occurrence of 100-150 bighorn sheep at Indian Creek or Wolf Creek is not expected to result in significant competition for livestock forage (See Chapter II, Section A, Issue #1). Competition for forage between bighorns and domestic livestock is reduced due to differences in behavior, habitat preferences, seasonal movements, and the number of bighorns expected to occur. Bighorns are a native species which has evolved to graze rugged, steep, rocky landscapes which few other species can negotiate. Bighorn winter and summer ranges overlap with some public grazing allotments. On the Beaverhead-Deerlodge National Forest, bighorn summer range is generally at higher elevation, outside of grazing allotments, or in more rugged portions of the allotment that are not easily accessible to cattle. Up to 1,240 cattle (720 AUMs) occupy public grazing allotments on the Beaverhead-Deerlodge National Forest during summer months. At a predicted population of 100-150 bighorn sheep, cattle would outnumber bighorns 8-12 to one. Given the much smaller body size of bighorn, the AUM comparison is 24-36 cattle AUMs per bighorn AUM. At relatively low bighorn sheep numbers compared to cattle, it is unlikely that much smaller bighorns would have a significant impact on available forage for cattle.

Some of the private grazing land in the project area occurs at lower elevation on relatively flat pastures or rolling foothills where slope is not a major factor. Domestic livestock prefer flat ground or gentle slopes and require frequent easy access to freestanding water, often provided by ranchers. Bighorns prefer more rugged steep habitats near effective escape cover and do not need frequent access to standing water. Escape cover (60% or greater slope with rock outcroppings) is a critical component of bighorn sheep habitat. Studies indicate that 95% of sheep activity occurs within 300 meters of escape cover. Critical escape cover is lacking on much of the private grazing land. Having a relatively small population of 100-150 sheep dispersed over a large area will also reduce the likelihood of competition in the few areas where livestock and bighorns may occasionally overlap. Again, bighorn sheep would be greatly outnumbered by livestock.

Houses, Subdivisions, and People

Bighorn sheep habitat in the Indian Creek area generally occurs away from home sites. There is one seasonally occupied home site at the reintroduction site, and these homeowners are advocates of this project. Other nearby home sites (about 1 mile away) are outside expected bighorn habitat. There are some seasonally-occupied guest ranch cabins near the reintroduction site at the edge of expected bighorn habitat. Other ranch home sites and a rural subdivision are more than 3-5 miles away and generally fall outside, or on the fringes of, expected habitat.

The Wolf Creek release area occurs more proximately to subdivision development with the Rising Sun Estates a mile away or less. This development contains about 50-60 lots of roughly 20 acres each. Most residents are seasonal, but some live in the area year-round. About 16-18 properties fall into marginal bighorn habitat. A homeowners' association board member speculates that most residents will be excited to see bighorn sheep in the area.

In all, approximately 8% of bighorn sheep habitat in the project area is in private ownership. Winter snows will bring bighorn to lower elevations where they may be more proximate to human habitation, but they will remain closely tied to the proximity of escape terrain year-round. Bighorn sheep, especially ewes, are generally found within 100 to 300 meters from escape terrain (Douglas and Leslie 1999, Smith et al. 1991, Erickson 1972, Oldemeyer 1971). Escape terrain is comprised of slopes 60% or greater with occasional rock outcroppings. Most home sites, including the Rising Sun Ranch subdivision, are not in close proximity to significant escape terrain. The majority of sheep activity is expected to occur on public land within the Beaverhead-Deerlodge National Forest.

In either area, residents may see the occasional wandering bighorn sheep, but large-scale conflicts are unlikely to develop. A factor in determining if wildlife conflicts occur is the number of animals involved. Often a small number of animals in or near a subdivision are tolerated, particularly if they are viewed as unique or unusual species for the area. Conflicts and complaints often develop when numbers increase beyond some level of tolerance and the novelty wears off. The total number of sheep expected to eventually occupy the study area is 100-150,

and based on sheep behavior and habitat modeling they will likely spend the majority of their time on public land away from subdivisions. FWP will pursue outreach and education to prevent landowners from feeding bighorn sheep. Homeowners often may think they are helping bighorn by providing food through winters whereas this actually congregates them unnaturally exposing them to disease. Feeding wildlife is illegal (MCA 87-6-213).

Should conflicts occur around home sites, FWP would consult with the landowner regarding options on how to deter the bighorn. Options may include strategic fencing, herding, or hazing. In some cases, bighorn may be transplanted away from the area. In the unlikely event of a human safety threat, FWP may lethally remove the offending animal(s).

With at least one large ranch in the area for sale, FWP contacted the realtor of this property to learn about how bighorn sheep reintroduction could affect the sale of the ranch. The realtor suggested that in general and over time, established wildlife populations will increase the value of a property. He did note that in the short term, any controversies surrounding a reintroduction may, via reality or perception, result in difficulties to the current owner or potential buyer.

F. Cumulative Effects

The addition of another bighorn sheep herd could improve the overall condition of the species in Montana. This new transplant could have a positive cumulative effect, as a healthy metapopulation has high potential value for the species through genetic exchange with other herds (Appendix A – Transplant Site Assessment Form).

Chapter III describes the existing conditions within the project area. As much of the area is in wilderness, the potential for prescribed burning or timber harvest to address conifer mortality associated with pine bark beetle die-offs is reduced. Continued expansion of rural subdivisions in the foothills is possible.

The potential cumulative effects on the bighorn sheep reintroduction relative to the above predicted activities were considered. Potential Forest Service land management activities, such as prescribed burns, may create additional bighorn sheep habitat and benefit the proposed bighorn sheep transplant effort. Further subdivision is unlikely in some areas as many of the nearby large ranchlands are under conservation easement. However, at least one major ranch in the area may sell. If subdivision increases, there may be occasional conflicts between bighorn sheep and home owners. However, bighorns are not expected to spend much time in subdivisions or use private land to a great extent, so some additional subdivision should not jeopardize the long-term success of bighorns at the reintroduction site.

A concern of several public contacts was that of “unforeseeable consequences” to this reintroduction. By the very nature that they are unforeseeable, we cannot respond to these concerns. FWP accepts that the political and environmental landscape can change quickly, but

notes that this is the case for any action we pursue. FWP will work to minimize the number and scale of potential issues through public outreach and agency coordination. This helps prepare a detailed plan to cover as many contingencies as possible.

Table 4: Comparison of alternatives relative to the affected environment.

Environmental Factor	Alternative B – Indian Creek	Alternative C – Wolf Creek
Soils	Equal	Equal
Water	Equal	Equal
Vegetation	5 species of concern in area*	1 species of concern in area*
Other Wildlife	10 species of concern in area*	6 species of concern in area*
Social Issues	Lower subdivision conflict risk	Higher subdivision conflict risk
Cumulative Effects	Equal	Equal

* Species of concern presence does not indicate bighorn would affect these species. See above text for discussion.

List of EA Preparers

This EA was prepared by Julie Cunningham, Bozeman Area Wildlife Biologist, FWP, with review and edits by Bruce Sterling, Howard Burt, George Pauley, and Quentin Kujala (FWP).

List of Individuals Consulted

Jennifer Ramsey (DVM), Neil Anderson, Joe Knarr; Montana Fish, Wildlife and Parks

Gordon Ash, Jenna Roose, Daryl Stewart, Kevin Suzuki; U.S. Forest Service

Katie Benzel, Bureau of Land Management

Dan Durham, Robert Natural Resource Conservation Service

Jim Hart, David Shulz, and Dan Happell; Madison County Commissioners

FWP has also contacted and discussed the bighorn sheep transplant proposal with numerous landowners within the project area.

References Cited

Akçakaya, H. R., M. A. Burgman, L. R. Ginzburg. 1999. Applied population ecology. 2nd ed. Sinauer Associates, Inc., Sunderland, MA. 285pp.

Brooks, R. and Z. King. 2012. 2012 statewide and regional hunter & angler use and expenditures sheet. Montana Fish, Wildlife and Parks, Helena MT. 4 pp.

Constan, K. J. 1972. Winter foods and range use of three species of ungulates. The Journal of Wildlife Management. 36: 1068-1076.

Douglas, C. L. and D. M. Leslie, Jr. 1999. Management of bighorn sheep. Pages 238-262 in R. Valdez and P. R. Krausman, editors. Mountain sheep of North America. University of Arizona Press, Tucson, AZ. 353 pp.

Erickson, G. L. 1972. The ecology of Rocky Mountain bighorn sheep in the Sun River area of Montana with special reference to summer food habits and range movements. Federal Aid Wildlife Restoration Project. W-120-R-2 and R-3. Montana Fish and Game Department, Helena, MT.

Fischer, D. 2011. Breakdown of $13.7M of direct expenditures by Madison County hunters in one year. Presentation to the Sonoran Institute, Planning for People and Wildlife Conference.

Fortin, J. K., C. C. Schwartz, K. A. Gunther, J. E. Teisberg, M. A. Haroldson, M. A. Evans, and C. T. Robbins. 2013. Dietary adjustability of grizzly bears and American black bears in Yellowstone National Park. The Journal of Wildlife Management. 77: 270-281.

Garrott, R., J. Rotella, M. O'Reilly, M. Sawaya, M. Zambon, and P.J. White. 2010. The Greater Yellowstone Area mountain ungulate research initiative 2010 annual report. Montana State University. 95pp.

Greene, A. 2008. Soil survey of Beaverhead National Forest area, Montana. United States Department of Agriculture, Forest Service in cooperation with Natural Resources Conservation Service. 1209pp.

Grigg, J. L. 2007. Gradients of predation risk affect distribution and migration of a large herbivore. Thesis, Montana State University, Bozeman MT. 77pp.

Holechek, J. L., R. D. Pieper, C. H. Herbel. 2001. Range management: principles and practices. 4th ed. Prentice-Hall Inc., Upper Saddle River, NJ. 587pp.

Kasworm, W.F., L.R. Irby and H.B. Ihsle Pac. 1984. Diets of ungulates using winter ranges in northcentral Montana. Journal of Range Management 37: 67-71.

Knopff, K. H., A. A. Knopff, A. Kortello, and M. S. Boyce. 2009. Cougar kill rate and prey composition in a multiprey system. The Journal of Wildlife Management. 74: 1435-1447.

Lawson, B. and R. Johnson. 1982. Mountain sheep (*Ovis Canadensis and O. dalli*). Pages 1036-1055 *in* Chapman, J. A. and Feldhammer, G. A. *eds.* Wild mammals of North America –

Biology, Management, and Economics. John Hopkins University Press, Baltimore and London. 1147 pp.

McKinney, T., J. C. Devos Jr., W. B. Ballard, and S. R. Boe. 2006. Mountain lion predation of translocated desert bighorn sheep in Arizona. Wildlife Society Bulletin. 34: 1255-1263.

Milakovic, B. and K. L. Parker. 2013. Quantifying carnivory by grizzly bears in a multi-ungulate system. The Journal of Wildlife Management. 77: 39-47.

Oldemeyer, J. L., W. L. Barmore, and D. L. Gilbert. 1971. Winter ecology of bighorn sheep in Yellowstone National Park. The Journal of Wildlife Management 35:257-269.

Pratt, M. and G. A. Rasmussen. 2001. Determining Your Stocking Rate. Utah State Cooperative Extension. 7 pp.

Rominger, E. M., H. A. Whitlaw, D. L. Weybright, W. C. Dunn, and W. B. Ballard. 2004. The influence of mountain lion predation on bighorn sheep translocations. The Journal of Wildlife Management. 68: 993-999.

Rominger, E. M., A. R. Dale, and J. A. Bailey. 1988. Shrubs in the summer diet of Rocky Mountain bighorn sheep. The Journal of Wildlife Management. 52: 47-50.

Shank, C. C. 1982. Age-sex differences in the diets of wintering Rocky Mountain bighorn sheep. Ecology. 63: 627-633.

Singer, F. J. and J. E. Norland. 1994. Niche relationships within a guild of ungulate species in Yellowstone National Park, Wyoming, following release from artificial controls. Canadian Journal of Zoology. 72: 1383-1394.

Society for Range Management. 1989. A glossary of terms used in range management. 3rd ed. Society for Range Management, Denver, CO.

Smith, T. S., J. T. Flinders, and D. S. Winn. 1991. A habitat evaluation procedure for Rocky Mountain bighorn sheep in the intermountain west. The Great Basin Naturalist. 51:205-225.

Smith, D. W. 2005. Ten years of Yellowstone wolves. Yellowstone Science 13: 7-33.

Tilton, M. E. and E. E. Willard. 1981. Winter food habits of mountain sheep in Montana. The Journal of Wildlife Management. 45: 548-553.

USDA 2013. Web soil survey. U.S. Department of Agriculture, Natural Resource Conservation Service. http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm accessed 8/16/13.

Wagner, G. D. and J. M. Peek. 2002. Bighorn sheep diet selection and forage quality in central Idaho. Northwest Science. 80: 246-258.

Wehausen, J.D. 1996. Effects of mountain lion predation on bighorn sheep in the Sierra Nevada and Granite Mountains of California. Wildlife Society Bulletin 24: 471-479.

White, K. R., G. M. Koehler, B. T. Maletzke, and R. B. Wielgus. 2011. Differential prey use by male and female cougars in Washington. The Journal of Wildlife Management 75: 1115-1120.

White, P.J., T.O. Lemke, D. B. Tyers, and J. A. Fuller. 2008. Initial effects of reintroduced wolves *Canis lupus* on bighorn sheep *Ovis canadensis* dynamics in Yellowstone National Park. Wildlife Biology. 14: 138-146.

Appendix A – Transplant Site Assessment Form

Fill out the following list of items as the various aspects of the potential transplant site are quantified according to the Habitat Evaluation Procedure (HEP) in the Translocation Section. Attach a map showing the potential site, including the overall area, potential lambing habitat, summer range and winter range.

Site Name: Indian Creek and Wolf Creek
Date: 8/31/13

1. Is this potential transplant site to your knowledge historical bighorn sheep habitat? Yes. Note that this area would be an extension of two other wintering areas in the same mountain range, so although MVP calculations (below) pertain only to this study area, in reality, these bighorn would be part of a larger population.

2. Are there any existing bighorn sheep populations in the vicinity? If yes, what is the name of the population, distance to it, and the likelihood for interchange assuming the establishment of a new population?

a. Name of nearest bighorn sheep population: i) Taylor-Hilgard Herd, ii) Spanish Peaks Herd
b. Distance from core habitat: i) 10-20 miles, ii) 20-25 miles
c. Likelihood of interchange: i) High, ii) Medium-Low

3. Are there any significant barriers to movement that need to be considered and if there are provide details and suggested mitigations if any? For example: prescribed burn to open up migration corridors where conifers are establishing on former grasslands. No significant barriers. Bighorn at this site are expected to move upward in elevation during summer, and on the high-elevation mountain meadows may exchange with the other Hilgard bighorn groups to the south. During winter, there will be barriers to travel as bighorn would have to traverse flat landscapes without escape terrain or through deep snows in the mountains. Areas of "non-habitat" do exist between this reintroduction site and the Spanish Peaks herd.

4. Based on your assessment of escape terrain in the entire potential area as described in the HEP (item 1 page 62 of Conservation Strategy) is there enough suitable habitat to support a MVP of 125 animals? What is the total estimated size of potential habitat from this analysis? If the area can support more animals what would be the estimate of total number of bighorn sheep the area could support at the appropriate density (see Translocation Section for densities in relation to habitat type)?

a. Is there suitable habitat for MVP: Yes, especially if bighorn use forested areas as well.
b. Size of potential habitat: Escape terrain for summer and winter exposures approximated at: 74-100km^2
c. Total number of bighorns the area can support: 108-147 bighorn at 1.47 sheep per km^2. Escape terrain is the limiting factor to this population.

5. Based on your assessment of potential winter range as described in the HEP (item 2) is there enough suitable habitat to support a MVP of 125 animals? What is the total estimated size of potential winter range habitat from this analysis? If the area can support more animals because of the size of potential winter range habitat what would be the estimate of total number of bighorn sheep the area could support at the suggested maximum density of 20 bighorn sheep /km2?

a. Is there suitable winter habitat for MVP: Yes.
b. Size of potential winter habitat: 33-53 km^2
c. Total number of bighorns the area can support: As higher densities can be expected on winter habitat (20/km^2 rather than 1.47 per km^2), winter range is not the limiting factor to this herd (663-1,058 bighorn).

6. Based on your assessment of potential lambing habitat range as described above in the HEP (item 3) is there enough suitable habitat to support a MVP of 125 animals? What is the total estimated size of potential lambing habitat from this analysis? If the area can support more animals because of the size of potential lambing habitat what would be the estimate of total number of bighorn sheep the area could support at the suggested amount of habitat (6 ha) required for each lambing ewe?

a. Is there suitable lambing habitat for MVP: Yes.
b. Size of potential lambing habitat: 33-53 km^2

c. Total number of bighorns the area can support: As higher densities can be expected on lambing habitat (16.6/km^2 rather than 1.47 per km^2), lambing range is not the limiting factor to this herd (550-878 bighorn).

7. Based on your assessment of potential summer range as described in the HEP (item 4) is there enough suitable habitat to support a MVP of 125 animals? What is the total estimated size of potential summer range habitat from this analysis? If the area can support more animals because of the size of potential summer range habitat what would be the estimate of total number of bighorn sheep the area could support?

a. Is there suitable summer habitat for MVP: Yes.
b. Size of potential summer habitat: 123-229 km^2
c. Total number of bighorns the area can support: Total at 1.47/km^2 = 181-336 bighorn

8. Are there domestic sheep or goats near this site? If so approximately how many and what would be their distance from the habitat to be potentially occupied by bighorn sheep? Are the domestic animals located on private or public lands? Is there opportunity for spatial/temporal separation based on minimum suggested distance of 23 km, effective physical barriers or other mitigating factors?

a. Number of domestic sheep and goats and distance to potential bighorn habitat: From the Indian Creek site, domestic flocks are 26km south (private), 29km north (private), 18km west (private) and 20-24km west (USFS allotment). From Wolf Creek, these distances are about 16km south, 40km north, 9km west and 15km west. Another domestic herd is grazed in a BLM/MSU/private land summertime weed control cooperative on BLM lands approximately 10 -17 km away from Indian Creek (8km away from Wolf Creek), but please see item c below regarding timing and physical barriers and note that as of a conversation of 3/15/11 with the BLM, the BLM is likely to cease domestic sheep grazing on these sites due to management conflicts and funding.
b. Located on Private or Public lands (describe): Lands in question include a mix of public and private in T9S, R1W; T10S, R1E; T11S, R2E; and T6S, R1W.
c. Opportunity for separation: Most domestic sheep herds lie at a significant distance, near or outside the 23km separation distance recommended by the Bighorn Conservation Strategy (MFWP 2010). Sheep herds to the west are also across major barriers: the Madison River and Highway 287. The BLM cooperative herd is across open flat lands bighorn would not be likely to cross, and they were only grazed in summer (June – Oct), when chance of contact would be low. There was a herder at all times, dogs to keep the sheep in control, and sheep were placed into a fence with electric wire at night. Conversations with Katie Benzel (biologist – BLM 2011) suggest that this grazing is not likely to continue into the future. Communications with producers will occur for awareness, but no mitigations are deemed necessary for this project.

9. Assuming there is adequate habitat to support an MVP of bighorn sheep what is your qualitative assessment on the juxtaposition of seasonal ranges. If the area is not large enough based on the assessment of the various seasonal ranges, how many bighorn sheep would it support?

The Indian Creek drainage includes two main areas bighorn sheep may exploit. The main fork of Indian Creek extends generally eastward through a narrow, steep canyon providing winter/lambing habitat to the north and plenty of rocky escape terrain. No Man Peak and No Man Ridge will provide excellent summering and lambing habitat. This area would be almost completely under public ownership. The South Fork of Indian Creek extends behind a large extension of steep, open grassland known locally as "The Hogsback". The Hogsback extends to a rocky feature known as The Wedge. Sheep in this area would likely exploit The Wedge, No Man Peak, and Sawtooth Ridge as their summering and lambing grounds. The wintering portion of this area may include some private lands, but the majority of this area would still be public lands.

At the Wolf Creek site, sheep are most likely to move up the drainage towards Expedition Pass, using the south-facing slopes during winter. They may also find The Wedge, which lies to the north. Sheep may also winter at Bad Luck creek, which lies to the south. This drainage may have deeper snowpack in winters.

Qualitatively, I would agree with the habitat models that the area could support 100-150 bighorn.

Table 5: Habitat analysis summary for bighorn sheep at the Indian Creek study area release site.

Land_Cover_Land_Use_Class	Area Other	Summer near Escape	Escape – North Aspect (Summer)	Escape – South Aspect (Winter)	Escape Total
Agriculture	0.4	0.0	0.0	0.0	0.0
Alpine	0.4	27.0	18.3	23.7	42.0
Forest	30.5	79.3	26.3	19.7	46.0
Human Use	0.0	0.0	0.0	0.0	0.0
Introduced	0.0	0.0	0.0	0.0	0.0
Shrub Grass	27.3	21.0	2.4	8.9	11.3
Sparse Barren	0.0	0.0	0.0	0.5	0.5
Transitional	0.5	0.1	0.0	0.0	0.0
Water	0.1	0.1	0.0	0.0	0.0
Wetland Riparian	1.9	1.2	0.0	0.0	0.0
Total km^2 Habitat	**61.1**	**128.7**	**47.0**	**52.9**	**99.9**

Population Supported Summary	Summer near escape	Escape ALL	Lambing/Winter	Total Escape + Summer	
Total Sq Km Habitat (**ALL** Landcover)	129	100	53	229	km^2
Population that can be Supported:					
1.47 / km^2 (Rocky Mountain)	**189**	**147**		**336**	**Sheep**
16.6 / km^2 Lambing Habitat			878		
20 / km^2 Winter Habitat			1058		

Population Supported Summary	Summer near escape	Escape ALL	Lambing/Winter	Total Escape + Summer	
Total Sq Km Habitat (**NON-FORESTED**)	49	74	33	123	km^2
Population that can be Supported:					
1.47 / km^2 (Rocky Mountain)	**73**	**108**		**181**	**Sheep**
16.6 / km^2 Lambing Habitat			550		
20 / km^2 Winter Habitat			663		