

Assessment of Risk of Physical Contact between Rocky Mountain Bighorn Sheep and Domestic Sheep in the Weminuche Grazing Analysis Landscape

INTRODUCTION

The Weminuche Landscape is located Hinsdale, La Plata and San Juan Counties, Colorado. The area is located northeast of Durango in Townships 36-40 North, Ranges 4-9 West, N.M.P.M., and is within the Columbine Ranger District of the San Juan National Forest (see Figure 2, at end of document). Most of the Weminuche Landscape analysis area is within the congressionally designated Weminuche Wilderness, the largest single wilderness area in the state of Colorado.

The Weminuche Landscape includes about 166,613 acres, of which about 161,077 acres (98%) is National Forest System (NFS) land. The remaining 3,983 acres are split out between Durango Reservoir Grant lands (City Reservoir) at 2,962 acres, and private lands at 1,021 acres. On National Forest System lands, 85% of the analysis area is in the Weminuche Wilderness. The remaining 15% is on non-wilderness lands.

Within the Weminuche Landscape, domestic sheep grazing is currently permitted on about 57,983 acres (36%) of National Forest System lands in 5 active allotments (Burnt Timber, East Silver Mesa, Spring Gulch, Tank Creek, and Virginia Gulch), and 8 vacant allotments (Canyon Creek, Cave Basin, Fall Creek, Flint Creek, Johnson Creek, Leviathan, Pine River, and Rock Creek). The only allotment in the Weminuche Landscape with permitted cattle grazing is the Canyon Creek Allotment. A small portion of the West Needles Allotment, which was closed to grazing in the Silverton Grazing Analysis, is proposed to be added to existing allotments and re-authorized for sheep grazing under this decision.

The majority of the Weminuche Landscape analysis area is located west and south of the Continental Divide, in extremely rugged and colorful volcanic mountains, with elevations ranging from about 7,200 feet to 14,100 feet. The Florida and Pine Rivers as well as Vallecito Creek have their headwaters in the analysis area. The analysis area is principally alpine tundra, mountain grassland, and spruce-fir forest. There are smaller areas of aspen, mixed conifer, ponderosa pine, and mountain shrub communities. Cirques and talus slopes, along with numerous streams, fens, and lakes add diversity to the rugged landscape.

Various sections of roads and trails may be used for trailing livestock. Some of these trailing routes are outside the Weminuche Landscape but they have been included in this analysis because they are integral to the function and effective management of the Landscape's allotments.

The trailing routes include the following:

U.S. Hwy 160, County Roads 151, 172, 240, 243, 318, 319, 421, 501, 502, 521, 523, 527, Forest Roads #076 (Red Rim #2), #081 (Lime Mesa), #595 (Red Rim), #597 (Endlich Mesa), #602 (Pine River), #682 (Missionary Ridge), #724 (Middle Mountain), #775 (Saul's Creek), and sections of the Pine River Trail #523, Vallecito Creek Trail #529, Cave Basin Trail #530, Young's Canyon Trail #546, and Lime Mesa Trail #676. This analysis also includes a pre-existing right of way across MacDonald Becket Family Trust properties, and their successors, for access to the Canyon Creek allotment and cattle allotments in an adjacent Landscape (Missionary).

Grazing of domestic livestock, sheep and cattle, has occurred in the Weminuche Landscape for over a century and has been authorized by the Forest Service since the early 1900's. The current

San Juan National Forest Land and Resource Management Plan of 2013 (Forest Plan), along with Allotment Management Plans (AMPs) and Grazing Permits, regulate the current numbers and type of livestock, dates of use, salting, vegetation manipulation and other activities undertaken for the purpose of grazing domestic livestock on NFS lands.

Domestic Sheep are the primary livestock permitted to graze in the Weminuche landscape, and their principle forage areas are in the alpine zone. Alpine rangelands in this Landscape have been used for grazing domestic sheep since the late 1800's. Prior to government control, sheep were herded in tightly grouped bands and continuously bedded in the same location for several nights in a row, which resulted in some areas of intense forage utilization and soil impacts from trampling and trailing. Some sites in the Weminuche Landscape still display these historic effects of long periods of intensive domestic sheep grazing. There are no additional bands of domestic sheep being grazed on adjacent or intermingled non-federal lands, in addition to the bands permitted to graze on the Forest Service allotments under analysis in this document.

Temporal Scale:

Two time frames are referred to throughout this analysis, short-term and long-term. Short-term refers to the immediate 10-year period (2014-2024) and long-term is considered beyond ten years (2025+).

PURPOSE OF THIS DOCUMENT

Rocky Mountain bighorn sheep are native to the Weminuche Landscape. Desert bighorn sheep are not known or thought likely to occur in the Landscape. For this reason, this document and analysis refers only to Rocky Mountain bighorn sheep.

Rocky Mountain bighorn sheep are designated by the Forest Service Rocky Mountain Region (Region 2) as a Sensitive Species on National Forest System lands within the Region (USDA Forest Service 2013d). This designation implies there is concern for the long-term viability and/or conservation status of bighorn sheep on NFS lands in the Region (Beecham et. al 2007). For this reason, all agency actions that have the potential to affect bighorn sheep conservation are analyzed for their potential impacts to bighorn sheep. Analyzing and disclosing the potential effects of domestic sheep grazing on bighorn sheep, a designated sensitive species, is needed to meet Forest Service Manual 2670 direction for sensitive species management, as described in FSM 2672.4.

Although habitat degradation from fire suppression, highways, livestock grazing, and human disturbance is of concern, the susceptibility of bighorn sheep herds to population declines or extirpation due to respiratory diseases, which can be transmitted by domestic sheep or goats (Besser et al. 2012b, Cassirer et al. 2013), appears to be the greatest concern for bighorn sheep population persistence on the San Juan National Forest (USDA Forest Service 2013a).

Mortality and depressed recruitment resulting from pathogens introduced by domestic livestock are regarded as the limiting factor for bighorn sheep in Colorado (George et al. 2009). Physical contact between domestic sheep or goats and bighorn sheep increases the risk of disease transmission from domestic animals to bighorn sheep, with potential for a subsequent bighorn sheep mortality event and/or extended period of reduced recruitment. The primary disease agents are respiratory diseases to which domestic sheep and goats are typically resistant or unaffected, and to which bighorn sheep have little resistance (Cassirer et al. 2013, Besser et al. 2012a, Besser et al. 2012b, George et al. 2008, Western Association of Fish and Wildlife Agencies 2007). Pneumonia caused by bacterial respiratory pathogens is considered the most virulent disease impacting bighorn sheep today (Besser et al. 2012b, George et al. 2009, Beecham et al. 2007). It can result in all age die-offs followed by suppressed lamb recruitment up to several decades after the initial die-off (George et al.

2008). Survivors become carriers of the disease and serve as a source of infection for other animals in the same herd, or other populations, through natural movements, forays, or translocations.

The complete range of mechanisms and/or causal agents that lead to disease events and low recruitment in bighorn sheep is still debated, and not all bighorn sheep disease events can be attributed to contact with domestic sheep or goats (Besser et al. 2012b, Colorado Division of Wildlife 2009, Aune et al. 1998, Onderka and Wishart 1984). However, when contact between bighorn sheep and domestic sheep or goats is documented, the severity of the bighorn sheep die-off is typically more pronounced (Aune et al. 1998, Martin et al. 1996). In some cases, bighorn sheep disease events can be devastating population-limiting events with outbreaks affecting animals of all age classes, and resulting in prolonged periods of low lamb survival (Cassirer et al. 2013, Besser et al. 2012b). For these reasons, it is prudent to implement management actions designed to reduce or eliminate the potential for physical contact between bighorn sheep and domestic sheep or goats (Colorado Division of Wildlife 2009, Western Association of Fish and Wildlife Agencies 2007).

The preponderance of scientific literature supports the potential for respiratory diseases to be transmitted from domestic sheep and goats to bighorn sheep, frequently followed by bighorn mortality events (Cassirer et al. 2013, Besser et al. 2012a and 2012b, USDA Forest Service 2011a, USDA Forest Service 2010a, Western Association of Fish and Wildlife Agencies 2007, Schommer and Woolever 2001, Martin et al. 1996). It is recognized that opposing arguments question this science and dispute the connection. The majority of literature, however, supports the potential for disease transmission between domestic sheep and bighorn sheep, and documents bighorn die-offs after contact with domestic sheep. Research continues on the science of disease transmission, bighorn mortality events, and the potential for development of effective vaccines. But until the science is better understood, it is prudent to consider and implement management actions designed to keep the species separate as a means to prevent the potential for disease transmission and subsequent bighorn mortality events.

Within the Weminuche Landscape, small portions of two active domestic sheep and goat allotments (Canyon Creek and Tank Creek), and portions of four vacant sheep allotments (Cave Basin, Flint Creek, Pine River and Rock Creek) overlap with Core Herd Home Range (CHHR) for bighorn sheep, as mapped by the Colorado Division of Parks and Wildlife (CPW). In some portions of these six allotments, direct overlap exists between mapped Core Herd Home Range for bighorn sheep and areas suitable for grazing by domestic sheep. Additional source (suitable) habitat for bighorn sheep extends across other areas of these allotments, suggesting that bighorn sheep could travel or disperse (i.e. foray) into currently unoccupied, but suitable, source habitat creating a potential risk of physical contact between bighorn and domestic sheep. The risk of contact between foraging bighorn sheep and domestic sheep corresponds to the number of bighorn sheep in a herd, proximity of domestic sheep allotments, the distribution of bighorn sheep source habitats (suitable habitat) across the landscape, and the distance and frequency of bighorn sheep forays outside their Core Herd Home Range.

As part of this analysis process, the Risk of Contact Tool, prepared by the USDA Forest Service Bighorn Sheep Working Group (USDA Forest Service 2013b), was used to help evaluate bighorn sheep movements outside their CHHR, and assess the potential for risk of contact between bighorn sheep and domestic sheep allotments in the Weminuche Landscape.

This “Risk Assessment” analysis is focused on the “risk of contact” between bighorn sheep and domestic sheep. No presumption is made that physical contact would lead to disease transmission or a subsequent bighorn sheep mortality event. However, the assumption is made that physical contact between bighorn sheep and domestic sheep results in an increased risk of disease transmission potential to bighorn sheep, with increased potential for a subsequent bighorn mortality event. Therefore it is prudent to reduce the risk of contact, and/or increase the distance

and/or degree or effectiveness of separation between the two species (Colorado Division of Wildlife 2009, Western Association of Fish and Wildlife Agencies 2007).

The goal of this “Risk Assessment” is to provide the decision maker with an objective evaluation of the risk of contact between bighorn sheep and domestic sheep in each active, vacant and forage reserve domestic sheep and goat grazing allotment in the Weminuche Landscape. Results from the Risk of Contact Tool provide the decision maker with an objective evaluation of foray probabilities and potential contact rates between bighorn sheep and each domestic sheep allotment in the Weminuche Landscape. Other qualitative information is provided and combined with results from the Risk of Contact Tool to determine a final ranking of risk of physical contact between bighorn sheep and domestic sheep. The decision maker will then use the results of this “Risk Assessment” as an important factor of consideration in their decision regarding domestic sheep grazing in the Weminuche Landscape.

As with most quantitative and qualitative approaches to evaluating risk of contact, there are a variety of uncertainties that must be recognized and considered. A more detailed discussion about uncertainties associated with the Risk of Contact Tool, with domestic sheep management techniques, and with ecological factors unique to the Weminuche Landscape is provided later in this document.

HISTORY OF DOMESTIC SHEEP GRAZING IN THE WEMINUCHE LANDSCAPE

Prior to the establishment of the San Juan Forest Reserve in 1905, the San Juan Mountains were used as summer range by large bands of domestic sheep from both Colorado and New Mexico, with the first small bands of sheep arriving in the Pagosa Springs, Bayfield, and Durango areas in 1882 (Scott 1932). It is estimated that by 1902, there were approximately 268,000 sheep in the San Juan Mountains. Sheep grazing was generally confined to the higher elevation range above 10,000 feet in elevation (DuBois 1903). Prior to the establishment of Forest Reserves, livestock grazing was unregulated, with season of use based on weather and vegetative development. Generally, sheep would begin slowly working their way up into the high country in May or June, eventually arriving on the highest elevation summer ranges in early July. They started to leave the high country sometime between September 15 and October 1 (DuBois 1903).

At this time, there was no division of allotments, so range was grazed on a first come first serve basis, with some areas grazed multiple times in a season. Domestic sheep were usually herded close together, which made it easier for herders to keep watch over the flocks and prevent individual animals from wandering. These large, close-herded bands were constantly moving ahead into fresh grazing, which in some areas resulted in damage to forage from close cropping and trampling. Bed grounds that were used for long periods of time, or that were used season after season, also became impacted (Roberts 1963). DuBois (1903) reported that large numbers of sheep prior to 1903 had already left definite trails through some alpine areas – especially in topographic constrictions (narrow, steep or rocky terrain). Domestic sheep also impacted previously well-defined trails by widening the trails, causing braiding of the trails and making the actual trail more difficult to locate (DuBois 1903).

Following the establishment of the San Juan Forest Reserve in 1905, many changes in management were implemented in an effort to more effectively manage the rangeland resource. Some of the noteworthy changes included dividing the domestic sheep ranges into distinct grazing districts (allotments) and assigning these areas to specific permittees with designated numbers and seasons of use, including the designation of specific trailing areas to be used to access the allotments. Other important management changes implemented during this time included the adoption of open herding, which allowed sheep to spread out and graze with a minimum of driving, which resulted in

less intensive grazing and less impacts from trampling. Use of bed grounds was also restricted to only a few nights in one place in order to reduce impacts to soils and vegetation.

Although it is difficult to precisely track historic sheep stocking rates, a search of historic records gives a general picture of the early days of regulated grazing on the San Juan NF. The earliest grazing reports located were from the Annual Grazing Report for the SJNF, 1908, and show 109,359 sheep and goats authorized to graze on the SJNF (in the area now covered by the Pagosa and Columbine Ranger Districts). Historic records show stocking of domestic sheep and goats in that same area in 1920 to be approximately 198,400. By 1930 the number of sheep reached the highest recorded at approximately 217,000 (M. Tucker pers. com.). From that period on, there were steady declines in stocking, including approximately 173,000 sheep in 1940, 107,000 in 1950, 73,000 in 1960, 33,000 in 1980, 19,000 in 1991, and 11,000 in 2004. Many factors contributed to the steady decades-long decline in domestic sheep stocking across the SJNF, the most important of which was a steady decline in demand for wool and lamb.

Historic records indicate that domestic sheep grazing either overlapped or occurred in close proximity to suitable and/or occupied bighorn sheep habitats across portions of the SJNF. Beginning in the late 1960s, Forest Managers began to note questions concerning competition between domestic sheep and bighorn sheep, and encouraged research programs on disease and predation of bighorns. During this same period, managers began discussions to reduce or limit domestic sheep grazing on bighorn sheep range in portions of the currently designated Weminuche Wilderness for the purpose of maintaining or enhancing known bighorn sheep herds.

ALTERNATIVES EVALUATED BY THIS ENVIRONMENTAL ASSESSMENT

Four alternatives are being evaluated by this Environmental Assessment (EA):

- 1 – No Action Alternative** whereby domestic livestock grazing would not be reauthorized on these allotments;
- 2 – Current Management Alternative** involving traditional livestock management using a predefined number of livestock (domestic sheep only) and specific grazing dates and allotment configurations (Figure 2, below).

Those design criteria as indicated in Appendix 1, EA Table 2-3, below, by an “x” in the Alternative 2 column are included as part of Alternative 2. These criteria apply to all active allotments across the landscape at all times.

- 3 – Adaptive Management with Forage Reserves Alternative.** This alternative is to continue to permit domestic livestock grazing on NFS lands by incorporating a variety of Adaptive Management strategies that will allow the lands within the landscape to meet or move towards meeting Forest Plan direction standards, and guidelines and desired conditions identified in this EA. Adaptive Management strategies are “tools” or management actions designed to maintain suitable resource conditions, or move unacceptable resource conditions towards desired conditions. Adaptive Management is designed to be flexible in regards to livestock numbers and season dates (Figure 3, below).

This alternative would incorporate adaptive management options for the active grazing allotments (Burnt Timber, Canyon Creek, East Silver Mesa, Spring Gulch, Tank Creek and Virginia Gulch), including boundary adjustments, allotment re-naming, trailing, and design criteria. This Alternative would permanently convert the Canyon Creek Allotment from sheep to cattle and permanently close the allotment to domestic sheep grazing. This Alternative would authorize the creation of a new domestic sheep forage reserve allotment out of portions of the Johnson Creek, Leviathan and Rock Creek Allotments. The remaining four vacant

sheep allotments (Cave Basin, Fall Creek, Flint Creek, and Pine River) would be closed to domestic sheep grazing. Finally, a cattle forage reserve allotment would be created out of the lower third of the Cave Basin Allotment. See the EA for a detailed list of specific actions that would be authorized under this Alternative.

Those design criteria as indicated in Appendix 1, EA Table 2-3, below, by an “x” in the Alternative 3 column are included as part of Alternative 3. These criteria apply to all active allotments across the landscape at all times.

4 – Adaptive Management/Closing Vacant Allotments Alternative, the Proposed Action.

The proposed action is to continue to permit domestic livestock grazing on NFS lands by incorporating a variety of Adaptive Management strategies. Adaptive Management strategies are “tools” or management actions designed to maintain suitable resource conditions, or move unacceptable resource conditions towards desired conditions. Adaptive Management is designed to be flexible in regards to livestock numbers and season dates (Figure 4, below).

This alternative would incorporate all the adaptive management options of Alternative 3 for the active grazing allotments (Burnt Timber, Canyon Creek, East Silver Mesa, Spring Gulch, Tank Creek and Virginia Gulch), including boundary adjustments, allotment re-naming, trailing, and design criteria. The difference between this Alternative and Alternative 3 is that all seven currently vacant allotments (Cave Basin, Fall Creek, Flint Creek, Johnson Creek, Leviathan, Pine River, and Rock Creek) would be entirely closed to all domestic sheep grazing. No forage reserves would be authorized. See the EA for a detailed list of specific actions that would be authorized under this Alternative.

Those design criteria as indicated in Appendix 1, EA Table 2-3, below, by an “x” in the Alternative 4 column are included as part of Alternative 4. These criteria apply to all active allotments across the landscape at all times. For Alternative 4, design criteria would be the same as Alternative 3 for current active allotments, but would not apply to closed allotments.

Alternative 2 - Current Management:

Under Current Management, livestock grazing continues with current AMP's or under the Annual Operating Instructions (AOI's). Permitted livestock numbers are shown below in Table 1.

Table 1. Current Domestic Sheep Grazing (Alternative 2), by Allotment, in the Weminuche Landscape.

Allotment	Total Acres	Permitted Numbers	Actual Use (5-Year Average)	On Date Range	Off Date Range	Days of Use	Last Year of Actual Use
Burnt Timber-Tank Creek Band	5,148	700	700	6/25 - 7/5	9/18 - 9/24	18	2013
Burnt Timber-Virginia Gulch Band	*	850	775	6/26 - 7/6	9/16 - 10/1	27	2013
East Silver Mesa	9,718	700	775	1-July	25-Sept	87	2013
Spring Gulch	3,077	700	700	6/15 - 6/30	9/22 - 10/5	16	2013
Tank Creek	10,954	700	700	6-July	14-Sept	71	2013
Virginia Gulch	14,375	850	775	10-July	15-Sept	68	2013
Burnt Timber-Canyon Creek Band	*	600	600	6/24 - 7/4	9/14 - 9/30	27	2012
Canyon Creek	6,328	600	600	5-July	13-Sept	71	2012
Cave Basin	22,452	750	**	1-July	15-Sept	77	1988
Fall Creek	10,939	1000	**	1-July	15-Sept	77	1968
Flint Creek	16,359	950	**	1-July	15-Sept	77	1972
Johnson Creek	9,456	388	**	16-July	15-Sept	62	1968
Leviathan	6,530	582	**	1-July	15-Sept	77	1970
Pine River	38,843	850	**	1-July	15-Sept	77	1980
Rock Creek	10,880	850	**	1-July	15-Sept	77	1970
Total	165,059	5,700	5,625				

**N/A, allotments vacant more than previous 5 years

~Active allotments are shaded in the table~

Existing improvements continue to be maintained as assigned in Term Livestock Grazing Permits and may be re-constructed once the useful life has been met and the need identified. New improvements would not be developed unless they are authorized in a NEPA decision.

Alternative 3 – Forage Reserve Alternative:

The Forage Reserve Alternative (see EA Table 2-3, and Figure 3, below) is to continue to permit livestock grazing in the Weminuche Landscape by incorporating adaptive management strategies

that will allow the lands within the landscape to meet or move towards meeting Forest Plan direction, standards, and guidelines and desired conditions identified in this EA. Adaptive management is a process where land managers implement management practices that are designed to meet Forest Plan standards and guidelines, and would likely achieve the desired conditions in a timely manner. However, if monitoring shows that desired conditions are not being met, or if movement toward achieving the desired conditions in an acceptable timeframe is not occurring, then an alternate set of management actions, as described and evaluated under this NEPA analysis, would be implemented to achieve the desired results. Adaptive Management is designed to be flexible in nature, and is based on conditions on the ground; not regulated by fixed livestock numbers or seasons of use. It can be compared to a performance-based contract that is written with specifications for the end results, rather than written with detailed specifications on how to accomplish the job.

The Forage Reserve Alternative continues to permit domestic sheep grazing on five active allotments (Burnt Timber, East Silver Mesa, Spring Gulch, Tank Creek and Virginia Gulch) and portions of three forage reserve allotments (Johnson Creek, Leviathan and Rock Creek). See additional forage reserve discussions below. Adaptive management strategies would be incorporated into all permitted livestock grazing allotments (see Table 2, below). Boundary adjustments would be made to Tank Creek and Virginia Gulch allotments to reduce the potential for contact between domestic sheep and bighorn sheep, more accurately reflect natural geographic and vegetation boundaries, and better reflect potential and actual domestic sheep use areas on the ground. As part of the boundary adjustments, the western most parts of Tank Creek would be closed to grazing. The East Silver Mesa Allotment would be re-named to Endlich Mesa to correctly reflect land features within the allotment. In response to a request from the Permittee, in 2013 the Canyon Creek Allotment was converted administratively from domestic sheep to cattle grazing. This Alternative would close the Canyon Creek Allotment to domestic sheep grazing.

The northern 2/3 of Rock Creek Allotment (7,344 acres), all of Leviathan Allotment (6,530 acres), and most of Johnson Creek Allotment (7,757 acres) would be designated as sheep forage reserves (see additional forage reserve discussions below). The remaining parts of Johnson Creek (1,699 acres) and Rock Creek (3,536 acres) allotments would be closed to grazing. Three other vacant allotments would be closed to grazing: Fall Creek, Flint Creek and Pine River. The entire Cave Basin Allotment would be closed to sheep grazing. However, the southern quarter of the Cave Basin Allotment would be designated a cattle forage reserve allotment. The Canyon Creek allotment was converted administratively to a cattle allotment in 2013 and would be closed to sheep grazing but remain an active cattle allotment. Access to allotments would continue through trailing from private lands to National Forest System lands. The USFS has no authority to authorize, or not authorize, use of trailing routes on non-National Forest lands.

Forage reserve is a specific designation for an allotment on which there is no current term permit, but for which a determination has been made to permit occasional livestock use (maximum 3 years out of any 10 consecutive years) for the purpose of enhancing management flexibility in other National Forest allotments. Forage reserve allotments are reserved for occasional use by livestock authorized in another allotment, when their allotment has a loss of forage availability due to a variety of potential factors such as drought, fire, rangeland restoration activities, or resource conflicts.

Generally, grazing of forage reserves is authorized through the issuance of temporary permits, but these temporary permits may be converted to term permits administratively under certain circumstances. Typically, a forage reserve would be expected to be used no more than two years out of ten, and would not exceed a total of 3 years out of any 10 consecutive years. If use is proposed to exceed this, then an inter-disciplinary team would verify whether allotment conditions were sufficient to support continued above average use.

Table 2. Status of allotments under Current Management (Alternative 2), under the Forage Reserve Alternative (Alternative 3), and under the Proposed Action (Alternative 4) in the Weminuche Landscape grazing analysis area.

Allotment	Current Management (Alternative 2)	Forage Reserve (Alternative 3)	Proposed Action (Alternative 4)
Burnt Timber-Tank Creek Band	Active Sheep	Active Sheep	Active Sheep
Burnt Timber-Virginia Gulch Band	Active Sheep	Active Sheep	Active Sheep
East Silver Mesa	Active Sheep	Active Sheep	Active Sheep
Spring Gulch	Active Sheep	Active Sheep	Active Sheep
Tank Creek	Active Sheep	Active Sheep	Active Sheep
Virginia Gulch	Active Sheep	Active Sheep	Active Sheep
Burnt Timber-Canyon Creek Band	Vacant Sheep	Closed	Closed
Canyon Creek	Vacant Sheep	Closed Sheep Active Cattle	Closed Sheep Active Cattle
Cave Basin	Vacant Sheep	Cattle Forage Reserve	Closed
Fall Creek	Vacant Sheep	Closed	Closed
Flint Creek	Vacant Sheep	Closed	Closed
Johnson Creek	Vacant Sheep	Sheep Forage Reserve	Closed
Leviathan	Vacant Sheep	Sheep Forage Reserve	Closed
Pine River	Vacant Sheep	Closed	Closed
Rock Creek	Vacant Sheep	Sheep Forage Reserve	Closed

~Active allotments are shaded in the table~

Alternative 4 – Proposed Action:

The primary difference between the Proposed Action (Alternative 4) and the Forage Reserve Alternative (Alternative 3) is that all seven currently vacant sheep allotments (Cave Basin, Fall Creek, Flint Creek, Johnson Creek, Leviathan, Pine River, and Rock Creek) would be entirely closed to domestic sheep grazing. No sheep forage reserves would be authorized. No cattle forage reserves would be authorized. As in Alternative 3, the Canyon Creek Allotment would remain an active cattle allotment and be closed to sheep grazing. All other actions described in the Forage Reserve Alternative (Alternative 3) would also be implemented in this Alternative, including incorporating adaptive management strategies that will allow the lands within the landscape to meet or move towards meeting Forest Plan direction, standards, and guidelines and desired conditions identified in this EA.

KEY CONCEPTS

The documents described below provide suggestions for consideration by land management agencies evaluating domestic sheep grazing activities within or in proximity to bighorn sheep range. These documents provide recommendations similar to “best management practices” and as such are not required. However, as generally accepted principles for achieving consensus-based conservation of bighorn sheep, these documents provide key concepts that can help land

management agencies achieve species conservation goals while also meeting multiple use goals. These documents, and a wide variety of scientific literature, were reviewed and key concepts were considered in the development of project design criteria (Appendix 1, EA Table 2-3, below) and this Risk Assessment.

- Colorado Bighorn Sheep Management Plan (George et al. 2009): directs Colorado Parks and Wildlife (CPW; formerly Colorado Division of Wildlife) to, among other things, prioritize conservation of bighorn sheep herds in Colorado on the basis of herd size, native status, management history, and potential for interaction with domestic sheep. State goals for the management of bighorn sheep herds affected by domestic sheep grazing in this Landscape were considered by local CPW staff who provided information regarding affects this project might have on bighorn sheep.
- Memorandum of Understanding (Colorado Division of Wildlife 2009): signed in March of 2009 by Forest Service Rocky Mountain Region, Bureau of Land Management Colorado State Office, Colorado Division of Wildlife, Colorado Department of Agriculture, and the Colorado Woolgrowers Association. This document recognizes, among other things, that contact between domestic sheep and bighorn sheep increases the potential for respiratory disease outbreaks in bighorn sheep, but also recognizes that not all disease outbreaks in bighorn sheep can be attributed to contact with domestic sheep. The stated goal is to minimize potential for contact by decreasing opportunities for domestic/bighorn sheep interaction; while still recognizing that some vacant sheep allotments are important to the domestic sheep industry as forage reserves or for other economic or management reasons. It is agreed that closure of active sheep allotments will not be recommended based solely on the potential for interaction between domestic and bighorn sheep, but land management agencies will follow existing regulation and direction regarding closure or modification of active allotments to resolve documented resource conflicts.
- Western Association of Fish and Wildlife Agencies Wild Sheep Report (WAFWA 2007): a report published by a collection of state and provincial wildlife management agencies. This group seeks to work collaboratively with livestock industry to reduce the potential for bighorn sheep die-offs. This report articulates concerns about the potential for disease transmission between domestic sheep and goats and bighorn sheep, and suggests an array of management approaches to minimize such risks. This report advocates, among other things, that effective separation (both temporal and/or spatial) of bighorn and domestic sheep should be a primary management goal, and recognizes that effective separation does not necessarily require the removal of domestic sheep.
- A Process for Finding Management Solutions to the Incompatibility Between Domestic and Bighorn Sheep (Schommer and Woolever 2001): provides Forest Service staff with recommendations for using a collaborative approach to find management solutions to reduce or eliminate contact between bighorn sheep and domestic sheep.
- Bighorn Sheep Analysis for NEPA Documents (USDA Forest Service 2011a): this unpublished letter from Deputy Chief of National Forest System, Joel Holtrop, directs National Forest units considering projects that could affect the potential for physical contact between bighorn and domestic sheep with subsequent potential for disease transmission to conduct a Risk Assessment analysis. This letter states “Forests that have necessary data, issue complexity, and the ability to conduct a quantitative bighorn sheep viability analysis may do so. However, a qualitative approach to NEPA analysis for bighorn sheep viability is sufficient as long as clear and reasonable rationale for the decision is displayed.” A follow-up letter from the Rocky Mountain Regional Office containing additional information regarding bighorn sheep analysis for NEPA Documents was also released (USDA Forest Service 2011b). As directed in these letters, the “Risk Assessment” displayed below utilizes the four-step process outlined in the Holtrop letter. The “Risk Assessment” uses a combination of quantitative and qualitative approaches to arrive at a conclusion about risk of contact between bighorn and domestic sheep in the Weminuche Landscape.

AFFECTED BIGHORN SHEEP HERDS

This section provides a summary, for each of the bighorn herds in the Weminuche Landscape, of bighorn management objectives identified by CPW for each herd, of population status and habitat present within the Weminuche Landscape, and of population estimates for bighorn herds addressed in this assessment. A separate discussion is provided for each herd which summarizes the baseline conditions for each bighorn herd. This information will be used later in the analysis to evaluate the potential for physical contact with domestic sheep.

The Weminuche Landscape intersects the mapped summer range of three bighorn sheep herds, with each herd representing a Game Management Unit (GMU). The three herds with summer range intersecting the Weminuche Landscape include: S-16, the Cimarrona Peak Herd, S-28, the Vallecito Creek Herd, and S-71, the West Needles Herd. See Figures 2, 3 and 4, at the end of this document, for maps displaying the locations of these three bighorn herds in the Weminuche Landscape. The S-16, Cimarrona Peak, and S-28, Vallecito Creek bighorn herds are considered by CPW to represent one large interconnected meta-population, along with S-15, the Sheep Mountain herd, to the east. Together, these three herds (GMUs) comprise the Weminuche Population Data Analysis Unit (DAU RBS-20). The current estimate for the Weminuche Population is 460 bighorn sheep, which includes 200 sheep in S-15, 135 sheep in S-16, and 90 sheep in S-28 (Weinmeister 2012). The current population objective for the Weminuche Population is to allow the population to expand to a maximum of 4.4 bighorn sheep/square kilometers.

There is no mapped overlap between domestic sheep allotments in the Weminuche Landscape and mapped summer range for S-15, although the Weminuche Population is considered to be an interconnected meta-population. Because the three GMU's are considered to be an interconnected meta-population, it is possible that decisions regarding domestic sheep grazing in the Weminuche Landscape could have indirect effects to the S-15 Sheep Mountain Herd. The level of risk to S-15 from indirect effects through exchange of individual bighorns across the larger meta-population is thought to be lower as compared to the direct effect of domestic sheep grazing within close proximity to S-16 and S-28. Domestic sheep grazing activities within proximity to S-15 are managed by the Pagosa Ranger District of the SJNF, and by the Divide Ranger District of the Rio Grande National Forest (RGNF).

A DAU management plan has been developed for the Weminuche Population, DAU RBS-20 (Weinmeister 2012). The Weminuche Population (DAU RBS-20) is a Tier 1 population, which places the population in the top priority State-wide for inventory and monitoring, habitat protection and improvement, disease prevention, and research. A Tier 1 population has ≥ 100 animals for $\geq 90\%$ of the years since 1986, and native populations comprised of one or more interconnected herds that have received few (< 50 animals total), if any, supplemental releases of bighorn sheep in the past (George et al 2009). The current population estimate of 460 bighorn sheep is based on CPW summer and winter helicopter surveys, and coordinated ground counts conducted by CPW and Forest Service employees on the SJNF and RGNF. The population is currently performing well as evidenced by continued growth, lamb production and recruitment, particularly in S-15 and S-16 (Weinmeister 2012). Bighorn sheep are being observed in places they have not previously been reported and they are presumed to be re-occupying historic ranges and filling gaps between disjunct core use areas.

There is some recent concern however for the population status of S-28, the Vallecito Creek Herd. This concern is due to a recent decline in bighorn observations in some traditional use areas, and fewer lamb observations (Weinmeister pers. comm.). Why recent bighorn observations might be declining in S-28 is unknown. A contributing factor may be the remote nature of this DAU and the core herd areas within it. Additional monitoring activities and monitoring opportunities in S-28 are

being discussed by CPW and the Forest Service in response to this perception of a recent decline in bighorn observations.

The bighorn population of the Weminuche Herd (DAU RBS-20) is one of the largest indigenous populations in the state (Weinmeister 2012). Primary (Tier 1) populations are regarded as those large, native populations comprised of one or more interconnected herds that have received few, if any, supplemental releases of bighorn sheep in the past. These populations likely represent those indigenous bighorn populations that have maintained the greatest genetic diversity, and their ranges represent habitats where bighorn populations have best been able to persist in sizeable numbers despite various adversities (George et al. 2009). As such, CPW considers the Weminuche population to be among the most important bighorn herds in the state. For this reason, George et al. (2009) recommend considering all opportunities to reduce the potential for contact with domestic sheep and potential for subsequent disease transmission.

A DAU management plan has not been completed for GMU S-71, the West Needles Herd (Weinmeister pers. com). The West Needles Herd is not a Tier 1 or a Tier 2 population, which places this population as a lower priority for inventorying, habitat protection and improvement, and research, as compared to populations that are considered primary core populations or Tier 2 populations.

Cimarrona Peak Herd (S-16):

The majority of S-16 on the San Juan NF is located on the Pagosa Ranger District. Only a small portion of the GMU is located on the Columbine Ranger District, but all of this is within the Weminuche Landscape. The vast majority of bighorn sheep habitat in the GMU occurs in alpine and subalpine habitats in the Weminuche Wilderness, along or adjacent to the Continental Divide. The herd is managed in conjunction with S-28, the Vallecito Creek Herd, and S-15, the Sheep Mountain Herd, and collectively referred to as the Weminuche Population (DAU RBS-20).

Early reports of bighorn sheep in S-16 from Forest Service records date from the early 1920s and note bighorn sheep present on the Piedra Ranger District around Cimarrona Peak. This area is still considered to be core herd home range today. The number of sheep reported ranged from 2 sheep in 1922 to 50 sheep in 1941. Additional early reports of bighorns in the GMU include from 1944 when 30 individuals were counted, and from 1970 when the population was estimated to be 35 to 40 animals (Bear and Jones 1973). Since these early periods, bighorn sheep have been inventoried and monitored sporadically via helicopter surveys conducted by CPW, ground surveys conducted by CPW and USFS crews, and coordinated ground counts (2009) conducted by CPW, USFS, and volunteers. The S-16 population was estimated at 70 animals from 1986 through 1993 (George et al. 2009). From 1994 through 2004, the recorded population estimate increased and remained at 100 animals, and from 2005 to 2007 the population was estimated at 90 animals, and from 2008 to present increased to 135 animals. Over the last 10 years, the average post-season lamb:ewe ratios have been 50:100 (Weinmeister 2012).

Current bighorn distribution in S-16 is similar to that reported by Bear and Jones (1973), but also includes areas north of Granite Lake and the Continental Divide, east to the Cliffs above Palisade Lakes (USDA Forest Service 2013a). Habitat along the Continental Divide serves as a natural linkage that may facilitate interaction with bighorn sheep in S-15. There have been no translocations into or out of S-16 (Beecham et al. 2007).

Recent bighorn observations and reports show a moderate range expansion in the GMU, compared to historic records. Bighorns are currently present along the far eastern boundary of the GMU, directly adjacent to S-15. The very close proximity of these two herds coupled with good habitat connectivity increases the likelihood of interaction.

Field reconnaissance and habitat modeling show an extensive amount of well-connected habitat across S-16. CPW identifies approximately 38,126 acres of occupied habitat on the SJNF which constitutes 87% of the occupied habitat in the GMU (USDA Forest Service 2013a). Bighorn sheep in S-16 generally winter and summer in the same terrain. There are no known lambing areas or wintering areas within the Weminuche Landscape, all known lambing and wintering areas for S-16 are on the Pagosa Ranger District. Summer range is extensive and does not appear to be a limiting factor.

There are several domestic sheep and goat grazing allotments on the Divide Ranger District of the Rio Grande NF that overlap or lie adjacent to S-16, but all are currently vacant. All domestic sheep allotments on the portion of S-16 managed by the Pagosa Ranger District were closed to domestic sheep grazing in 2010 (USDA Forest Service 2010b). Only one sheep allotment within the Weminuche Landscape overlaps S-16, the Pine River Allotment. The Pine River Allotment has been vacant since 1980.

Summer range in S-16 is extensive and does not appear to be a limiting factor. Winter range, however, is somewhat restricted particularly following big snowfalls. There are no known wintering areas in the Weminuche Landscape. On the Pagosa Ranger District, bighorns are known to winter in lower elevation portions of S-16 characterized by scattered Douglas-fir within large rocky outcrops and cliff bands. In these locations, canopy cover and sight distance may constrain bighorn distribution, and increase exposure to predation.

An extensive amount of spruce bark beetle activity is present in S-16, including those portions of the GMU in the Weminuche Landscape. Large stands of Engelmann spruce have either died or are dying due to an epidemic beetle infestation, causing extensive openings in the overstory forest canopy. The spruce die-offs resulting from this beetle epidemic are expected to increase forbs and grasses in the understory of previously closed-canopy stands, thus having a potentially beneficial impact on bighorn sheep by allowing more abundant and higher quality forage to develop in these stands. Visual barriers caused by stands of living conifers are expected to be reduced, thereby improving the ability of bighorn sheep to detect predators.

Predation is not considered a factor likely to be limiting bighorns in S-16. A variety of summer and winter recreation activities occur in the GMU. During summer, moderate to high amounts of backpacking, day hiking, and horseback riding occur due to the presence of the Continental Divide Trail and popular destination lakes. Most of these activities occur in areas away from known lambing and optimal security habitat. Due to the general remoteness of the GMU, and limited access to winter bighorn habitat by winter recreationists, winter recreation activities and associated human disturbances are not considered a limiting factor for bighorns in S-16.

In summary, the bighorn population in S-16 appears to be doing well. The current population is estimated at 135 animals. The long-term (25-year) trend in CPW population estimates show this herd has increased moderately in numbers and in distribution. There are no current concerns for bighorns in S-16 associated with habitat quality or quantity, predation, competition with other ungulate species, or human disturbance. The primary management issue of concern for bighorn sheep in S-16 is the potential for physical contact with domestic sheep.

Vallecito Creek Herd (S-28):

Unit S-28, the Vallecito Creek Herd, lies between units S-16 and S-71. S-28 lies almost entirely on the Columbine Ranger District, and nearly all (97%) is on NFS lands. The vast majority of bighorn sheep habitat in the GMU occurs in alpine and subalpine habitats in the Weminuche Wilderness.

The herd is managed in conjunction with S-15, Sheep Mountain Herd, and S-16, Cimarrona Peak Herd, and collectively referred to as the Weminuche Population (DAU RBS-20).

Early records suggesting the presence of bighorn sheep in S-28 are from 1908 on a map titled “Map of the San Juan National Forest Showing Ranger Districts and Grazing Divisions” (USDA Forest Service 2013a). The map identifies the “Mountain Sheep Game Refuge, No Grazing” encompassing the headwaters of Needle Creek (unit S-71) east to Vallecito Creek (unit S-28), and north to Vallecito Lake. Other reports from the Colorado State Game Department in 1954 note mountain sheep present in the area around Trinity Peak and Sunlight Peak, areas they are not known to occur today.

Other early reports of bighorn sheep in the GMU are from harvests reported in the 1950’s and sightings in the 1960’s (Bear and Jones 1973). Early accounts of bighorn sheep in the late 1960’s and early 1970’s include 16 bighorn sheep counted via helicopter in winter 1968, 8 bighorns counted via fixed wing airplane in fall 1969, 11 bighorns in winter 1969, 9 bighorns in spring 1971, and 8 bighorns in summer 1971 (Bear and Jones 1973). Since these early periods, bighorn sheep have been inventoried and monitored sporadically via helicopter surveys conducted by CPW.

The S-28 bighorn population was estimated at 40 animals from 1986 through 1992 (George et al. 2009). In 1993 the population was estimated at 50, and then 60 in 1994. From 1995 through 1999, the recorded population estimate increased and remained at 80 animals, and from 2000 to 2002 the population was estimated at 100 animals, and increased to 125 animals from 2003 to 2011. In 2012 however, the population estimate was reduced to 90 animals (Weinmeister 2012). Over the last 10 years, the average post-season lamb:ewe ratios have been 45:100 in the GMU (Weinmeister 2012).

Bear and Jones (1973) reported the herd summers and winters on the alpine ranges bounded by the Pine River, Flint Creek, and Lake Creek (USDA Forest Service 2013a). They also reported animals wintering in the downstream cliffs along the Pine River on private lands. This represents a very similar distribution to that reported today, but more extensive use of the high ridgeline on the east side of the Pine River has been documented in the past 20 years. Also recently, the alpine ridges east of Emerald Lake are now recognized to be an important year-round use area (Weinmeister 2012). Based on comparison of historic reports and current observations, it is presumed that the distribution of S-28 may have increased moderately to the east over the past 30 years, but still includes the same areas thought to be core areas in the late 1960’s. Bighorn activity has increased over the years along the far eastern boundary of the GMU, directly adjacent to S-16. Habitat along the Continental Divide and the ridge extending from Bald Mountain south to Three Sisters Peaks and Granite Peak serve as natural linkages that may facilitate interaction between S-28 and S-16. The very close proximity of these two herds, coupled with good habitat connectivity, increases the likelihood of interaction. For this reason, S-28 is considered to be part of the larger interconnected meta-population of the Weminuche Population (DAU RBS-20).

There have been no confirmed bighorn die-off events in any of the native bighorn herds on the San Juan NF. There is however, strong circumstantial evidence a mortality event occurred in S-28 in 1988 after observed close proximity and presumed physical contact between domestic sheep and a small number of transplanted bighorn sheep. None of the transplanted bighorn sheep were known to have survived their first winter season, and a complete mortality event of the transplanted bighorns is assumed to have occurred.

The event was also the only recorded translocation into S-28. It involved 20 bighorns from the Snowmass Unit (Beecham et al. 2007, Weinmeister 2012). This translocation was intended to increase the genetic diversity and vigor of S-28 and increase distribution through pioneering, but was considered unsuccessful (Carron, pers. comm.). A total of 20 translocated bighorns were

released in January 1988 on private land along the Pine River. That summer, a nearby domestic sheep grazing allotment that had not been grazed for over a decade was restocked and in August physical contact was observed (Weinmeister 2012). By September, all but one of the translocated bighorns was known or presumed to be dead. *Pasteurella* was suspected as the agent that had caused the die-off, based on the typical pattern of the disease. The translocated bighorns were monitored intermittently by ground observations but no direct interaction between the transplanted bighorns and native bighorns was observed. If *Pasteurella* was the cause of mortality, the disease did not appear to have been spread to the native bighorns because steady lamb recruitment in the native bighorns was observed following the death of the transplanted bighorns (Weinmeister 2012). It is common that lamb recruitment is depressed for many years and sometimes decades following a *Pasteurella* epidemic (George et al. 2009). Weinmeister (2012) states “it is possible that the deaths of the transplanted sheep could have been caused by some other factor, although the swiftness of the deaths is not familiar in other documented causes of mortality.”

Field reconnaissance and habitat modeling show an extensive amount of well-connected habitat across S-28. CPW identifies approximately 49,909 acres of occupied habitat on the SJNF, which constitutes 99% of the occupied habitat in the GMU (USDA Forest Service 2013a). Bighorn sheep are known to winter and summer in some of the same areas. Summer range is extensive and does not appear to be a limiting factor; however, winter range is somewhat restricted particularly following big snowfalls (Weinmeister 2012). Bighorns are known to winter in lower elevations portions of S-28 that are characterized by scattered trees within large rocky outcrops, where reduced sight distances may be a constraint for bighorns by increasing their vulnerability to predators (Beecham et al. 2007). Known wintering areas include the Pine River near Runlett Peak, the ridges east of Emerald Lake, and private lands downstream along the Pine River. Known lambing areas include the ridges on either side of the Pine River downstream from Lake Creek, and the ridges east of Emerald Lake (Weinmeister 2012).

Mapped summer range for bighorn sheep in S-28 overlaps with the Pine River, Flint Creek, Cave Basin and Rock Creek domestic sheep and goat grazing allotments. All of these allotments have remained vacant for decades (see Table 1, above). The Pine River Allotment was last stocked in 1980. The Flint Creek Allotment was last stocked in 1972. Cave Basin Allotment was last stocked with domestic sheep in 1988. The Rock Creek Allotment was last stocked in 1970. There have been no recent requests to stock these allotments due to their remoteness and access difficulties, as well as a steady decline in the market for wool and lamb.

Spruce bark beetle activity in mapped summer range areas for S-28 has not currently reached the epidemic levels seen across much of S-16, but is expected to increase substantially in the near future. If so, significant mortality of overstory Engelmann spruce trees is expected that is likely to increase forbs and grasses in the understory of previously closed-canopy stands, thus potentially benefiting bighorn sheep by allowing more abundant and higher quality forage to develop under previously closed-canopy stands. Visual barriers caused by stands of living conifers are expected to be reduced, thereby potentially improving the ability of bighorn sheep to detect predators.

There is some concern that lion predation may be limiting lamb survival in S-28 (Weinmeister 2012). A variety of summer and winter recreation activities occur in the Unit, and recreation use can be high in some areas in summer. During summer, moderate to high amounts of backpacking, dayhiking, and horseback riding occur in S-28 due to the presence of the Pine River and Vallecito Creek Trails, and popular destination areas such as Emerald Lake. Past concerns about the potential for motorized access as a source of human disturbance impacts in lambing areas were addressed by travel management restrictions designed to minimize disturbance in known lambing areas. The presence of recreational pack goats has been documented on the Pine River Trail, raising the possibility of potential physical contact and subsequent disease transmission to bighorn sheep from sources outside of domestic sheep grazing within permitted allotments. Substantial winter use

by cross-country skiers and snowshoer's occurs along the Pine River Trail to Canyon Creek Ridge. This same area provides quality winter habitat for bighorns, and represents a potential disturbance factor to bighorns during the wintering period. However, at this time, the amount of winter recreational use of this area is not thought to be limiting bighorn use of this important wintering area (Carron pers. comm.).

In summary, current information suggests that the bighorn population in Unit S-28 may be in decline from previous years, but the reasons for such a decline are not known. The current population is estimated at 90 animals, a decline from previous estimates of about 125 animals. Very recent concern for the population status of S-28 stems from a perceived decline in bighorn observations within traditional use areas, and fewer lamb detections (Weinmeister pers. comm.). The long-term (25-year) trend in CPW population estimates shows this herd as having increased moderately in both numbers and distribution, but with recent declines in numbers. There are currently no concerns for bighorns in S-28 associated with habitat quality or quantity, or competition with other ungulate species. There is some recent concern that lion predation may be limiting lamb survival. Human disturbance in low elevation winter range along the Pine River Trail to Canyon Creek Ridge, and use of recreational pack goats on the Pine River Trail may pose potential risk factors for bighorns in the GMU, but these potential risk factors are not thought to be limiting bighorn distribution or habitat use at this time. The primary management issue of concern for bighorns in S-28 is the potential for physical contact with domestic sheep.

West Needles Herd (S-71):

Unit S-71, the West Needles Herd, is located on the west side of the Weminuche Landscape, and on NFS lands, it is entirely on the Columbine Ranger District. The majority of bighorn sheep habitat in the GMU occurs in alpine and subalpine habitats in the Weminuche Wilderness in the West Needle Mountains, and on steep, rocky cliffs along the Animas River Canyon north of Rockwood.

Early records suggesting the presence of bighorn sheep in S-71 are from 1908 on a map titled "Map of the San Juan National Forest Showing Ranger Districts and Grazing Divisions" (USDA Forest Service 2013a). The map identifies the "Mountain Sheep Game Refuge, No Grazing" encompassing the headwaters of Needle Creek (unit S-71) east to Vallecito Creek (unit S-28), and north to Vallecito Lake. Other reports from the Colorado State Game Department in 1954 note mountain sheep present in the Trinity Peak (9 animals), and Sunlight Peak (60 animals) areas.

The current S-71 West Needles Herd was established with animals translocated from the Georgetown Herd in 2000, and 2002-2003 (Beecham et al. 2007). Bighorn sheep now appear to use the entire Animas River Canyon from Rockwood to Needle Creek, and perhaps somewhat further north. The primary summer range of this herd is the West Needle Mountains, and primary winter and lambing range is the Animas River Canyon from Rockwood to the Cascade Wye (Beecham et al 2007). Immediately after release, two bighorns dispersed north into Unit S-21 near Ouray. Based on ear tag observations, several sheep also dispersed northeast into Unit S-33 near Lake City. In addition, six or seven sheep moved into the Hermosa Cliffs area to the west of the Animas River Canyon and remained there for several years (Beecham et al. 2007). Recent observations (summer 2012 and 2013) show increased bighorn use along U.S. Highway 550 near Coalbank Pass, west of the West Needle Mountains, indicating the herd may be expanding its range to the west and north.

Because S-71 is a translocated herd it is considered by CPW to be an 'unclassified' herd (George et al. 2009). As an unclassified herd, S-71 is placed at a lower priority for inventorying, habitat protection and improvement, and research, as compared to populations that are considered primary core populations or Tier 2 populations. Also, as a translocated population, CPW recognizes the presence of pre-existing active domestic sheep grazing allotments to the north, east, and west of S-71. CPW does not advocate closure of pre-existing active domestic sheep allotments based solely on

the potential for interaction between domestic and bighorn sheep originating from translocated herds (Colorado Division of Wildlife 2009). CPW does, however, suggest working with existing sheep permittees with bands in areas of mapped overlap with bighorn sheep summer range to collaboratively take advantage of opportunities, if/when they arise, to reduce the potential for physical contact between domestic sheep and bighorn sheep, and the subsequent potential for disease transmission to the S-71 herd.

Regardless of the origin and status of the S-71 bighorn herd, the Columbine Ranger District recognizes the presence of all bighorn sheep, regardless of their origin, as a highly valued natural resource on the District. The social value of species such as bighorn sheep is high in terms of their value as watchable wildlife, and for the current and future hunting opportunities each herd represents. The designation of bighorn sheep as a Sensitive Species in the Rocky Mountain Region also places high value on all existing bighorn herds, irrespective of herd origin. Therefore subsequent analyses in this "Risk Assessment" will not differentiate bighorn herds, risk of contact with domestic sheep, management recommendations, or potential effects of the proposed alternatives based solely on CPW's Tier rankings or herd origins. For these reasons, the translocated (unclassified) status of S-71 will not be used as the basis for considering or accepting higher or lower risks of physical contact with domestic sheep.

Population estimates for S-71 were 30 animals in 2001, then 45 in 2002 and 2003. In 2004, the population was estimated at 50 animals, and increased to 70 in 2005, and 75 from 2006 through 2008. The population decreased slightly from 2009 through 2012 where it has remained at 60 animals (Weinmeister pers. comm.). Reproduction and survival are thought to have been good (Beecham et al. 2007).

Habitat modeling shows an extensive amount of well-connected habitat from the southern portion of the West Needle Mountains north to Molas Lake on the west side of the Animas River, and from Lime Mesa east to Sheep Mountain and north to Highland Mary Lakes. CPW identifies approximately 53,840 acres of occupied habitat on the SJNF which constitutes 83% of the occupied habitat in the GMU (USDA Forest Service 2013a). Summer range is extensive and does not appear to be a limiting factor in S-71. Winter range is somewhat restricted however, particularly following big snowfalls.

The only domestic sheep grazing allotments within the Weminuche Landscape that currently overlap S-71 summer range are the Tank Creek and Canyon Creek Allotments. Both are active allotments. Very small portions of the Flume and Deer Creek/Engine Creek Allotments also overlap mapped bighorn summer range. These two allotments were analyzed in the 2009 Silverton Landscape Grazing Analysis (USDA Forest Service 2009).

The available information does not suggest habitat competition by ungulate species as a potential limiting factor for bighorns in S-71 (USDA Forest Service 2013a). A healthy and expanding population of mountain goats is present in the far eastern portion of the Unit, centered on Chicago Basin and the headwaters of Needle Creek. The Needle Creek drainage is currently thought to be unoccupied by bighorns, with speculation that the lack of occupancy by bighorns may be evidence of exclusion by mountain goats.

A variety of summer and winter recreation activities occur in the GMU. During summer, moderate to high amounts of backpacking, day hiking, and horseback riding occur due to the presence of trails that access many portions of the Weminuche Wilderness. The bighorn core use areas of S-71, however, such as southern and western portions of the West Needle Mountains, receive relatively little summer recreation use and human disturbance is not thought to be limiting bighorn distribution or habitat use in S-71. There is no evidence that the presence of the Durango and

Silverton Narrow Gauge Railroad that follows the Animas River throughout its canyon has any influence on bighorn sheep use of the Animas River canyon.

In summary, current information suggests that the bighorn population in S-71 is gradually expanding in numbers and in distribution, primarily in a westward direction. The current population is estimated at 60 animals. The long-term (25-year) trend in CPW population estimates show this herd has increased moderately in numbers and in distribution since the herd was established with translocated animals in the early 2000's. There are currently no concerns for bighorns in S-71 associated with habitat quality or quantity, predation, competition with other ungulate species, or human disturbance. There is speculation that the presence of mountain goats may be limiting bighorns in some eastern portions of the GMU. The primary management issue of concern for bighorns in S-71 is the potential for physical contact with domestic sheep.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Leave vacant allotments vacant instead of closing them, until a vaccine could be developed that would prevent disease transmission from domestic sheep to bighorn sheep (Subramaniam 2011), allowing the vacant allotments to be restocked. The best available science (Srikumaran 2011) indicates a usable vaccine with practical field application is unlikely to be readily available within the next 10 to 15 years. We did not consider this anticipated long term duration for research and development to be a reasonable basis on which to base management decisions for the immediate future (less than five years). If a useable and effective vaccine is developed in the future, a new NEPA analysis could be undertaken to consider re-opening the allotments to domestic sheep grazing.

We considered the possibility of moving domestic sheep bands from currently active allotments where the perceived risk of contact with bighorn sheep is high to other currently vacant allotments where the perceived risk of contact with bighorns may be lower. The only other vacant allotment on the Columbine Ranger District is the Elkhorn Allotment. Elkhorn Allotment is currently being used by adjacent cattle allotments on a temporary basis. Since 2004, the Tank Creek sheep band has grazed portions of Elkhorn, Coon Creek, Bear Creek West, and Steven/Shearer Allotments. Sheep have been used as a management tool to address larkspur (poisonous to cattle) and aspen regeneration issues on these cattle allotments. This management tool is likely to continue, as needed, into the future for resource management purposes.

RISK ASSESSMENT PROCESS

In response to concerns about bighorn sheep conservation on NFS lands, in August of 2011 a four-step approach to risk assessment and viability analysis was outlined by the Deputy Chief of the Forest Service (USDA Forest Service 2011a, USDA Forest Service 2011b). This process directed field units to conduct qualitative, and where possible quantitative analyses of the potential for interaction between domestic and bighorn sheep when the agency is making decisions requiring National Environmental Policy Act (NEPA) analysis regarding livestock grazing activities. The goal of these analyses is to minimize the potential for physical contact between domestic and bighorn sheep, thereby minimizing the potential for disease transmission and a subsequent mortality event of bighorn sheep.

The analysis process outlined in the August 2011 Washington Office letter of direction consists of four steps. First, gather applicable data and information from appropriate sources. Second, assess spatial and temporal overlap of bighorn sheep core herd home ranges with domestic sheep allotments, use areas, and driveways. Third, Assess likelihood of contact based on spatial and temporal overlap between allotments and bighorn sheep herds. And fourth, identify management

practices with the goal of separation between domestic and bighorn sheep where necessary to provide for Forest-wide bighorn sheep viability.

It is recognized that even one contact between domestic and bighorn sheep could lead to disease transmission, with potential for a subsequent bighorn mortality event. Increased contact rates between bighorn and domestic sheep increases the likelihood of disease transmission and potential for a subsequent bighorn mortality event. Vaccines that could reduce the potential for disease transmission are in development (Subramaniam 2011), but are unlikely to be ready for use in the field in less than 10-15 years (Srikumaran 2011). For this reason, the most effective means of reducing the risk of disease transmission is to minimize the potential for contact through effective separation. Effective separation is complicated by the tendency of bighorn sheep, both rams and ewes, to leave their core herd home range and carry out occasional exploratory movements (aka forays).

This Risk Assessment process involved the participation by FS wildlife biologists, rangeland management specialists, decision makers, Colorado Division of Parks and Wildlife (CPW) terrestrial biologists and District Wildlife Managers, and domestic livestock permittees. A series of meetings were held to review maps of the affected bighorn sheep herds and domestic sheep grazing allotments.

The focus of the risk assessment process was on active, vacant and forage reserve domestic sheep and goat allotments within the Weminuche Landscape (see Figures 2, 3 and 4, below). Because vacant allotments could be restocked administratively at any time, it is important to assess the potential for physical contact between bighorn and domestic sheep in the event the allotment was restocked. Forage reserve allotments are allotments that may be stocked up to a maximum of three years out of any ten consecutive years. For the purpose of this model, forage reserve allotments are treated as active allotments during the years they are stocked. Allotments that were already closed were not specifically reviewed but would have received a rating of low risk.

FACTORS CONSIDERED IN THE RISK ASSESSMENT PROCESS

- Bighorn sheep mapped summer range, summer concentration areas, production areas, and winter range (provided by Colorado Parks and Wildlife):
 - Summer range (Core Herd Home Range - CHHR) is that part of the overall range where 90% of individual bighorn sheep are located between spring green-up and the first heavy snowfall. Summer range is not necessarily exclusive of winter range; in some areas winter range and summer range may overlap. Summer range does not necessarily include all occurrences during the summer season. These polygons are assumed to be occupied habitat.
 - Summer concentration areas are those areas where bighorn sheep concentrate from mid-June through mid-August. High quality forage, security, and lack of disturbance may be characteristics of these areas to meet the high energy demands of lactation and lamb rearing. These polygons are assumed to be occupied habitat
 - Mapped production areas were considered but domestic sheep are generally not in permitted allotments (late June to early July) where lambing is known to occur until after lambing has completed (generally by mid-June). In addition, all mapped lambing areas in the Weminuche Landscape are also mapped as occupied summer range (Core Herd Home Range). High quality forage, security, and lack of disturbance may be characteristics of these areas. These areas are assumed to be occupied habitat.
 - Mapped winter range areas were considered but not used in greater detail because domestic sheep are not permitted in any of the Weminuche Landscape allotments during winter.
- Domestic sheep allotment activity status;

- Changes in allotment boundary configuration;
- Domestic sheep grazing suitability maps;
- Vegetation types and topographic features within the allotment;
- Colorado Parks and Wildlife local staff's professional opinions (District Wildlife Managers and Terrestrial Biologists);
- FS local staff's professional opinions (Wildlife Biologists, Range Management Specialists, NEPA Specialists, Decision Maker);
- Domestic sheep permittees' herding practices and bighorn sheep observations;
- Project Design Criteria (see Appendix 1, EA Table 2-3, attached at the end of this document). Project design criteria are expected to enhance the effectiveness of separation of bighorn and domestic sheep, thereby reducing the risk of physical contact and subsequent potential for disease transmission. However, the effectiveness of most individual measures remains untested and therefore the degree of risk reduction achieved from implementing project design criteria is also unknown. Although there is uncertainty regarding the effectiveness of project design criteria, it is logical to expect that full and complete implementation of all project design criteria has the potential to improve the effectiveness of separation of the species. Discussions with the permittees concluded that the project design criteria included as part of Alternatives 3 and 4 (Appendix 1, EA Table 2-3, below) are reasonable and feasible.

At this time, the best condensed source of Best Management Practices to more effectively separate bighorn and domestic sheep and goats is the 2012 WAFWA Guidelines (Wild Sheep Working Group 2012). The WAFWA Guidelines are widely recognized as the best available source for Best Management Practices to minimize the potential for physical contact between bighorn and domestic sheep, and many of the guidelines were incorporated into project design criteria for the Weminuche Landscape. However, the Guidelines do not preclude the adoption of other management actions, where appropriate, for achieving effective separation. Additional management practices were added after discussion with the domestic sheep permittees that contribute to achieving physical separation between bighorn and domestic sheep. It must be recognized however, that the effectiveness of many of the recommended guidelines have not been tested or verified using a rigorous scientific approach. For this reason, there is uncertainty about their effectiveness.

RISK OF CONTACT TOOL

In response to a need for tools to assist with the analysis of risk of contact of between domestic and bighorn sheep, the USDA Forest Service Bighorn Sheep Working Group developed a methodology for calculating probabilities and rates of contact between bighorn sheep and domestic sheep allotments. This 'Risk of Contact Tool' is a geospatial desktop application developed for use by field unit resource managers as a tool for evaluating the risk of physical contact between bighorn sheep and domestic sheep allotments under various management scenarios (USDA Forest Service 2013b).

Results from the Risk of Contact Tool provide a consistent framework by which various management scenarios can be compared. Tool results allow the user to compare and contrast management scenarios as to their potential to affect modeled rates of contact between bighorn sheep and domestic sheep allotments. From these results and alternative comparisons, inferences can be drawn about how various management alternatives and project designs might increase or decrease the potential for physical contact and presumed potential for subsequent disease transmission to adjacent bighorn sheep herds.

The Risk of Contact Tool does not consider the potential mitigating effect that full implementation of project design criteria (Appendix 1, EA Table 2-3, below) might have on the probability of contact between bighorn and domestic sheep. Project design criteria are expected to enhance the effectiveness of separation, thereby reducing the risk of physical contact of foraging bighorn sheep

with domestic sheep and the subsequent potential for disease transmission. However, there is uncertainty about the effectiveness of project design criteria and it is unknown how much, if any, reduction might be expected in the contact probabilities produced by the Risk of Contact Tool from full and complete implementation of all project design criteria. Because of uncertainty about the effectiveness of project design criteria, they are not relied on as the sole reason for assuming actual contact probabilities would be lower than those predicted by the model.

The Risk of Contact Tool utilizes bighorn sheep Core Herd Home Range (CHHR) information, a summer source habitat model representing suitable bighorn summer habitat, ram and ewe foray rates, and domestic sheep allotment boundaries to calculate probabilities that rams and ewes may leave a CHHR, undertake a foray, and subsequently contact a specific domestic sheep allotment. Output from the tool also calculates rates of contact between individual bighorns from specific bighorn herds with specific domestic sheep allotments. The CHHR used by the Risk of Contact Tool was provided by Colorado Parks and Wildlife as professional knowledge-based polygons. Or, CHHR can be calculated by the model using telemetry or observation points supplied by the user.

The summer source habitat model used by the Risk of Contact Tool was developed by the USFS. It was tested modified by Colorado Parks and Wildlife using their extensive State-wide bighorn sheep telemetry data set and found to be effective, covering 91% of telemetry points from their pooled bighorn telemetry location datasets (Eichhoff et al. 2012, and S. Wait pers. comm.). The summer source habitat model assigns all areas surrounding the CHHR to one of three habitat classes – source (suitable) habitat, connectivity areas and non-habitat. Source habitat includes factors such as vegetation cover type, reggedness and horizontal visibility. Connectivity areas do not meet source habitat criteria, but are located within 350 meters of source habitat, or 525 meters if between two areas of source habitat (such as a meadow area between two canyons). Areas of non-habitat do not meet these criteria and are located more than 350 meters from source habitat. It is assumed that bighorns spend less than 1% of their time in these non-habitat areas. Data from other areas indicate bighorn sheep are 34 times more likely to be in source habitat than non-habitat, and are six times more likely to be in source habitat than connectivity areas.

The summer source habitat model is used to infer habitat suitability based on species requisites and observed bighorn habitat preferences. However, there is no assumption that areas identified by the model as suitable for bighorns are in fact occupied. The only areas assumed to be occupied by bighorn sheep are the areas mapped by CPW bighorn summer range (CHHR), summer concentration areas and production areas. Currently, bighorn summer source habitat does not appear to be limiting for bighorn sheep in the Weminuche Landscape. Primarily, apparently suitable bighorn habitat appears to be unoccupied.

Bighorn sheep make occasional long-distance movements beyond their CHHR. Singer et. al. (2001) called these movements forays, and defined them as any short-term movement of an animal away from then subsequently back to its herd's CHHR. This life-history trait places bighorn sheep at risk of contact with domestic sheep, particularly when bighorn summer source habitats are well connected to or overlap with domestic sheep use areas, even when domestic sheep use areas are well removed from bighorn CHHR areas. The risk of contact between foraging bighorn sheep (mostly rams) and domestic sheep is related to the extent of bighorn sheep source habitat, proximity of domestic sheep allotments, distance of bighorn forays outside their CHHR, and the frequency of bighorn forays outside their CHHR's. Because information on foray distance and frequency is lacking for bighorn sheep herds on the San Juan National Forest and the Weminuche Landscape in particular, the analysis in this Risk Assessment uses the default value in the Risk of Contact Tool (USDA Forest Service 2013b). The default value for foray frequency is 14.1% for rams and 1.4% for ewes, indicating that 14.1% of rams and 1.5% of ewes are predicted to foray outside of their CHHR during the summer season. Based on known bighorn sheep preferences for each of the three habitat classes, the model estimates the proportion of rams and ewes reaching each one kilometer band

outside of the CHHR. The model estimates this proportion out to 35 kilometers (21 miles) away from the CHHR, which incorporates the extent of most forays throughout the western United States (USDA Forest Service 2013b).

The Risk of Contact Tool uses the inputs to conduct a bighorn foray analysis (USDA Forest Service 2013b). This foray analysis determines how frequently bighorn foray movements occur, as well as how far beyond the CHHR bighorn rams and ewes are likely to travel, relative to the amount and connectivity of bighorn summer source habitat across the landscape. Together, the source habitat, CHHR, and foray models, along with bighorn herd size and sex ratio (i.e. proportion of rams to ewes) are used to estimate the probability that a ewe or a ram from a particular herd will leave their CHHR and reach a domestic sheep allotment in a given year (USDA Forest Service 2013b). Based on these probabilities, rates of contact with a particular allotment by individual rams and ewes from a specific bighorn CHHR can be calculated. Because predicted rates of contact are sensitive to bighorn herd size, the largest bighorn herds have the greatest impact on the calculated contact probabilities.

Direct overlap between a bighorn CHHR and an allotment presumes a 100% probability of contact between bighorns and the allotment (USDA Forest Service 2013b). Therefore, by definition, an allotment which overlaps with bighorn CHHR is assumed to experience at least one bighorn contact per year. Although the Tool assumes a contact rate of 1.0 for allotments that overlap bighorn CHHR, annual contact rates could be higher with multiple contacts occurring per year. When there is direct overlap between an allotment and bighorn CHHR there is automatically high risk for contact and therefore no need to model the potential for contact by foray.

The sequence of events by which a contact between bighorn sheep and domestic sheep in a permitted grazing allotment located outside a bighorn CHHR might occur can be broken down into a number of steps. First, to reach an active domestic sheep allotment, a bighorn sheep must (1) leave their CHHR; (2) travel far enough to reach the domestic sheep grazing allotment; and (3) intersect the allotment. For disease transmission to occur, the bighorn must (4) come into physical contact with a domestic sheep in the allotment; and (5) contract a disease from the domestic sheep. Finally, for a disease outbreak to affect the bighorn's home herd, the infected bighorn must (6) return to their CHHR; and (7) transmit disease to other members of their home herd. For domestic sheep allotments that overlap portions of bighorn CHHR, steps 1-3 and 6 do not need to occur, thereby likely increasing the potential for a disease transmission event to occur, and also likely increasing the potential for a subsequent disease outbreak in the bighorn home herd.

The Risk of Contact Tool provides a calculated probability that bighorn forays will intersect a given domestic sheep allotment, and the total annual predicted rate of contact with the allotment (USDA Forest Service 2013b). The total herd contact rate (i.e. aggregate rate of both rams and ewes) is the most important output of the analysis. More frequent contacts implies a greater probability of a bighorn coming into physical contact with a domestic sheep, and thus greater potential for disease transmission and potential for a subsequent bighorn mortality event within the CHHR.

The Risk of Contact Tool represents the best available science regarding estimating the probability of bighorn sheep contacting domestic sheep allotments (USDA Forest Service 2013c). Results of the Risk of Contact Tool are then reviewed and a conclusion is drawn regarding the relative risk of contact with the potential for disease transmission and subsequent bighorn mortality event, and the effect that event might have on bighorn population viability. This analysis will utilize recent disease transmission information for comparison to better inform the outcome of each alternative regarding their relative potential for contributing to the long-term viability of bighorn sheep on the planning area.

There are uncertainties regarding the Risk of Contact Tool that must be recognized when considering how to interpret the results. A more detailed discussion about uncertainties associated with the Risk of Contact Tool is provided later in this document.

RISK ASSESSMENT OUTCOMES

The risk of physical contact between bighorn sheep and a domestic sheep allotment, with the potential for disease transmission and potential for a subsequent bighorn mortality event, was given a qualitative rating of “High”, “Moderate”, or “Low”, based on factors relating to spatial and temporal separation. Disease transmission with a subsequent bighorn mortality event however, is considered a correlate of contact, not an effect. And, although disease transmission is discussed in this assessment, these ratings are not intended to be an estimate of disease transmission probability, only an estimate of relative level of risk for physical contact between domestic and bighorn sheep. The likelihood of disease transmission following physical contact, and the potential for a subsequent bighorn mortality event, is not known with certainty and remains the subject of debate, and therefore will not be used as the basis for determining relative level of risk.

A rating of “High” risk indicates that contact between domestic sheep and bighorn sheep is thought to be likely in the immediate future, although disease transmission resulting in a subsequent bighorn mortality event is not assumed to be a certainty. Conversely, if allotments have been operated for many years without evidence of disease transmission, we do not use this observation to infer a lower risk rating. The fact that contact has not been observed, or a bighorn disease event has not been detected, does not imply a lower risk for such events happening in the future. For this reason, the allotment would still receive a rating of “High” risk. A rating of “High” risk would occur when there is direct overlap between an allotment and mapped bighorn summer range or summer concentration area or CHHR, or these areas are within about 10 miles (17 km) of an allotment and there is high bighorn source habitat connectivity for bighorn dispersal to an allotment.

A rating of “Moderate” risk indicates that physical contact between bighorn and domestic sheep may occur at some point in the future, but effective separation may be achieved and/or maintained for many years. The risk of physical contact between bighorn and domestic sheep, with the potential for a subsequent bighorn disease outbreak, is thought to be less than for allotments in the high risk category, but is still of concern. Factors that reduce the apparent risk of contact could include: the presence of towns, the presence of terrain features and/or habitat features that act as barriers to bighorn sheep movement (Schommer and Woolever 2001), bighorn sheep distribution patterns, and application of herding techniques and other project design criteria (Appendix 1, EA Table 2-3 below). A rating of “Moderate” risk could occur when there is no direct overlap between mapped bighorn summer range or summer concentration area or CHHR, and these areas are 10+ to 16 miles (18 to 26 km) from an allotment, and/or there is fair bighorn source habitat connectivity for bighorn dispersal to an allotment.

A rating of “Low” risk indicates that physical contact between domestic and bighorn sheep is believed to be unlikely or irregular and unpredictable, with the potential for a subsequent bighorn disease outbreak thought to be unlikely or irregular in the future under the configuration of allotments and bighorn CHHR’s. A rating of “Low” risk could occur when there is no direct overlap between mapped bighorn summer range or summer concentration area or CHHR, and these areas are greater than 16 miles (27 km) from an allotment and/or there is poor bighorn source habitat connectivity for bighorn dispersal to an allotment

Where overlap exists between active domestic sheep allotments and bighorn CHHR (see Figure 2, below), the risk of contact between domestic sheep and bighorn sheep, with the potential for subsequent disease transmission, is considered to be “High” (see Figure 5, below). In vacant allotments, the risk of contact is “Low” when the allotment is vacant, but becomes “High” when the

allotment is restocked. In forage reserve allotments, similar to vacant allotments, the risk of contact is “Low” when the allotment is not stocked, but becomes “High” when the allotment is restocked.

After assigning an initial risk rating for each allotment under Alternative 2, additional factors from the list provided above (Factors Considered in the Risk Assessment Process) were considered and a determination was made whether to maintain or alter the initial risk rating. Factors such as allotment boundary changes and application of project design criteria differ between Alternative 2 and Alternatives 3 and 4, leading to potentially different risk ratings among the three action alternatives for the same allotment. Because of uncertainty about the effectiveness of project design criteria, their application is not relied on as the sole reason for assigning a lower risk rating under Alternative 3 or 4.

RISK ASSESSMENT RESULTS

Under current conditions (Alternative 2) there is direct overlap between mapped bighorn Core Herd Home Range (CHHR) and six domestic sheep grazing allotments in the Weminuche Landscape (see Figure 2, below). The six allotments in the Weminuche Landscape which have direct overlap with bighorn CHHR are Canyon Creek (vacant sheep, active cattle), Cave Basin (vacant), Flint Creek (vacant), Pine River (vacant), Rock Creek (vacant), and Tank Creek (active sheep). Under Alternatives 3 and 4, however, allotment boundary adjustments remove all areas of direct overlap with bighorn CHHR from all allotments in the Weminuche Landscape. The analysis and findings for each allotment and alternative will be discussed individually, and are displayed below in Figures 5, 6 and 7.

Risk of Contact Tool Results:

Table 3, below, displays the input values used in the Risk of Contact Tool for each bighorn herd in the Weminuche Landscape analysis. The values used for ram and ewe annual foray probabilities were the default values provided by the Risk of Contact Tool application because no similar data was available for bighorn herds in the Weminuche Landscape. The Tool’s default values were derived from an extensive bighorn sheep radio telemetry dataset on the Payette National Forest (USDA Forest Service 2013b). The default values represent the proportion of radio-collared adult bighorns observed outside their CHHR during the summer grazing season, May through October. The values used for bighorn herd sex ratio (ram:ewe) were the default values provided by the Risk of Contact Tool application because only limited sex ratio data was available for bighorn herds in the Weminuche Landscape. Sex ratio data provided by Colorado Parks and Wildlife for bighorn herds in the Weminuche Landscape (Weinmeister pers. comm.) corresponded with the Tool’s default values. For this reason, the Tool’s default values were assumed to be a reasonable estimate of sex ratios for bighorn herds in the Weminuche Landscape. The Tool’s default values for bighorn sex ratios were calculated from an extensive observation dataset of Hells Canyon area herds (USDA Forest Service 2013b). Values for total population size of bighorn herds in the Weminuche Landscape were provided by Colorado Parks and Wildlife (Weinmeister pers. comm.), and the number of rams and number of ewes in each bighorn herd were then calculated by multiplying the sex ratio by the total population size of each herd.

Table 3. Input values used in the Risk of Contact Tool for bighorn sheep herds in the Weminuche Landscape grazing analysis area.

	S-16 Cimarrona Peak Herd	S-28 Vallecito Creek Herd	S-71 West Needles Herd
Annual Foray Probability (Rams):	0.141	0.141	0.141
Annual Foray Probability (Ewes):	0.015	0.015	0.015
Total Population Size 2012:	135	90	60
Sex Ratio (Ram:Ewe):	35:65	35:65	35:65
Number of Rams:	47	32	21
Number of Ewes:	88	59	39

For the purpose of illustrating results generated by the Risk of Contact Tool, Table 4, below, displays the model’s output data for domestic sheep grazing allotments and the Vallecito Creek bighorn herd (S-28) under current allotment configuration (Alternative 2). The Risk of Contact Tool produced similar output tables for each combination of allotment configuration, bighorn herd, and action alternative (Alternatives 2, 3 and 4) in the Weminuche Landscape, totaling nine independent tables. For the sake of brevity, only one of the nine tables is presented here. All nine tables can be found in the project record.

Displayed on Table 4, below, is the probability of ram contact and probability of ewe contact, which is the annual probability that once a ram or ewe in the population leaves its CHHR on a foray, it would contact a specific allotment. For example on Table 4, once a ram leaves the Vallecito Creek S-28 core herd home range on a foray, there is a 1.95% probability it would contact the Burnt Timber Allotment during the summer season. For ewes, once a ewe leaves the S-28 CHHR on a foray, there is a 0.50% probability it would contact the Burnt Timber Allotment during the summer season. However, few individual rams or ewes actually leave their CHHR each summer and undertake a foray. For that reason, the values in these two columns, Probability of Ram Contact and Probability of Ewe Contact, need to be multiplied by the proportion of rams or ewes in the population that are likely to leave their CHHR during the summer season and go on a foray. The default foray probabilities are 14.1% for rams, and 1.5% for ewes. The resulting number (Single Ram and Single Ewe) is the probability that a single ram or ewe will leave their CHHR on a summer foray and contact a specific allotment.

Table 4. Risk of Contact Tool estimated annual herd contact rates (all adult rams and ewes combined) via foray for all allotments and bighorn sheep herds in the Weminuche Landscape grazing analysis area under current allotment configuration (Alternative 2).

S-28 Vallecito Creek Herd - Alternative 2			Annual Contact Rates via Foray				
Allotment	Prb of Ram Contact	Prb of Ewe Contact	Single Ram	Single Ewe	All Rams	All Ewes	Herd Contact Rate
Burnt Timber	0.0195163	0.00509975	0.002751798	0.000076	0.086681646	0.004475031	0.091156677
Canyon Creek	0.00467823	0.00153944	0.00065963	0.000023	0.020778359	0.001350859	0.022129217
Cave Basin	This allotment intersects the CHHR polygon and is therefore not included in the analysis.						
East Silver Mesa	0.0634138	0.021086	0.008941346	0.000316	0.281652393	0.018502965	0.300155358
Fall Creek	0.154087	0.103034	0.021726267	0.001546	0.684377411	0.090412335	0.774789746
Flint Creek	This allotment intersects the CHHR polygon and is therefore not included in the analysis.						
Johnson Creek	0.134739	0.109531	0.018998199	0.001643	0.598443269	0.096113453	0.694556721
Leviathan	0.0992336	0.0501078	0.013991938	0.000752	0.440746034	0.043969595	0.484715629
Pine River	This allotment intersects the CHHR polygon and is therefore not included in the analysis.						
Rock Creek	This allotment intersects the CHHR polygon and is therefore not included in the analysis.						
Spring Gulch	0.00352443	0.000997182	0.000496945	0.000015	0.015653756	0.000875027	0.016528783
Tank Creek	0.0238075	0.00673597	0.003356858	0.000101	0.105741011	0.005910814	0.111651825
Virginia Gulch	0.0674336	0.0259058	0.009508138	0.000389	0.299506334	0.02273234	0.322238674

CHHR = Bighorn Core Herd Home Range

Table 4, above, displays the rate of contact for single rams and single ewes. Therefore, for the Burnt Timber Allotment for example, the probability an individual ram would leave the S-28 CHHR on a foray (14.1%) and contact the allotment is $0.0195163 * 0.141 = 0.002751798$, less than two per

thousand. For ewes in S-28, the value is $0.00509975 * 0.015 = 0.000076$, less than 1 per ten thousand. All remaining columns in Table 4 incorporate both the probability an animal will go on a foray (i.e. the probability that an individual animal will leave its CHHR on a foray) and the probability that a foraying animal would subsequently contact a given allotment.

Next, Table 4 displays the rate of contact with a specific allotment for all rams in the population, given the total number of rams in the population. This is the expected number of rams to contact a specific allotment during the summer season. Based on the number of rams in the Vallecito Creek S-28 population (32) and their individual contact probabilities (0.275%), it is estimated that rams from S-28 would foray from their CHHR and make contact with the Burnt Timber Allotment at a rate of 0.08668 times per season. In other words, contact with the Burnt Timber Allotment by a foraying ram from the S-28 CHHR, given the estimate of 32 rams in the S-28 herd, is expected to occur once every 11.5 years ($1/0.08668$). For ewes in S-28, given a total of 59 ewes and a contact probability of 0.0076% per single ewe, contact with the Burnt Timber Allotment by a foraying ewe is expected to occur at a rate of 0.004475 times per summer season, or once every 223 years.

Finally on Table 4, the total herd contact rate is the number of adult bighorn sheep (rams plus ewes) expected to foray from the CHHR and contact the allotment each summer season. Based on the aggregate ram and ewe contact rates (All Rams + All Ewes; $0.08668 + 0.004475$ contacts/year, respectively), it is estimated that an adult bighorn sheep would leave the S-28 CHHR on a foray and make contact with the Burnt Timber Allotment at a rate of 0.09115 times per summer season. In other words, given the estimate of adult 90 bighorns in the Vallecito Creek Herd, adult bighorn sheep from S-28 are expected to contact the Burnt Timber Allotment once every 10.97 years ($1/0.09115$).

For the purpose of illustrating how results from the Risk of Contact Tool were combined and summarized, Table 5, below, displays the summary results for total annual herd contact rates for all allotments and bighorn sheep herds in the Weminuche Landscape, under the current allotment configuration (Alternative 2). Similar summarized tables showing total annual herd contact rates for all allotments and bighorn herds were produced for Alternatives 3 and 4 (total of three independent tables). Again for the sake of brevity, only one of the three summarized alternative tables is presented here. All three summarized alternative tables can be found in the project record.

Table 5. Summary of Risk of Contact Tool estimated total annual herd contact rates (all adult rams and ewes combined) via foray for all allotments and bighorn sheep herds in the Weminuche Landscape grazing analysis area under current allotment configuration (Alternative 2).

Alternative 2		Annual Herd Contact Rates via Foray				1 Contact/X Years
		S-28	S-16	S-71	Total	
Burnt Timber		0.091156677	0.002087584	0.053108006	0.146352267	6.83
Canyon Creek		0.022129217	0.000425644	1.0	1.022554861	0.98
Cave Basin		1.0	0.437065545	0.081683277	1.518748822	0.66
East Silver Mesa		0.300155358	0.016567166	0.097029216	0.41375174	2.42
Fall Creek		0.774789746	0.071262229	0.091313168	0.937365142	1.07
Flint Creek		1.0	0.738298557	0.043067301	1.781365858	0.56
Johnson Creek		0.694556721	0.131695508	0.113022669	0.939274898	1.06
Leviathan		0.484715629	0.117073416	0.112246841	0.714035886	1.40
Pine River		1.0	1.0	0.034590562	2.034590562	0.49
Rock Creek		1.0	0.172703523	0.083010336	1.25571386	0.80
Spring Gulch		0.016528783		0.004876606	0.021405389	46.72
Tank Creek		0.111651825	0.007926509	1.0	1.119578334	0.89
Virginia Gulch		0.322238674	0.047868855	0.175824859	0.545932387	1.83
Total		6.817922629	2.742974536	2.889772841	12.45067001	0.08

CHHR Intersects With Allotment

N/A: Too Far From Allotment

CHHR = Bighorn Core Herd Home Range

The cells shaded in tan in Table 5, above, indicate allotments where there is direct overlap between a herd's CHHR and some portion of that domestic sheep allotment. For example, portions of Canyon Creek and Tank Creek allotments overlap with the CHHR for the West Needles Herd (S-71), and portions of the Pine River Allotment overlap with the CHHR for the Cimarrona Peak Herd (S-16). Because there is overlap between these allotments and CHHR's, the Risk of Contact Tool assumes that contact is occurring each year and does not attempt any further calculations of the number of contacts per year within that zone of overlap (USDA Forest Service 2013b). This is because, by definition, contact with the allotment is occurring whenever a bighorn utilizes that portion of their CHHR that overlaps with the allotment. For this reason the Tool does not attempt to estimate a probability of contact. In these cases, because it is assumed that at least one and perhaps multiple contacts per year may be occurring within the allotment (USDA Forest Service 2013c), it is appropriate to place a value of 1.0 in each cell indicating a 100% probability of contact occurring in this zone of overlap.

Because total annual herd contact rates are additive, they can be summed across multiple allotments within an individual bighorn herd, or summed across bighorn herds for each allotment. Annual herd contact rates can be added across bighorn herds because the bighorn total population size and sex ratio for each herd has already been incorporated into the calculation process prior to estimating total herd contact rates. For example, given the additive nature of total herd contact rates, the Risk of Contact Tool predicts that about 7 times per year adult bighorn sheep from the Vallecito Creek Herd (S-28) would contact an allotment in the Weminuche Landscape, under current allotment configuration (Alternative 2). This compares to an overall rate of 2.7 times per year for bighorns from the Cimarrona Peak Herd (S-16), and a rate of 2.9 times per year for bighorns from the West Needles Herd (S-71).

Finally, from the total annual herd contact rates discussed above in Table 5, for each action alternative (Alternatives 2, 3 and 4), the combined overall herd contact rates were converted to a rate of one contact per total number of years and displayed below in Table 6. Thus Table 6 summarizes the results from all of the calculation processes described above in Tables 3, 4 and 5, across all three action alternatives (Alternatives 2, 3 and 4), and displays the total annual combined herd contact rates in the form of total number of years per contact for each allotment for all bighorn herds combined. Numbers less than one indicate a prediction of multiple contacts per year.

Table 6. Risk of Contact Tool estimated total annual herd contact rates for each allotment, for all bighorn sheep herds combined, under each action alternative (Alternatives 2, 3 and 4), displayed as the predicted number years per contact.

Allotment	Annual Total Herd Contact Rates via Foray (1 Contact/X Years)		
	Alternative 2	Alternative 3	Alternative 4
Burnt Timber	6.83	7.22	7.22
Canyon Creek	0.98		
Cave Basin	0.66		
Endlich Mesa	2.42	1.32	1.32
Fall Creek	1.07		
Flint Creek	0.56		
Johnson Creek	1.06	1.24	
Leviathan	1.40	1.40	
Pine River	0.49		
Rock Creek	0.8	1.78	
Spring Gulch	46.72	47.63	47.63
Tank Creek	0.89	3.02	3.02
Virginia Gulch	1.83	1.89	1.89
Total	0.08	0.26	0.56

CHHR Intersects With Allotment

Allotment Proposed Closed

CHHR = Bighorn Core Herd Home Range

The cells shaded in tan in Table 6, above, indicate allotments where there is direct overlap between a herd's CHHR and some portion of that domestic sheep allotment. The cells shaded in green indicate allotments proposed for closure under that alternative. For example, portions of Canyon Creek and Cave Basin allotments overlap with the CHHR for the West Needles Herd (S-71) under current allotment configuration (Alternative 2) but both allotments are proposed to be closed to domestic sheep grazing under Alternatives 3 and 4.

Also for example in Table 6, above, the Risk of Contact Tool estimates that an adult bighorn sheep from S-16, S-28 or S-71 would contact the Burnt Timber Allotment at a rate of 1 contact every 6.83 years under current allotment configuration (Alternative 2). This compares to an estimated rate of one contact every 7.22 years under Alternatives 3 and 4. Therefore, the Risk of Contact Tool predicts that allotment boundary adjustments proposed to occur under Alternatives 3 and 4 would reduce the estimated rate of contact by adult bighorns with the Burnt Timber Allotment from one contact every 6.83 years to one contact every 7.22 years.

Further from Table 6, above, the Risk of Contact Tool predicts, for example, that under the current allotment configuration (Alternative 2) an adult bighorn from one of the three herds would contact a domestic sheep allotment about 12 times per year while foraging outside their CHHR across the

Weminuche Landscape. Under the allotment configuration proposed in Alternative 3, the combined total predicted rate of contact with an allotment by foraging adult bighorns from one of the three herds across the Weminuche Landscape would be reduced to about 4 contacts per year across all allotments in the Weminuche Landscape. Under Alternative 4, the predicted rate of contact would be further reduced to about 2 contacts per year.

Similar to Table 6, above, Table 7, below, summarizes the results from all calculation processes described above in Tables 3, 4 and 5, across all three action alternatives (Alternatives 2, 3 and 4), and displays the total annual combined herd contact rates in the form of total number of years per contact for all allotments combined. Numbers less than one indicate a prediction of multiple contacts per year. For example, the Risk of Contact Tool estimates that adult bighorn sheep foraging outside their S-16 CHHR would contact an allotment in the Weminuche Landscape at a rate of about 3 contacts per year, under current allotment configuration (Alternative 2). This compares to an estimated rate of one contact every 2.07 years under Alternative 3, and one contact every 8.06 years under Alternative 4. Therefore, the Risk of Contact Tool predicts that allotment boundary adjustments and allotment closures proposed to occur under Alternatives 3 and 4 would reduce the estimated rate of allotment contact by foraging adult bighorns outside their S-16 CHHR from three contacts per year under Alternative 2 to one contact per 2.07 years under Alternative 3, and further reduced to one contact per 8.06 years under Alternative 4.

Table 7. Risk of Contact Tool estimated total annual herd contact rates for individual bighorn sheep herds across all allotments combined, under each action alternative (Alternatives 2, 3 and 4), displayed as the number years per contact.

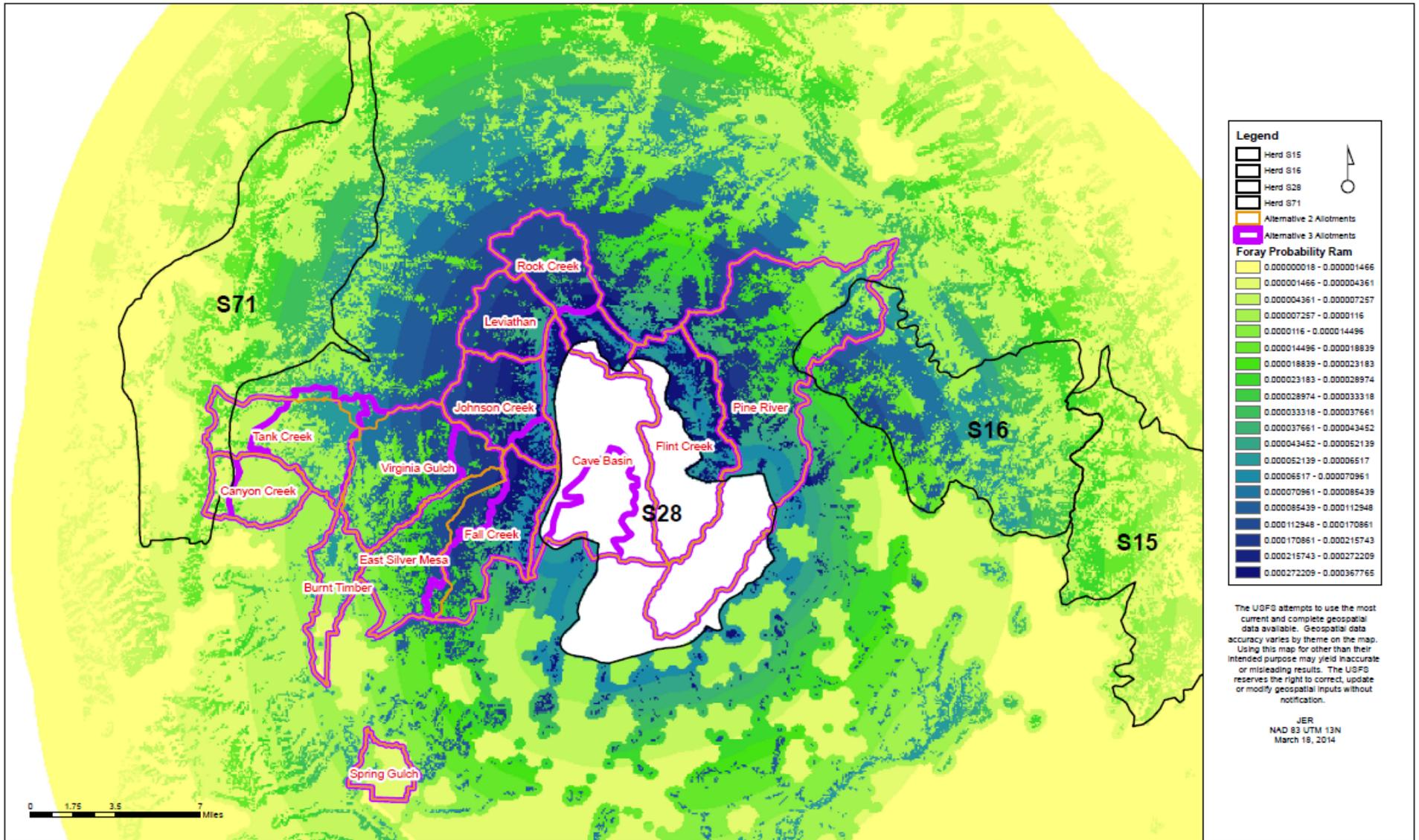
Bighorn Sheep Herd	Annual Total Herd Contact Rates via Foray (1 Contact/X Years)		
	Alternative 2	Alternative 3	Alternative 4
Cimarrona Peak S-16	0.36	2.07	8.06
Vallecito Creek S-28	0.15	0.4	0.92
West Needles S-71	0.35	1.17	1.78
Total	0.08	0.26	0.56

CHHR Intersects With an Allotment

CHHR = Bighorn Core Herd Home Range

Also for purposes of illustration, Figure 1, below, provides a graphical display produced by the Risk of Contact Tool that illustrates bighorn ram CHHR for the Vallecito Creek Herd (S-28), distribution of summer source habitat across the Weminuche Landscape, domestic sheep allotment configurations under the action alternatives (Alternatives 2, 3 and 4), and estimated rates of ram contact extending out from the S-28 CHHR in 1 km distance bands. The Risk of Contact Tool produced similar individual output graphical displays for estimated rates of ram and ewe contact for the Cimarrona Peak Herd (S-16) and the West Needles Herd (S-71), for a total of six graphical displays. Again for the sake of brevity, only one of the six graphical displays is presented here. All six graphical displays can be found in the project record.

Figure 1. Map of ram foray probabilities from the Vallecito Creek Herd S-28; output from the Risk of Contact Tool.



Results for Individual Domestic Sheep Allotments:

The following sections analyze each domestic sheep grazing allotment individually. The Risk of Contact Tool results are presented for each allotment, along with statistics for the amount of suitable domestic sheep grazing range, bighorn sheep summer source habitat, and amount of overlap between suitable domestic sheep range and bighorn sheep source habitat within each allotment. Finally, the qualitative ranking of risk of physical contact between bighorn and domestic sheep is presented for each allotment.

Burnt Timber Allotment (active sheep allotment):

Table 8. Risk of Contact Tool estimated total herd contact rates for the Burnt Timber Allotment for individual bighorn sheep herds under each action alternative (Alternatives 2, 3 and 4).

Burnt Timber Allotment	Annual Herd Contact Rates via Foray				1 Contact Per X Years
	S-16 Cimarrona Peak Herd	S-28 Vallecito Creek Herd	S-71 West Needles Herd	Total	
Alternative 2	0.002088	0.091157	0.053108	0.146352	6.83
Alternative 3	0.002043	0.086821	0.049616	0.13848	7.22
Alternative 4	0.002043	0.086821	0.049616	0.13848	7.22

CHHR Intersects With Allotment
 Allotment Proposed Closed
 N/A: Too Far From Allotment
 CHHR = Bighorn Core Herd Home Range

Table 9. Acreage statistics for the Burnt Timber Allotment for domestic sheep grazing range, bighorn sheep summer source habitat, and acres of overlap between domestic sheep and bighorn sheep grazing acres under each action alternative (Alternatives 2, 3 and 4).

Alternative	Distance from Bighorn Core Herd Home Range (CHHR)	Total Allotment Acres	Suitable Domestic Sheep Grazing Acres (% of Allotment)	Bighorn Summer Source Habitat Acres (% of Allotment)	Acres of Overlap Between Suitable Grazing Acres and Bighorn Source Habitat (% Overlap)
Alternative 2	4.12 mi – S-71 7.11 mi – S-28 19.22 mi – S-16	5,146	3,948 (77%)	1,288 (25%)	820 (21%)
Alternative 3	Same Distance	5,090	3,900 (77%)	1,252 (25%)	791 (20%)
Alternative 4	Same Distance	5,090	3,900 (77%)	1,252 (25%)	791 (20%)

The Burnt Timber Allotment is located southeast of the CHHR for the West Needles Herd S-71, and west of the CHHR for the Vallecito Creek Herd S-28. There is no overlap between the Burnt Timber allotment and bighorn CHHR for any bighorn sheep herd under current allotment configuration (Alternative 2) or under a minor boundary adjustment made under

Alternatives 3 and 4. It is primarily a trailing allotment, providing the Tank Creek and Virginia Gulch bands and the recently vacant Canyon Creek allotment with access to higher elevation primary grazing ranges. A minor boundary adjustment at the far north end of the allotment would slightly reduce the size of the allotment under Alternatives 3 and 4, compared to current condition (Alternative 2). The purpose of the boundary adjustment is to reduce impacts of sheep trailing along the Lime Mesa Trail corridor, and to provide greater flexibility for the Tank Creek and Virginia Gulch bands in the immediate proximity of the trail corridor. About half of the allotment is located within the Weminuche Wilderness.

The highest elevation in the allotment is about 11,700 feet on the northwest side of the allotment. Most of the central and southern portions of the allotment are at moderate and lower elevations. The majority of the allotment and of the suitable domestic sheep grazing areas are below the alpine zone in natural meadows and older timber harvest areas.

Compared to other allotments in the Weminuche Landscape, the Burnt Timber Allotment has a relatively high percentage of the allotment suitable for domestic sheep grazing (77% of the Allotment; 3,948 acres; see Table 9, above). Most bighorn source habitat in the allotment is along the western and eastern sides of the allotment, in the upper half of the allotment. Although there is a relatively large amount of suitable domestic sheep grazing range in the allotment, there is a relatively low amount of overlap of that suitable range with bighorn source habitat (about 20% of suitable domestic sheep range is bighorn source habitat; see Table 9, above). The minor boundary adjustment proposed under Alternatives 3 and 4 would have little impact on the degree of overlap between suitable domestic sheep range and bighorn source habitat with only about 1% decline in overlap from current condition (Alternative 2) to Alternatives 3 and 4.

Estimated total herd contact rates from the Risk of Contact Tool for the Burnt Timber Allotment with each of the three herds in the Analysis area, under each of the three action alternatives, are shown above in Table 8. The herd closest to the allotment, West Needles S-71, has an estimated total herd contact rate of 0.053 under current allotment configuration (Alternative 2) and 0.0496 under Alternatives 3 and 4. These estimates equate to a predicted average of one contact with the allotment by an adult bighorn from S-71 every 6.83 years the allotment is grazed under the current allotment configuration (Alternative 2). Under the allotment configuration of Alternatives 3 and 4 there is estimated to be one bighorn contact with the allotment every 7.22 years.

Using a moderate estimate of one out of four (25%) contacts resulting in a disease transmission event with potential for subsequent bighorn mortality event (USDA Forest Service 2010a), these allotment contact rates equate to a disease transmission with potential for subsequent bighorn mortality event once every 27.3 years under current allotment configuration (Alternative 2), and once every 28.9 years under Alternatives 3 and 4. When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) these allotment contact rates equate to disease transmission events with potential for a subsequent bighorn mortality event once every 68.3 years under current allotment configuration (Alternative 2), and once every 72.2 years under Alternatives 3 and 4.

When comparing total herd contact rates for the Burnt Timber Allotment for all bighorn herds combined, under Alternative 2 there is predicted to be one bighorn contact with the allotment every 6.83 years (Table 8, above). Using a moderate estimate of one out of four (25%) contacts (USDA Forest Service 2010a) results in a disease transmission event with potential for subsequent bighorn mortality event once every 27.3 years. When the probability

of contact resulting in disease transmission is assumed to be low (one out of 10, or 10%) the total herd contact rate for all bighorn herds combined under Alternative 2 equates to a predicted disease transmission event once every 68.3 years. Under the allotment boundary configuration proposed for Alternatives 3 and 4 there is predicted to be one bighorn contact with the allotment every 7.22 years. The total herd contact rate for all bighorn herds combined under Alternatives 3 and 4 equates to a disease return interval of every 28.9 years with a 25% disease transmission probability. With a 10% disease transmission probability, there is a predicted disease return interval of every 72.2 years. Therefore the slight boundary adjustments made under Alternatives 3 and 4 results in a slight (about 6%) reduction in the predicted rate of contact with the allotment. Under the boundary configuration proposed for Alternatives 3 and 4, the potential disease return interval is moderate (every 28.9 years) when the presumed rate of disease transmission is moderate (25%) and is low (every 72.2 years) when the presumed rate of disease transmission is low (10%).

The nearest bighorn CHHR to the Burnt Timber Allotment is the West Needles Herd S-71. The distance to the West Needles Herd CHHR is 4.12 miles away at its closest point (Table 9, above). The Risk of Contact Tool assumes a distribution frequency that equates to about half of rams on a foray and about 20% of ewes on a foray predicted to reach this distance away from their CHHR (USDA Forest Service 2010c). The nearest distance to S-28, the Vallecito Creek Herd CHHR, is 7.1 miles away, with about 25% of rams and 15% of ewes on a foray expected to reach this distance from their CHHR. The nearest distance to S-16, the Cimarrona Peak Herd CHHR, is 19.2 miles away, with about 1% of adult bighorns on a foray expected to reach this distance from their CHHR.

It should be noted that under all alternatives the Risk of Contact Tool predicted the highest total herd contact rates with the Vallecito Creek Herd S-28 (0.091), not the West Needles Herd S-71 (0.053), which is closer to the allotment. The Vallecito Creek Herd S-28 is 7.1 miles away from the allotment at its closest point, compared to the West Needles Herd S-71, which is about half the distance, 4.1 miles, from the allotment at its closest point. The reason for the higher predicted total herd contact rate with S-28 is its greater population size than S-71, and greater bighorn source habitat connectivity between the allotment and the CHHR for S-28, compared to that with S-71. Connectivity of bighorn source habitat with S-28 CHHR is fair, and that with S-71 CHHR is poor, despite its closer proximity.

Based on the information presented above, a rank of **Moderate Risk** was assigned to the Burnt Timber Allotment. The reasons for assigning a rank of Moderate Risk to the Burnt Timber Allotment are:

- There is no direct overlap of the allotment with bighorn CHHR under any alternative.
- There are moderate total herd contact rates (about 0.08, or less; Table 8, above) from the Risk of Contact Tool for all bighorn herds and action alternatives, resulting in moderate lengths of time between potential for bighorn contact with the allotment (once per 27.3 years to 72.2 years).
- The slight boundary adjustments made under Alternatives 3 and 4 results in a slight (about 6%) reduction in the predicted rate of contact with the allotment. Under the boundary configuration proposed for Alternatives 3 and 4, the potential disease return interval is moderate (every 28.9 years) when the presumed rate of disease transmission is moderate (25%), and the potential disease return interval is low (every 72.2 years) when the presumed rate of disease transmission is low (10%).

- There is moderate separation from the nearest bighorn’s CHHR (S-71 and S-28) in terms of both distance (4.12 to 19.22 miles; Table 9, above) and geographic terrain, with fair connectivity between bighorn source habitat and CHHR’s for dispersal of bighorns from S-71 and S-28 to the allotment.
- There is a relatively low amount (about 20%) of suitable domestic sheep grazing range that overlaps with bighorn source habitat under all alternatives (Table 9, above). This indicates lower likelihood that foraging bighorns reaching the allotment might find and contact domestic sheep on suitable range.
- About half of foraging bighorns from S-71 are predicted to reach the distance away from their CHHR (Table 9, above) that is equal to the distance to the nearest allotment (S-71, 4.1 miles). About one quarter of foraging bighorns are predicted to reach the distance away from the S-28 CHHR to the allotment (7.1 miles). This indicates moderate risk for bighorns from S-71 contacting the allotment, and lower risk for bighorns from S-28 contacting the allotment.
- The allotment is dominated by forested habitats and old timber harvest areas, and the few areas that are mapped as bighorn source habitats are generally small in size with fair to poor connectivity within the allotment and with bighorn CHHR’s.
- The domestic sheep permittees report they have not seen bighorn sheep in the allotment, and no reports have been received from the public of bighorn sheep observed in the allotment during the summer grazing season.
- Project design criteria applied under Alternatives 3 and 4 (Appendix 1, EA Table 2-3, below), when fully and completely implemented, are expected to enhance the effectiveness of separation between the species, although the amount of improvement in effectiveness is not known with certainty.

Summary of Risk Rating for Burnt Timber Allotment:

Risk Rating: Alternative 2 – Moderate
 Alternative 3 – Moderate
 Alternative 4 – Moderate

Canyon Creek Allotment (vacant sheep and active cattle allotment):

Table 10. Risk of Contact Tool estimated total herd contact rates for the Canyon Creek Allotment for individual bighorn sheep herds under each action alternative (Alternatives 2, 3 and 4).

Canyon Creek Allotment	Annual Herd Contact Rates via Foray				1 Contact Per X Years
	S-16 Cimarrona Peak Herd	S-28 Vallecito Creek Herd	S-71 West Needles Herd	Total	
Alternative 2	0.000426	0.022129	1.00	1.022555	0.98
Alternative 3	Allotment Proposed Closed				N/A
Alternative 4	Allotment Proposed Closed				N/A

CHHR Intersects With Allotment
 Allotment Proposed Closed
 N/A: Too Far From Allotment
 CHHR = Bighorn Core Herd Home Range

Table 11. Acreage statistics for the Canyon Creek Allotment for domestic sheep grazing range, bighorn sheep summer source habitat, and acres of overlap between domestic sheep and bighorn sheep grazing acres under each action alternative (Alternatives 2, 3 and 4).

Alternative	Distance from Bighorn Core Herd Home Range (CHHR)	Total Allotment Acres	Suitable Domestic Sheep Grazing Acres (% of Allotment)	Bighorn Summer Source Habitat Acres (% of Allotment)	Acres of Overlap Between Suitable Grazing Acres and Bighorn Source Habitat (% Overlap)
Alternative 2	Overlap – S-71 9.57 mi – S-28 20.54 mi – S-16	6,231	3,467 (56%)	919 (15%)	177 (5%)
Alternative 3	Allotment Proposed Closed				
Alternative 4	Allotment Proposed Closed				

The Canyon Creek Allotment is located along the eastern edge of Weminuche Landscape and overlaps with the CHHR for the West Needles Herd S-71. A boundary adjustment proposed under Alternatives 3 and 4 would eliminate the entire zone of overlap from the allotment, and the remainder of the allotment would be converted to a cattle allotment and closed permanently to domestic sheep grazing. The allotment was grazed by domestic sheep annually through the 2011 season, was vacant in the 2012 grazing season, and was stocked with cattle in the 2013 grazing season. Under current management (Alternative 2) it is considered a vacant domestic sheep allotment that was stocked temporarily with cattle but could be restocked with sheep at any time. For this reason, under Alternative 2 the Canyon Creek Allotment will be analyzed as a vacant sheep allotment that could be restocked with sheep administratively at any time. Under Alternatives 3 and 4, the allotment is proposed to be closed to domestic sheep grazing and converted permanently to a cattle allotment.

The highest elevation in the Canyon Creek Allotment is about 11,400 feet on the northern edge allotment. None of the allotment is within designated wilderness. Most of the suitable domestic sheep range consists of large open natural parks on moderately sloped hillsides surrounded by spruce-fir and mixed aspen-conifer forests at moderate elevations. Some additional grazing areas are in older timber harvest areas within the spruce-fir forest zone. The entire allotment is below the alpine zone.

Under current condition (Alternative 2) there is about 1,005 acres of overlap with the S-71 CHHR, about 16 percent of the allotment. All of the overlap area is on the east side of the Animas River. Within this area of overlap, about 65 acres (6%) is suitable domestic sheep grazing range. Also within this area of overlap, CPW has mapped 251 acres as bighorn summer concentration area, of which about 47 acres are classified as suitable domestic sheep range. Under Alternatives 3 and 4, the entire area of overlap with the S-71 CHHR, including the bighorn summer concentration area within it, would be removed from the allotment and closed to domestic sheep grazing.

Under Alternative 2 the Canyon Creek Allotment has about 3,467 acres of suitable domestic sheep grazing range, about half (56%) of the Allotment (see Table 11, above). There is a relatively small amount of bighorn source habitat in the allotment, 919 acres or 15% of the allotment (Table 11, above). Nearly all bighorn source habitat in the allotment is along the

northern and eastern boundary of the allotment, across the allotment from the CHHR for S-71. Although there is a substantial amount of suitable domestic sheep grazing range in the allotment (3,467 acres), there is only a very small overlap of that suitable range with bighorn source habitat (177 acres, about 5% of suitable domestic sheep range in the allotment; see Table 11, above).

Estimated total herd contact rates from the Risk of Contact Tool for the Canyon Creek Allotment with each of the three herds in the Analysis area, under each of the three action alternatives, are shown above in Table 10. The allotment overlaps with the West Needles Herd S-71 and therefore a contact rate of 1.0 (contact occurring every year) is assumed for this bighorn herd. The next closest bighorn herd to the allotment, Vallecito Creek S-28, has an estimated total herd contact rate of 0.022 under current allotment configuration (Alternative 2), and the Cimarrona Peak S-16 herd has a total herd contact rate of 0.0004 (Table 10, above). These estimates equate to a predicted average of one contact with the allotment by an adult bighorn from S-28 every 45.4 years the allotment is grazed under the current allotment configuration (Alternative 2). For the Cimarrona Peak Herd S-16, the contact rate equates to one contact with the allotment every 2500 years. Table 10 does not display total herd contact rates for Alternatives 3 or 4 because the allotment is proposed to be closed to domestic sheep grazing under both alternatives.

Using a moderate estimate of one out of four (25%) contacts resulting in a disease transmission event with potential for subsequent bighorn mortality event (USDA Forest Service 2010a), the bighorn contact rate under current management (Alternative 2) from the S-28 CHHR equates to a disease transmission with potential for subsequent bighorn mortality event once every 181.6 years. When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 20, or 5%) the allotment contact rate equates to a disease transmission event with potential for a subsequent bighorn mortality event once every 908 years under current allotment configuration.

The nearest bighorn CHHR to the Canyon Creek Allotment is the West Needles Herd S-71, with direct overlap of CHHR under current configuration (Alternative 2). The distance to the Vallecito Creek Herd S-28 CHHR is 9.57 miles away at its closest point (Table 11, above). The Risk of Contact Tool assumes a distribution frequency that equates to less than 20% of rams on a foray and about 10% of ewes on a foray predicted to reach this distance away from their CHHR (USDA Forest Service 2010c). The nearest distance to S-16, the Cimarrona Peak Herd CHHR, is 20.54 miles away, with about 1% of adult bighorns on a foray expected to reach this distance from their CHHR.

Based on the information presented above, a rank of **High Risk** was assigned to the Canyon Creek Allotment under Alternative 2, but a rank of **Low Risk** was assigned under Alternatives 3 and 4. The reasons for assigning a rank of High Risk to the Canyon Creek Allotment under Alternative 2 and rank of Low Risk under Alternatives 3 and 4 are:

- About 18% of the allotment directly overlaps the West Needles Herd S-71 bighorn CHHR under current configuration (Alternative 2). For this reason, it is assumed that under current allotment configuration multiple bighorn contacts per year with the allotment are possible, and thus there is high risk for physical contact with potential for disease transmission and subsequent bighorn mortality event within the S-71 CHHR.

- The allotment is proposed to be closed to domestic sheep grazing under Alternatives 3 and 4, and thus there is low risk for physical contact between the species under Alternatives 3 and 4.
- Under current condition (Alternative 2) total herd contact rate with S-71 from the Risk of Contact Tool is assumed to be at least one contact per year due to overlap with CHHR. However, for bighorn herd S-16 and S-28 CHHR's the total herd contact rates are low (less than about 0.02) and thus risk of contact with S-16 and S-28 is predicted to be low (Table 10, above).
- High separation from the next nearest bighorn CHHR's (S-28, then S-16) in terms of both distance (9.57 and 20.54 miles, respectively; Table 11, above) and geographic terrain, with poor connectivity between bighorn source habitat and CHHR's for dispersal of bighorns from S-16 and S-28 to the allotment. High separation and low connectivity of bighorn source habitat indicates lower risk for bighorns contacting the allotment from S-28 and S-16.
- Relatively low amount (about 5%) of suitable domestic sheep grazing range overlaps with bighorn source habitat in the allotment under current configuration (Alternative 2; Table 11, above). This indicates lower likelihood that foraging bighorns reaching the allotment might find and contact domestic sheep on suitable range.
- Less than 20% of foraging bighorns from S-28 are predicted to reach the distance away from their CHHR (9.57 miles; Table 11, above) that is equal to the distance to the allotment. Less than 1% of foraging bighorns are predicted to reach the distance away from the S-16 CHHR to the allotment (20.54 miles; Table 11, above). This indicates that few bighorns foraging from S-28 and S-16 are likely to reach the allotment.
- The allotment is dominated by forested habitats, natural parks and old timber harvest areas, and the few areas mapped as preferred bighorn habitats or escape terrain are generally small in size with poor connectivity within the allotment and with bighorn CHHR's.
- The domestic sheep permittees report they have not seen bighorn sheep in the allotment, and no reports have been received from the public of bighorn sheep observed in the allotment during the summer grazing season.

Summary of Risk Rating for Canyon Creek Allotment:

Risk Rating: Alternative 2 – High
Alternative 3 – Low
Alternative 4 – Low

Cave Basin Allotment (vacant sheep allotment):

Table 12. Risk of Contact Tool estimated total herd contact rates for the Cave Basin Allotment for individual bighorn sheep herds under each action alternative (Alternatives 2, 3 and 4.

Cave Basin Allotment	Annual Herd Contact Rates via Foray				1 Contact Per X Years
	S-16 Cimarrona Peak Herd	S-28 Vallecito Creek Herd	S-71 West Needles Herd	Total	
Alternative 2	0.437066	1.00	0.081683	1.518749	0.66
Alternative 3	Allotment Proposed Closed				N/A
Alternative 4	Allotment Proposed Closed				N/A

CHHR Intersects With Allotment
Allotment Proposed Closed
N/A: Too Far From Allotment
CHHR = Bighorn Core Herd Home Range

Table 13. Acreage statistics for the Cave Basin Allotment for domestic sheep grazing range, bighorn sheep summer source habitat, and acres of overlap between domestic sheep and bighorn sheep grazing acres under each action alternative (Alternatives 2, 3 and 4).

Alternative	Distance from Bighorn Core Herd Home Range (CHHR)	Total Allotment Acres	Suitable Domestic Sheep Grazing Acres (% of Allotment)	Bighorn Summer Source Habitat Acres (% of Allotment)	Acres of Overlap Between Suitable Grazing Acres and Bighorn Source Habitat (% Overlap)
Alternative 2	Overlap – S-28 5.93 mi – S-16 7.13 mi – S-71	22,452	5,858 (26%)	12,732 (57%)	1,849 (32%)
Alternative 3	Allotment Proposed Closed				
Alternative 4	Allotment Proposed Closed				

The Cave Basin Allotment is located in the middle of the Weminuche Landscape. The entire allotment is located within the Weminuche Wilderness. Most of the allotment overlaps with the CHHR for the Vallecito Creek Herd S-28. Under current condition (Alternative 2) there is about 19,575 acres of overlap with the S-28 CHHR, about 87 percent of the allotment. Within this overlap area, about 5,389 acres (28%) is suitable domestic sheep grazing range. Also within this overlap area, about 11,681 acres (60%) is bighorn summer source habitat. Bighorn sheep are regularly observed in eastern and northern portions of the allotment during summer, and large portions of the eastern half of the allotment overlap with areas mapped by CPW as bighorn summer concentration area. Domestic sheep were grazed in the allotment annually from 1928 through 1971, then from 1980 through 1982, 1984, and ending in 1988. Bighorns have been documented in the area since at least the 1940s.

The allotment was last grazed by domestic sheep in 1988 and has remained vacant since then. However, there was strong circumstantial evidence of physical contact between transplanted bighorns and domestic sheep grazed in the allotment in 1988, and that this

contact resulted in a presumed complete mortality event of the released bighorns before winter. Disease did not appear to have been transmitted from the transplanted bighorns to the native bighorn herd because population size and lamb survival remained stable in the native bighorn herd after the event (Weinmeister 2012).

Under current management (Alternative 2), Cave Basin is considered a vacant domestic sheep allotment that could be restocked administratively at any time. Under Alternatives 3 and 4, the allotment is proposed to be closed to domestic sheep grazing. Also under Alternative 3, the southern approximately one third of the allotment (6,036 acres, 27% of the allotment) is proposed to be converted to a cattle forage reserve allotment, allowing cattle grazing for a maximum of three out of any ten consecutive years. The entire area of this proposed cattle forage reserve allotment overlaps with bighorn CHHR for the Vallecito Creek Herd S-28. Within this overlap area, about 4,319 acres (72%) is suitable livestock grazing range. Also within this overlap area, about 1,918 acres (32%) is bighorn summer source habitat. Under Alternative 4, the allotment is proposed to be closed to all livestock grazing.

Elevations on the allotment vary from 8,400 to 13,600 feet. More than half of the allotment is too steep or produces too little forage to be suitable for livestock grazing. Most of the suitable grazing range is in the southern third of the allotment, and above about 10,500 feet in elevation in older timber harvest areas within the spruce-fir forest zone. Most of the northern half of the allotment is above timberline.

Under current condition (Alternative 2) there is about 19,574 acres of overlap with the S-28 CHHR, about 87 percent of the allotment. Within this overlap area, about 5,389 acres (28%) is suitable domestic sheep grazing range. Also within this area of overlap, CPW has mapped 6,328 acres as bighorn summer concentration area, of which about 609 acres are classified as suitable domestic sheep range. Also within this area of overlap, CPW has mapped 164 acres as bighorn production area, of which 14 acres are classified as suitable domestic sheep range. Under Alternatives 3 and 4, the entire area of overlap with the S-28 CHHR, including the bighorn summer concentration and production areas within it, would be closed to domestic sheep grazing.

Under Alternative 2 the Cave Basin Allotment has 22,452 acres within the allotment, of which approximately 5,858 acres (26%) are suitable domestic sheep grazing range (Table 13, above). There is a relatively large amount of bighorn source habitat in the allotment, 12,732 acres or 57% of the allotment (Table 13, above). There is substantial overlap in the allotment between suitable domestic sheep range and bighorn summer source habitat, with 32% of suitable domestic sheep range (1,849 acres) also bighorn summer source habitat. Most of the northern two-thirds of the allotment is bighorn source habitat with large contiguous areas of interconnected habitat patches spanning long distances across alpine ridges and basins.

Total herd contact rates from the Risk of Contact Tool for the Cave Basin Allotment with each of the three herds in the Analysis area, under each of the three action alternatives, are shown above in Table 12. The allotment overlaps substantially with the CHHR for the Vallecito Herd S-28 and therefore a contact rate of 1.0 (contact occurring every year) is assumed for this bighorn herd. The next closest bighorn herd to the allotment, Cimarrona Peak S-16, has an estimated total herd contact rate of 0.437 under current allotment configuration (Alternative 2). The West Needles Herd S-71 has a total herd contact rate of 0.081 (Table 12, above). These total herd contact rates equate to a predicted average of one contact with the allotment by an adult bighorn from the Cimarrona Peak Herd S-16 every 2.28 years the allotment is grazed under the current allotment configuration (Alternative 2). For the West Needles Herd

S-71, the contact rate equates to one contact with the allotment every 12.35 years. Table 12 does not display total herd contact rates for Alternatives 3 or 4 because the allotment is proposed to be closed to domestic sheep grazing under both alternatives.

Using a moderate estimate of one out of four (25%) contacts resulting in a disease transmission event with potential for subsequent bighorn mortality event (USDA Forest Service 2010a), the bighorn contact rate under current management (Alternative 2) from the S-16 CHHR equates to a disease transmission with potential for subsequent bighorn mortality event once every 9.0 years. When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) the total herd contact rate for S-16 under Alternative 2 equates to a disease transmission event with potential for a subsequent bighorn mortality event once every 22.5 years. The total herd contact rates for West Needles Herd S-71 equates to a disease return interval of every 49.4 years with a 25% disease transmission probability, and return interval of 123.5 years with a 10% disease transmission probability.

As stated earlier, the Cave Basin Allotment directly overlaps a substantial portion of the Vallecito Creek Herd S-28 CHHR. The next nearest bighorn CHHR to the Cave Basin Allotment is the Cimarrona Peak Herd S-16. The closest distance to the Cimarrona Peak Herd S-16 CHHR is 5.93 miles away at its closest point (Table 13, above). The Risk of Contact Tool assumes a distribution frequency that equates to less than 30% of rams on a foray and about 15% of ewes on a foray predicted to reach this distance away from their CHHR (USDA Forest Service 2010c). The nearest distance to S-71, the West Needles Herd CHHR, is 7.13 miles away, with about 40% of all adult bighorns on a foray expected to reach this distance from their CHHR.

Based on the information presented above, a rank of **High Risk** was assigned to the Cave Basin Allotment under Alternative 2, but a rank of **Low Risk** was assigned under Alternatives 3 and 4. The reasons for assigning a rank of High Risk to the Cave Basin Allotment under Alternative 2 and rank of Low Risk under Alternatives 3 and 4 are:

- About 87% of the allotment directly overlaps the Vallecito Creek Herd S-28 bighorn CHHR under current configuration (Alternative 2). For this reason, it is assumed that under current allotment configuration multiple bighorn contacts with the allotment per year are possible, and thus there is high risk for physical contact with potential for disease transmission and subsequent bighorn mortality event within the S-28 CHHR.
- Allotment proposed to be closed to domestic sheep grazing under Alternatives 3 and 4, and thus there is low risk for physical contact between the species under Alternatives 3 and 4.
- Under current condition (Alternative 2) total herd contact rate with S-28 from the Risk of Contact Tool is assumed to be at least one contact per year due to overlap with CHHR. For the Cimarrona Peak Herd S-16, the total herd contact rate is high (0.437, equating to one contact per 2.29 years) and thus risk of contact with S-16 is predicted to be high (Table 12, above). For the West Needles Herd S-71, the total herd contact rate is low (0.082, equating to one contact per 12.1 years) and thus risk of contact with S-71 is predicted to be low.
- Moderate separation from S-16 and S-71 in terms of distance (5.93 and 7.13 miles, respectively; Table 13, above), but strong connectivity with S-16 in terms of bighorn source habitat for dispersal of bighorns from S-16 to the allotment.

- Relatively high amount (about 32%) of suitable domestic sheep grazing range overlaps with bighorn source habitat in the allotment under current configuration (Alternative 2; Table 13, above). This indicates higher likelihood that foraging bighorns reaching the allotment might find and contact domestic sheep on suitable range.
- About 40% of foraging bighorns from S-16 and S-71 are predicted to reach the distance away from their CHHR (5.93 and 7.13 miles, respectively; Table 13, above) that is equal to the distance to the allotment. This indicates moderate risk for bighorns contacting the allotment.
- Most of the northern two-thirds of the allotment is bighorn source habitat with large contiguous areas of interconnected habitat patches spanning long distances across alpine ridges and basins. Large portions of the eastern half of the allotment overlap with areas mapped by CPW as bighorn summer concentration area. This indicates a higher likelihood that contact would occur if domestic sheep and bighorn sheep were present in the allotment during the same season.
- Bighorn sheep are regularly observed in eastern and northern portions of the allotment during the summer grazing season, indicating a high likelihood for contact if domestic sheep are present.

Summary of Risk Rating for Cave Basin Allotment:

Risk Rating: Alternative 2 – High
 Alternative 3 – Low
 Alternative 4 – Low

East Silver Mesa Allotment, Renamed Endlich Mesa (active sheep allotment):

Table 14. Risk of Contact Tool estimated total herd contact rates for the East Silver Mesa Allotment for individual bighorn sheep herds under each action alternative (Alternatives 2, 3 and 4.

East Silver Mesa Allotment	Annual Herd Contact Rates via Foray				1 Contact Per X Years
	S-16 Cimarrona Peak Herd	S-28 Vallecito Creek Herd	S-71 West Needles Herd	Total	
Alternative 2	0.016567	0.300155	0.097029	0.413752	2.42
Alternative 3	0.064539	0.562903	0.128045	0.755487	1.32
Alternative 4	0.064539	0.562903	0.128045	0.755487	1.32

CHHR Intersects With Allotment
 Allotment Proposed Closed
 N/A: Too Far From Allotment
 CHHR = Bighorn Core Herd Home Range

Table 15. Acreage statistics for the East Silver Mesa (Endlich Mesa) Allotment for domestic sheep grazing range, bighorn sheep summer source habitat, and acres of overlap between domestic sheep and bighorn sheep grazing acres under each action alternative (Alternatives 2, 3 and 4).

Alternative	Distance from Bighorn Core Herd Home Range (CHHR)	Total Allotment Acres	Suitable Domestic Sheep Grazing Acres (% of Allotment)	Bighorn Summer Source Habitat Acres (% of Allotment)	Acres of Overlap Between Suitable Grazing Acres and Bighorn Source Habitat (% Overlap)
Alternative 2	2.07 mi – S-28 6.17 mi – S-71 12.81 mi – S-16	8,714	4,730 (54%)	3,628 (42%)	1,829 (39%)
Alternative 3	1.89 mi – S-28 4.51 mi – S-71 12.51 mi – S-16	10,257	5,335 (52%)	5,149 (50%)	2,344 (44%)
Alternative 4	Same Distance	10,257	5,335 (52%)	5,149 (50%)	2,344 (44%)

The East Silver Mesa Allotment is located on the southwest side of the Weminuche Landscape. It is located between the Florida River and Vallecito Creek drainages. About three quarters of the allotment is located within the Weminuche Wilderness. There is no direct overlap with bighorn CHHR for any of the bighorn herds in the analysis area. Bighorn sheep have not been reported within the allotment during the summer grazing season. This allotment was included in the Virginia Gulch allotment during early years. It then became part of the Florida allotment, which no longer exists. In 1962, it was combined with Johnson Creek Allotment, but it is unclear what allotment boundaries or allotment combinations were being used in early years. It was not considered a separate allotment until 1974. In 1986, the boundary was changed to its present configuration and the permitted number of sheep was set at 850. Domestic sheep have been grazed in the allotment annually since at least 1928, and probably earlier.

The majority of the East Silver Mesa Allotment is in the Florida River watershed and consists primarily of McClure Canyon, Stump Canyon, and numerous unnamed drainages on the east side of the headwaters of the Florida River. Elevations on the allotment range between 9,200 and 13,000 feet. About half of the allotment is either too steep or produces too little forage to be suitable for grazing. Most of the suitable grazing range is located at the higher elevations near or above timberline, but older spruce-fir timber harvest areas in the lower third of the allotment also provide substantial amounts of grazing range. Most of the north half of the allotment is above timberline, with the south half of the allotment primarily within the spruce-fir forest zone. The domestic sheep band typically uses the allotment in a two year rotation pattern: clock-wise rotation in year one and counter clock-wise rotation in year two. Herder camps are used every year but bed grounds are used only every other year to allow for recovery. The permittee moves camps about every 7 days.

Under current management (Alternative 2) the East Silver Mesa Allotment is an active domestic sheep allotment. Under Alternatives 3 and 4, the allotment would remain an active domestic sheep allotment.

Under Alternatives 3 and 4, there would be minor adjustments to the eastern boundary of the allotment to better reflect actual use areas, and better reflect topographic features of the area. Portions of the southeast section of the allotment would be added to the Fall Creek Allotment and closed to domestic sheep grazing, due to topography and lack of vegetation (mainly rock). Other portions of the eastern edge of the allotment would be expanded to include portions of the Fall Creek Allotment, to better reflect actual use by the band, and better reflect topographic features of the area. The northern boundary of the allotment would also be expanded to include portions of the Virginia Gulch Allotment near City Reservoir, providing a more functional allotment arrangement for the permittee. Finally, under Alternatives 3 and 4 the allotment would be renamed the Endlich Mesa Allotment.

Under Alternative 2 the East Silver Mesa Allotment has 8,714 acres within the allotment, of which approximately 4,730 acres (47%) are suitable domestic sheep grazing range (Table 15, above). There is a relatively large amount of bighorn source habitat in the allotment, 3,628 acres or 42% of the allotment. There is substantial overlap in the allotment between suitable domestic sheep range and bighorn summer source habitat, with 39% of suitable domestic sheep range (1,829 acres) also bighorn summer source habitat. Most of the northern third of the allotment is bighorn source habitat. The northern third of the allotment is dominated by large contiguous patches of bighorn source habitat. In the southern two-thirds of the allotment, bighorn source habitat is primarily in a narrow strip along the eastern boundary of the allotment and in a few isolated patches within the interior of the allotment.

Under Alternatives 3 and 4 the allotment would be expanded to a total of 10,257 acres in size (Table 15, above), due to boundary adjustments and additions from the Fall Creek and Virginia Gulch allotments. Because these expansion areas also happen to be in areas of bighorn summer source habitat, the amount of bighorn source habitat in the allotment would increase by 8% under Alternatives 3 and 4 (50% of the allotment). In addition, the amount of overlap between domestic sheep suitable grazing range and bighorn source habitat would also increase by 5% (44% of suitable grazing range is also bighorn source habitat).

Total herd contact rates from the Risk of Contact Tool for the East Silver Mesa Allotment with each of the three herds in the Analysis area, under each of the three action alternatives, are shown above in Table 14. The estimated total herd contact rate with the Vallecito Creek Herd S-28 is 0.30 under current allotment configuration (Alternative 2). The next closest bighorn herd to the allotment, West Needles Herd S-71, has an estimated total herd contact rate of 0.097. The Cimarrona Peak Herd S-16 has a total herd contact rate of 0.017. These total herd contact rates equate to a predicted average of one contact with the allotment by an adult bighorn from the Vallecito Creek Herd S-28 every 3.3 years the allotment is grazed under the current allotment configuration (Alternative 2). For the West Needles Herd S-71 and the Cimarrona Peak Herd S-16, the contact rates equate to one contact with the allotment every 10.31 and 58.82 years, respectively.

Due to allotment boundary adjustments proposed under Alternatives 3 and 4, the total herd contact rates increase for all three bighorn herds under Alternatives 3 and 4 (Table 14, above). Because the boundary adjustments would expand the allotment, primarily along the eastern and northern ends which also have high amounts of bighorn source habitat, the total herd contact rates for the Vallecito Creek S-28 and Cimarrona Peak S-16 herds would increase substantially, whereas the total herd contact rate for the West Needles Herd S-71 would increase only slightly. These increases are due to better connectivity across often contiguous blocks of bighorn source habitat, and slight reductions in the distance from the

new allotment boundary to the CHHR's for S-28 and S-16. The slight increase in total herd contact rate with S-71 is due primarily to including more bighorn source habitat in the northern portion of the allotment, which are also areas of better bighorn habitat connectivity to the CHHR.

Under current allotment configuration (Alternative 2), using a moderate estimate of one out of four (25%) contacts resulting in a disease transmission event with potential for subsequent bighorn mortality event (USDA Forest Service 2010a), the bighorn contact rate from the S-28 CHHR (0.30) equates to a disease transmission with potential for subsequent bighorn mortality event once every 13.3 years (Table 14, above). When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) the total herd contact rate for S-28 under Alternative 2 equates to a disease transmission event with potential for a subsequent bighorn mortality event once every 33.3 years. The total herd contact rate for the West Needles Herd S-71 (0.097) equates to a disease return interval of every 41.2 years with a 25% disease transmission probability, and return interval of 103.1 years with a 10% disease transmission probability. The total herd contact rates for the Cimarrona Peak Herd S-16 (0.017) equates to a disease return interval of every 235.3 years with a 25% disease transmission probability, and return interval of 588.2 years with a 10% disease transmission probability.

Under the allotment configuration in Alternatives 3 and 4, a moderate estimate of one out of four (25%) contacts (USDA Forest Service 2010a) and a total herd contact rate of 0.563 for the S-28 bighorn herd results in a disease transmission event with potential for subsequent bighorn mortality event once every 7.1 years (Table 14, above). When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) the total herd contact rate for S-28 under Alternatives 3 and 4 equates to a disease transmission event with potential for a subsequent bighorn mortality event once every 17.8 years. The total herd contact rate for the West Needles Herd S-71 (0.128) equates to a disease return interval of every 31.25 years with a 25% disease transmission probability, and return interval of 78.1 years with a 10% disease transmission probability. The total herd contact rates for the Cimarrona Peak Herd S-16 (0.065) equates to a disease return interval of every 61.54 years with a 25% disease transmission probability, and return interval of 153.8 years with a 10% disease transmission probability.

When comparing total herd contact rates for the East Silver Mesa Allotment for all bighorn herds combined, under Alternative 2 there is predicted to be one bighorn contact with the allotment every 2.42 years (Table 14, above). Using a moderate estimate of one out of four (25%) contacts (USDA Forest Service 2010a) there is predicted to be a disease transmission event with potential for subsequent bighorn mortality once every 9.7 years. When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) the total herd contact rate for all bighorn herds combined under Alternative 2 equates to a predicted disease transmission event once every 24.2 years.

Under the allotment boundary configuration proposed for Alternatives 3 and 4 there is predicted to be one bighorn contact with the allotment every 1.32 years. The total herd contact rate for all bighorn herds combined under Alternatives 3 and 4 equates to a disease return interval of every 5.3 years with a 25% disease transmission probability. With a 10% disease transmission probability, there is a predicted disease return interval of every 13.2 years. Therefore the boundary adjustment made under Alternative 3 results in a substantial (about 55%) increase in the predicted rate of contact with the allotment. Under all boundary

configurations, the potential disease return interval remains high (every 13.2 years) even when the presumed rate of disease transmission is low (10%).

The closest distance from the East Silver Mesa Allotment to the Vallecito Creek Herd S-28 CHHR, under current configuration (Alternative 2), is 2.07 miles away at its closest point (Table 15, above). The Risk of Contact Tool assumes a distribution frequency that equates to about 80% of rams and 35% of ewes on a foray are expected to reach this distance away from their CHHR (USDA Forest Service 2010c). The next nearest bighorn CHHR to the allotment is the West Needles Herd S-71, which is 6.17 miles away at its closest point under current allotment configuration. This equates to about 35% of rams and 15% of ewes on a foray are expected to reach this distance away from their CHHR. The nearest distance to S-16, the Cimarrona Peak Herd CHHR, is 12.81 miles away, with about 25% of all adult bighorns on a foray expected to reach this distance from their CHHR.

Due to adjustments made under Alternatives 3 and 4 in the allotment boundary, the shortest distance from the allotment to all three bighorn herds was somewhat reduced under Alternatives 3 and 4, compared to Alternative 2 (see Table 14, above). Because of the slight reduction in distance to each of the three bighorn herd CHHR's under Alternatives 3 and 4, there was also a slight increase in the percentage of adult bighorns that would be expected to reach the allotment while on a foray. For S-28, S71 and S-16, the distance to each bighorn CHHR was 1.89, 4.51 and 12.51 miles, respectively.

Based on the information presented above, a rank of **High Risk** was assigned to the East Silver Mesa (renamed Endlich Mesa) Allotment under Alternative 2, and a rank of **High Risk** was assigned under Alternatives 3 and 4. The reasons for assigning a rank of High Risk to the East Silver Mesa Allotment under Alternative 2 and under Alternatives 3 and 4 are:

- Although there is no direct overlap of the allotment with any bighorn herd CHHR under current configuration (Alternative 2), the allotment is in relatively close proximity to the S-28 CHHR. For the reasons of close proximity to the S-28 CHHR and good connectivity of bighorn source habitat with the S-28 CHHR, it is concluded that under current allotment configuration there is high risk for physical contact, with potential for disease transmission and subsequent bighorn mortality event, with bighorns from the S-28 CHHR.
- Under Alternatives 3 and 4, the proximity of the allotment becomes closer to the S-28 CHHR, and the connectivity of the allotment to the CHHR via bighorn source habitat is increased. This is due primarily to boundary adjustments that reduce the distance to the S-28 CHHR and increase the amount of bighorn source habitat within the allotment under Alternatives 3 and 4. For these reasons, the risk of contact with foraging bighorns from the S-28 CHHR remains high, and is increased under Alternatives 3 and 4, compared to Alternative 2.
- Under current condition (Alternative 2), the total herd contact rate from the Risk of Contact Tool with the Vallecito Creek Herd S-28 is high (0.30), equating to one contact every 3.3 years) and thus risk of contact with S-16 is predicted to be high (Table 14, above). For the West Needles Herd S-71, the total herd contact rate is moderate (0.091, equating to one contact per 10.99 years) and thus risk of contact with S-71 is predicted to be Moderate. For the Cimarrona Peak Herd S-16, the total herd contact rate is low (0.017, equating to one contact per 58.82 years) and thus risk of contact with S-16 is predicted to be low.

- Under Alternatives 3 and 4, the total herd contacts rates from the Risk of Contact Tool increase for all three bighorn herds, compared to Alternative 2, especially for the S-28 and S-16 bighorn herds. Despite the increases in total herd contact rates for all three CHHR's, the potential for contact between bighorns from the S-28 CHHR and the allotment remains high risk, the risk remains moderate for S-71, and the risk remains low for S-16. This increase in potential for contact with all three bighorn CHHR's is due to allotment boundary adjustments under Alternatives 3 and 4 expanding the allotment, primarily along the eastern and northern ends, which also have high amounts of bighorn source habitat. The increased total herd contact rates are due to better connectivity across often contiguous blocks of bighorn source habitat, slight reductions in the distance from the new allotment boundary to the CHHR's for S-28 and S-16, and the new allotment boundary including more bighorn source habitat in the northern portion of the allotment, which provides better bighorn habitat connectivity to the CHHR for all three herds.
- The boundary adjustments made under Alternatives 3 and 4 results in a substantial (about 55%) increase in the predicted rate of contact with the allotment. Under all boundary configurations, the potential disease return interval remains high (every 13.2 years), even when the presumed rate of disease transmission is low (10%).
- Low separation from the Vallecito Creek Herd S-28 CHHR (2.07 miles) in terms of distance. Moderate separation from S-71 (6.87 miles) and high separation from S-16 (12.81 miles) in terms of distance (Table 15 above). However, there is strong connectivity with S-28 and S-16 in terms of source habitat for dispersal of bighorns from these two CHHR's to the allotment.
- Boundary adjustments made under Alternatives 3 and 4 reduce the degree of separation by reducing the minimum distances from the allotment to all three bighorn CHHR's. The potential for foraging bighorns to contact the allotment is increased under Alternatives 3 and 4, compared to Alternative 2, because the adjusted allotment boundary includes more bighorn source habitat in the northern portion of the allotment, which improves connectivity to the CHHR for all three herds.
- Relatively high amount (about 39%) of suitable domestic sheep grazing range overlaps with bighorn source habitat in the allotment under current configuration (Alternative 2; Table 15, above). This indicates higher likelihood that foraging bighorns reaching the allotment might find and contact domestic sheep on suitable range.
- Due to boundary adjustments under Alternatives 3 and 4, the amount of overlap between domestic sheep suitable range and bighorn source habitat increases to 44% of the domestic sheep range in the allotment. This increased amount of overlap of domestic sheep range and bighorn source habitat under Alternatives 3 and 4 indicates an increased risk that foraging bighorns that reach the allotment might find and contact domestic sheep on suitable range.
- About 80% of rams on a foray and about 35% of ewes on a foray from S-28 are predicted to reach the distance away from their CHHR (2.07 miles; Table 15, above) that is equal to the distance to the allotment. This indicates a high risk for bighorns contacting the allotment. For S-71, about 35% of rams and 15% of ewes on a foray are expected to reach this distance from their CHHR (6.17 miles). This indicates a moderate risk for bighorns contacting the allotment. For S-16, the distance is 12.81 miles, indicating less than about 25% of all adult bighorns on a foray are expected to reach the allotment from their CHHR.
- Due to boundary adjustments under Alternatives 3 and 4, the distance between the allotment and the CHHR for all three bighorn herds is somewhat reduced, compared to Alternative 2. Because of the slight reduction in distance from the allotment to each

of the three bighorn herd CHHR’s under Alternatives 3 and 4, there was also a slight increase in the percentage of adult bighorns that would be expected to reach the allotment while on a foray.

- Most of the northern third of the allotment is bighorn source habitat dominated by large contiguous patches of bighorn source habitat. . This indicates a higher likelihood that contact would occur in northern portions of the allotment if domestic sheep and bighorn sheep were present in the allotment during the same season. In the southern two-thirds of the allotment, bighorn source habitat is primarily in a narrow strip along the eastern boundary of the allotment and in a few isolated patches within the interior of the allotment. . This indicates a lower likelihood that contact would occur if domestic sheep and bighorn sheep were present in the allotment during the same season.
- The domestic sheep permittees report they have not seen bighorn sheep in the allotment, and no reports have been received from the public of bighorn sheep observed in the allotment during the summer grazing season.
- Project design criteria applied under Alternatives 3 and 4 (Appendix 1, EA Table 2-3, below), when fully and completely implemented, are expected to enhance the effectiveness of separation between the species, although the amount of improvement in effectiveness is not known with certainty.

Summary of Risk Rating for East Silver Mesa, renamed Endlich Mesa Allotment:

Risk Rating: Alternative 2 – High
 Alternative 3 – High
 Alternative 4 – High

Fall Creek Allotment (vacant sheep allotment):

Table 16. Risk of Contact Tool estimated total herd contact rates for the Fall Creek Allotment for individual bighorn sheep herds under each action alternative (Alternatives 2, 3 and 4).

Fall Creek Allotment	Annual Herd Contact Rates via Foray				1 Contact Per X Years
	S-16 Cimarrona Peak Herd	S-28 Vallecito Creek Herd	S-71 West Needles Herd	Total	
Alternative 2	0.071262	0.774790	0.091313	0.937365	1.07
Alternative 3	Allotment Proposed Closed				N/A
Alternative 4	Allotment Proposed Closed				N/A

CHHR Intersects With Allotment
Allotment Proposed Closed
N/A: Too Far From Allotment
CHHR = Bighorn Core Herd Home Range

Table 17. Acreage statistics for the Fall Creek Allotment for domestic sheep grazing range, bighorn sheep summer source habitat, and acres of overlap between domestic sheep and bighorn sheep grazing acres under each action alternative (Alternatives 2, 3 and 4).

Alternative	Distance from Bighorn Core Herd Home Range (CHHR)	Total Allotment Acres	Suitable Domestic Sheep Grazing Acres (% of Allotment)	Bighorn Summer Source Habitat Acres (% of Allotment)	Acres of Overlap Between Suitable Grazing Acres and Bighorn Source Habitat (% Overlap)
Alternative 2	0.11 mi – S-28 6.68 mi – S-71 10.63 mi – S-16	10,939	1,081 (10%)	6,754 (62%)	606 (56%)
Alternative 3	Allotment Proposed Closed				
Alternative 4	Allotment Proposed Closed				

The Fall Creek Allotment is located on the southwest side of the Weminuche Landscape. It is located entirely on the west side of the Vallecito Creek drainage. The entire allotment is located within the Weminuche Wilderness. There is no direct overlap with bighorn CHHR for any of the bighorn herds in the analysis area. Although there is no direct overlap of the allotment with bighorn CHHR under current configuration (Alternative 2), the allotment is immediately adjacent to the Vallecito Creek Herd S-28 CHHR, and sheep trailed to the allotment would likely have to pass through the S-28 CHHR to reach the allotment. Bighorn sheep have not been reported within the allotment during the summer grazing season and no reports have been received of bighorn observations along the portion of the Vallecito Creek Trail leading to the allotment. Domestic sheep were grazed in the allotment annually from 1928 through 1968. The last year of domestic sheep grazing was 1968. It was grazed temporarily by cattle from 1969 through the 1974 season but no domestic livestock have been grazed in the allotment since 1974. A 1960 grazing analysis showed that 3,397 acres of the allotment were in fair condition, and 2,650 acres were in poor condition. No portion of the allotment's vegetation was considered to be in good or excellent condition classes.

The Fall Creek allotment includes most of the D Creek drainage, Weasel Skin Creek drainage, Fall Creek, Taylor Creek and Sheep Draw. Elevations on the allotment range between 8,500 and 13,000 feet. Most of the allotment is on steep slopes that form the west side of the Vallecito Creek drainage with long open avalanche chutes commonly bisecting the landscape from top to bottom of the slopes. Some portions of the extreme north end of the allotment are above timberline but most of the allotment is within the spruce-fir and mixed aspen-conifer forest zones.

Under current management (Alternative 2) the Fall Creek Allotment is considered a vacant domestic sheep allotment that could be restocked administratively at any time. Under Alternatives 3 and 4, the allotment is proposed to be closed to all domestic livestock grazing.

Under Alternatives 3 and 4, there would be minor adjustments to the western boundary of the allotment to reflect actual use by the East Silver Mesa domestic sheep band, and better reflect topographic features of the area. Portions of the south-east section of the East Silver Mesa (Endlich Mesa) Allotment would be added to the Fall Creek Allotment and closed to domestic sheep grazing due to topography and lack of vegetation (mainly rock). Other

portions of the western edge of the allotment would be added to the East Silver Mesa Allotment to better reflect actual use by the East Silver Mesa domestic sheep band, and better reflect topographic features of the area. The southeast portion of the Johnson Creek Allotment would be added to the Fall Creek Allotment and closed to domestic sheep grazing.

Under Alternative 2 the Fall Creek Allotment has 10,939 acres within the allotment, of which approximately 1,081 acres (10%) are suitable domestic sheep grazing range (Table 17, above). There is a relatively large amount of bighorn source habitat in the allotment, 6,754 acres or 62% of the allotment. There is substantial overlap in the allotment between suitable domestic sheep range and bighorn summer source habitat, with 56% of suitable domestic sheep range (606 acres) also bighorn summer source habitat. Much of the western and northern portions of the allotment are bighorn source habitat, especially near the heads of drainages and in the many avalanche chutes that bisect the allotment. There are some large contiguous patches of bighorn source habitat along the western boundary of the allotment.

Total herd contact rates from the Risk of Contact Tool for the Fall Creek Allotment with each of the three herds in the Analysis area, under each of the three action alternatives, are shown above in Table 16. The estimated total herd contact rate with the Vallecito Creek Herd S-28 is 0.775 under current allotment configuration (Alternative 2. The next closest bighorn herd to the allotment, West Needles Herd S-71, has an estimated total herd contact rate of 0.091). The Cimarrona Peak Herd S-16 has a total herd contact rate of 0.071. These total herd contact rates equate to a predicted average of one contact with the allotment by an adult bighorn from the Vallecito Creek Herd S-28 every 1.29 years the allotment is grazed under the current allotment configuration (Alternative 2). For the West Needles Herd S-71 and the Cimarrona Peak Herd S-16, the contact rates equate to one contact with the allotment every 10.99 and 14.08 years, respectively. Table 16 does not display total herd contact rates for Alternatives 3 or 4 because the allotment is proposed to be closed to domestic sheep grazing under both alternatives.

Using a moderate estimate of one out of four (25%) contacts resulting in a disease transmission event with potential for subsequent bighorn mortality event (USDA Forest Service 2010a), the bighorn contact rate under current management (Alternative 2) from the S-28 CHHR equates to a disease transmission with potential for subsequent bighorn mortality event once every 5.2 years. When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) the total herd contact rate for S-28 under Alternative 2 equates to a disease transmission event with potential for a subsequent bighorn mortality event once every 12.9 years. The total herd contact rates for the West Needles Herd S-71 equates to a disease return interval of every 44 years with a 25% disease transmission probability, and return interval of 109.9 years with a 10% disease transmission probability. The total herd contact rates for the Cimarrona Peak Herd S-16 equates to a disease return interval of every 56.3 years with a 25% disease transmission probability, and return interval of 140.8 years with a 10% disease transmission probability.

The closest distance from the Fall Creek Allotment to the Vallecito Creek Herd S-28 CHHR, under current configuration (Alternative 2), is 0.11 miles away at its closest point (Table 17, above). The Risk of Contact Tool assumes a distribution frequency that equates to nearly all adult bighorn sheep on a foray are predicted to reach this distance away from their CHHR (USDA Forest Service 2010c). The next nearest bighorn CHHR to the allotment is the West Needles Herd S-71, which is 6.68 miles away at its closest point under current allotment configuration. This equates to about 35% of rams and 15% of ewes on a foray are expected to reach this distance away from their CHHR. The nearest distance to S-16, the Cimarrona Peak

Herd CHHR, is 10.63 miles away, with about 30% of all adult bighorns on a foray expected to reach this distance from their CHHR.

Based on the information presented above, a rank of **High Risk** was assigned to the Fall Creek Allotment under Alternative 2, but a rank of **Low Risk** was assigned under Alternatives 3 and 4. The reasons for assigning a rank of High Risk to the Fall Creek Allotment under Alternative 2 and rank of Low Risk under Alternatives 3 and 4 are:

- Although there is no direct overlap of the allotment with the Vallecito Creek Herd S-28 CHHR under current configuration (Alternative 2), the allotment is immediately adjacent to the CHHR and sheep trailed to the allotment would likely have to pass through the S-28 CHHR to reach the allotment. For the reasons of immediate proximity to and need for trailing through the S-28 CHHR to reach the allotment, it is concluded that under current allotment configuration there is high risk for physical contact, with potential for disease transmission and subsequent bighorn mortality event, with bighorns from the S-28 CHHR.
- The allotment is proposed to be closed to domestic sheep grazing under Alternatives 3 and 4, and thus there is low risk for physical contact between the species under Alternatives 3 and 4.
- Under current condition (Alternative 2) total herd contact rate with S-28 from the Risk of Contact Tool is assumed to be at least one contact per year due to overlap with CHHR. This is a very high rate of contact. For the Cimarrona Peak Herd S-16, the total herd contact rate is high (0.738, equating to one contact per 1.36 years) and thus risk of contact with S-16 is predicted to be high (Table 18, above). For the West Needles Herd S-71, the total herd contact rate is low (0.043, equating to one contact per 23.26 years) and thus risk of contact with S-71 is predicted to be low.
- Moderate separation from S-16 and S-71 in terms of distance (3.13 and 10.71 miles, respectively; Table 19 above). However, there is strong connectivity with S-16 in terms of source habitat for dispersal of bighorns from S-16 to the allotment.
- Relatively high amount (about 39%) of suitable domestic sheep grazing range overlaps with bighorn source habitat in the allotment under current configuration (Alternative 2; Table 19, above). This indicates higher likelihood that foraging bighorns reaching the allotment might find and contact domestic sheep on suitable range.
- About 65% of rams on a foray and about 35% of ewes on a foray from S-16 are predicted to reach the distance away from their CHHR (3.13 miles; Table 19, above) that is equal to the distance to the allotment. This indicates a moderate risk for bighorns contacting the allotment. For S-71, about 30% of all adult bighorns on a foray are expected to reach this distance from their CHHR (10.71 miles). This indicates a low risk for bighorns contacting the allotment.
- Most of the northern two-thirds of the allotment is bighorn source habitat with large contiguous areas of interconnected habitat patches spanning long distances across ridges and alpine lake basins. Large portions of the western half of the allotment overlap with areas mapped by CPW as bighorn summer concentration area. This indicates a higher likelihood that contact would occur if domestic sheep and bighorn sheep were present in the allotment during the same season.
- Bighorn sheep are regularly observed in western, northern and eastern portions of the allotment during the summer grazing season, indicating a high likelihood for contact if domestic sheep are present.

Summary of Risk Rating for Fall Creek Allotment:

Risk Rating: Alternative 2 – High
 Alternative 3 – Low
 Alternative 4 – Low

Flint Creek Allotment (vacant sheep allotment):

Table 18. Risk of Contact Tool estimated total herd contact rates for the Flint Creek Allotment for individual bighorn sheep herds under each action alternative (Alternatives 2, 3 and 4).

Flint Creek Allotment	Annual Herd Contact Rates via Foray				1 Contact Per X Years
	S-16 Cimarrona Peak Herd	S-28 Vallecito Creek Herd	S-71 West Needles Herd	Total	
Alternative 2	0.738299	1.00	0.043067	1.781366	0.56
Alternative 3	Allotment Proposed Closed				N/A
Alternative 4	Allotment Proposed Closed				N/A

CHHR Intersects With Allotment
 Allotment Proposed Closed
 N/A: Too Far From Allotment
 CHHR = Bighorn Core Herd Home Range

Table 19. Acreage statistics for the Flint Creek Allotment for domestic sheep grazing range, bighorn sheep summer source habitat, and acres of overlap between domestic sheep and bighorn sheep grazing acres under each action alternative (Alternatives 2, 3 and 4).

Alternative	Distance from Bighorn Core Herd Home Range (CHHR)	Total Allotment Acres	Suitable Domestic Sheep Grazing Acres (% of Allotment)	Bighorn Summer Source Habitat Acres (% of Allotment)	Acres of Overlap Between Suitable Grazing Acres and Bighorn Source Habitat (% Overlap)
Alternative 2	Overlap – S-28 3.13 mi – S-16 10.71 mi – S-71	16,359	3,647 (22%)	8,884 (54%)	1,411 (39%)
Alternative 3	Allotment Proposed Closed				
Alternative 4	Allotment Proposed Closed				

The Flint Creek Allotment is located roughly in the middle of the Weminuche Landscape. The entire allotment is located within the Weminuche Wilderness. Much of the allotment overlaps with CHHR for the Vallecito Creek Herd S-28. Under current configuration (Alternative 2) there is about 9,008 acres of overlap with the S-28 CHHR, about 55 percent of the allotment. Within this overlap area, about 1,334 acres (15%) is suitable domestic sheep grazing range. Also within this overlap area, about 4,911 acres (54%) is bighorn summer source habitat. Bighorn sheep are regularly observed in western, northern and southeastern portions of the allotment during summer, and large portions of the western half of the allotment overlap with areas mapped by CPW as bighorn summer concentration area. Bighorns have been

documented in the area since at least the 1940s. There is consensus that within the past 20 years bighorn use areas have likely expanded slightly in the southeast portion of the allotment, upstream on the north side of the Pine River to just north of Flint Creek. The allotment was last grazed by domestic sheep in 1972.

Inspections cited in the 1969 management plan state that overgrazing in the northeast part of the allotment was a problem leading to erosion and a 50 acre area being closed. Additional exclusions in 1969 were 169 acres around Flint Lake and recreation horse allotments along middle and lower Flint Creek. The reason given for the erosion was lack of herder knowledge and failure to graze according to the prescribed system. In addition to the closures, the high areas in the Basin-Hole and Blue Lake-Bench sections were scheduled for light use. Domestic sheep grazing in the allotment began in 1928. The allotment was originally the Flint Creek and Flint Lakes allotment. Sometime between 1938 and 1943 the allotments were combined to form the present Flint Creek allotment. The last time this allotment was grazed was in 1972. The last grazing permit was a nonuse permit issued to the Southern Ute Sheep Association in 1974. The Association waived all grazing permits back to the San Juan National Forest in 1975.

Under current management the Flint Creek Allotment is considered a vacant domestic sheep allotment that could be restocked administratively at any time. Under Alternatives 3 and 4, the allotment is proposed to be closed to all domestic livestock grazing.

The Flint Creek allotment includes most of the Flint Creek drainage south from the Continental Divide to the Pine River, including Emerald Lake. Elevations on the allotment range between 9,200 and 13,000 feet. Much of the northern half of the allotment is above timberline with rocky basins and alpine lakes. Much of the southern half of the allotment is on steep slopes within the spruce-fir and mixed aspen-conifer forest zones.

Under current condition (Alternative 2) there is about 9,009 acres of overlap with the S-28 CHHR, about 55 percent of the allotment. Within this overlap area, about 1,334 acres (15%) is suitable domestic sheep grazing range. Also within this area of overlap, CPW has mapped 3,812 acres as bighorn summer concentration area, of which about 413 acres are classified as suitable domestic sheep range. Also within this area of overlap, CPW has mapped 2,906 acres as bighorn production area, of which 201 acres are classified as suitable domestic sheep range. Under Alternatives 3 and 4, the entire area of overlap with the S-28 CHHR, including the bighorn summer concentration and production areas within it, would be closed to domestic sheep grazing.

Under Alternative 2 the Flint Creek Allotment has 16,359 acres within the allotment, of which approximately 3,647 acres (22%) are suitable domestic sheep grazing range (Table 15, above). There is a relatively large amount of bighorn source habitat in the allotment, 8,884 acres or 54% of the allotment (Table 13, above). There is substantial overlap in the allotment between suitable domestic sheep range and bighorn summer source habitat, with 39% of suitable domestic sheep range (1,411 acres) also bighorn summer source habitat. Most of the northern two-thirds of the allotment is bighorn source habitat with large contiguous areas of interconnected habitat patches spanning long distances across alpine ridges and basins.

Total herd contact rates from the Risk of Contact Tool for the Flint Creek Allotment with each of the three herds in the Analysis area, under each of the three action alternatives, are shown above in Table 18. The allotment overlaps substantial portions of the CHHR for the Vallecito Herd S-28 and therefore a contact rate of 1.0 (contact predicted to occur at least once every

year) is assumed for this bighorn herd. The next closest bighorn herd to the allotment, Cimarrona Peak S-16, has an estimated total herd contact rate of 0.738 under current allotment configuration (Alternative 2). The West Needles Herd S-71 has a total herd contact rate of 0.043. These total herd contact rates equate to a predicted average of one contact with the allotment by an adult bighorn from the Cimarrona Peak Herd S-16 every 1.36 years the allotment is grazed under the current allotment configuration (Alternative 2). For the West Needles Herd S-71, the contact rate equates to one contact with the allotment every 23.26 years. Table 18 does not display total herd contact rates for Alternatives 3 or 4 because the allotment is proposed to be closed to domestic sheep grazing under both alternatives.

Using a moderate estimate of one out of four (25%) contacts resulting in a disease transmission event with potential for subsequent bighorn mortality event (USDA Forest Service 2010a), the bighorn contact rate under current management (Alternative 2) from the S-16 CHHR equates to a disease transmission with potential for subsequent bighorn mortality event once every 5.4 years. When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) the total herd contact rate for S-16 under Alternative 2 equates to a disease transmission event with potential for a subsequent bighorn mortality event once every 13.6 years. The total herd contact rates for West Needles Herd S-71 equates to a disease return interval of every 93 years with a 25% disease transmission probability, and return interval of 232.6 years with a 10% disease transmission probability.

As stated earlier, the Flint Creek Allotment directly overlaps a substantial portion of the Vallecito Creek Herd S-28 CHHR. The next nearest bighorn CHHR to the allotment is the Cimarrona Peak Herd S-16. The closest distance to the Cimarrona Peak Herd S-16 CHHR is 3.13 miles away at its closest point (Table 19, above). The Risk of Contact Tool assumes a distribution frequency that equates to less than about 65% of rams on a foray and about 35% of ewes on a foray predicted to reach this distance away from their CHHR (USDA Forest Service 2010c). The nearest distance to S-71, the West Needles Herd CHHR, is 10.71 miles away, with about 30% of all adult bighorns on a foray expected to reach this distance from their CHHR.

Based on the information presented above, a rank of **High Risk** was assigned to the Flint Creek Allotment under Alternative 2, but a rank of **Low Risk** was assigned under Alternatives 3 and 4. The reasons for assigning a rank of High Risk to the Flint Creek Allotment under Alternative 2 and rank of Low Risk under Alternatives 3 and 4 are:

- About 55% of the allotment directly overlaps the Vallecito Creek Herd S-28 bighorn CHHR under current configuration (Alternative 2). For this reason, it is assumed that under current allotment configuration multiple bighorn contacts with the allotment per year are possible, and thus there is high risk for physical contact with potential for disease transmission and subsequent bighorn mortality event within the S-28 CHHR.
- The allotment is proposed to be closed to domestic sheep grazing under Alternatives 3 and 4, and thus there is low risk for physical contact between the species under Alternatives 3 and 4.
- Under current condition (Alternative 2) total herd contact rate with S-28 from the Risk of Contact Tool is assumed to be at least one contact per year due to overlap with CHHR (Table 18, above). This is a very high rate of contact. For the Cimarrona Peak Herd S-16, the total herd contact rate is high (0.738, equating to one contact per 1.36 years) and thus risk of contact with S-16 is predicted to be high. For the West Needles

Herd S-71, the total herd contact rate is low (0.043, equating to one contact per 23.26 years) and thus risk of contact with S-71 is predicted to be low.

- There is moderate separation from S-16 and S-71 in terms of distance (3.13 and 10.71 miles, respectively; Table 19 above). However, there is strong connectivity with S-16 in terms of source habitat for dispersal of bighorns from S-16 to the allotment.
- A relatively high amount (about 39%) of suitable domestic sheep grazing range overlaps with bighorn source habitat in the allotment under current configuration (Alternative 2; Table 19, above). This indicates higher likelihood that foraging bighorns reaching the allotment might find and contact domestic sheep on suitable range.
- About 65% of rams on a foray and about 35% of ewes on a foray from S-16 are predicted to reach the distance away from their CHHR (3.13 miles; Table 19, above) that is equal to the distance to the allotment. This indicates a moderate risk for bighorns contacting the allotment. For S-71, about 30% of all adult bighorns on a foray are expected to reach this distance from their CHHR (10.71 miles). This indicates a low risk for bighorns contacting the allotment.
- Most of the northern two-thirds of the allotment is bighorn source habitat with large contiguous areas of interconnected habitat patches spanning long distances across ridges and alpine lake basins. Large portions of the western half of the allotment overlap with areas mapped by CPW as bighorn summer concentration area. This indicates a high likelihood that contact could occur if domestic sheep and bighorn sheep were present in the allotment during the same season.
- Bighorn sheep are regularly observed in western, northern and eastern portions of the allotment during the summer grazing season, indicating a high likelihood for contact if domestic sheep were present in the allotment during summer.

Summary of Risk Rating for Flint Creek Allotment:

Risk Rating: Alternative 2 – High
 Alternative 3 – Low
 Alternative 4 – Low

Johnson Creek Allotment (vacant sheep allotment):

Table 20. Risk of Contact Tool estimated total herd contact rates for the Johnson Creek Allotment for individual bighorn sheep herds under each action alternative (Alternatives 2, 3 and 4.

Johnson Creek Allotment	Annual Herd Contact Rates via Foray				1 Contact Per X Years
	S-16 Cimarrona Peak Herd	S-28 Vallecito Creek Herd	S-71 West Needles Herd	Total	
Alternative 2	0.131696	0.694557	0.113023	0.939275	1.06
Alternative 3	0.110477	0.584137	0.111931	0.806545	1.24
Alternative 4	Allotment Proposed Closed				N/A

CHHR Intersects With Allotment
 Allotment Proposed Closed
 N/A: Too Far From Allotment
 CHHR = Bighorn Core Herd Home Range

Table 21. Acreage statistics for the Johnson Creek Allotment for domestic sheep grazing range, bighorn sheep summer source habitat, and acres of overlap between domestic sheep and bighorn sheep grazing acres under each action alternative (Alternatives 2, 3 and 4).

Alternative	Distance from Bighorn Core Herd Home Range (CHHR)	Total Allotment Acres	Suitable Domestic Sheep Grazing Acres (% of Allotment)	Bighorn Summer Source Habitat Acres (% of Allotment)	Acres of Overlap Between Suitable Grazing Acres and Bighorn Source Habitat (% Overlap)
Alternative 2	0.10 mi – S-28 3.38 mi – S-71 10.26 mi – S-16	9,428	1,067 (11%)	7,206 (76%)	551 (52%)
Alternative 3	0.39 mi – S-28 3.38 mi – S-71 10.27 mi – S-16	7,775	929 (12%)	7,190 (92%)	445 (48%)
Alternative 4	Allotment Proposed Closed				

The Johnson Creek Allotment is located in the north-central portion of the Weminuche Landscape. It is located entirely on the west side of the Vallecito Creek drainage. The entire allotment is located within the Weminuche Wilderness. There is no direct overlap with bighorn CHHR for any of the bighorn herds in the analysis area. Although there is no direct overlap of the allotment with bighorn CHHR under current configuration (Alternative 2), the allotment is immediately adjacent to the Vallecito Creek Herd S-28 CHHR.

Under current management (Alternative 2) the Johnson Creek Allotment is considered a vacant domestic sheep allotment that could be restocked administratively at any time. Under Alternative 3, it is proposed that approximately the southeastern quarter of the allotment (1,653 acres, 18% of the allotment) would be added to the Fall Creek Allotment and permanently closed to livestock grazing. The remaining three quarters of the allotment (7,775 acres, 82% of the allotment) are proposed to be combined with the Leviathan Allotment and about two thirds of the Rock Creek Allotment to form a single domestic sheep forage reserve allotment. This would allow domestic sheep grazing for a maximum of three out of any ten consecutive years. Under Alternative 4 the allotment would be permanently closed to all livestock grazing.

Bighorn sheep have not been reported within the allotment during the summer grazing season and no reports of have been received of bighorn observations along the portion of the Vallecito Creek Trail that is within or near the allotment, or along the Johnson Creek Trail. Data for the Johnson Creek allotment is absent until 1962, when it was grazed in conjunction with the East Silver Mesa and Virginia Gulch Allotments. Domestic sheep were almost certainly grazed in what is now the Johnson Creek Allotment beginning in the early 1900's. The last year of domestic sheep grazing was 1968. A color-coded vegetation map from 1962 showed approximately 20-25% of the Johnson Creek Allotment was grassland in fair condition, and an additional 10% was conifer with forage in excellent condition. The remainder of the allotment was considered "rock".

The Johnson Creek allotment includes all of the drainages of Grizzly Gulch and Johnson Creek and a portion of Vallecito Creek. Elevations on the allotment range between 9,000 and

over 14,000 feet on Windom Peak. Much of the allotment is on steep slopes that form the west side of the Vallecito Creek drainage and sides of the Johnson Creek drainage, with many long open avalanche chutes commonly bisecting the landscape from top to bottom of the slopes. Much of the allotment, especially on the west and north ends, is above timberline in the alpine zone, but the lower slopes are mostly in spruce-fir and mixed aspen-conifer forests.

Under current configuration (Alternative 2) the Johnson Creek Allotment has 9,428 acres within the allotment, of which approximately 1,067 acres (11%) are suitable domestic sheep grazing range (Table 21, above). There is a relatively large amount of bighorn source habitat in the allotment, 7,206 acres or 76% of the allotment. There is substantial overlap in the allotment between suitable domestic sheep range and bighorn summer source habitat, with 52% of suitable domestic sheep range (551 acres) also bighorn summer source habitat. Much of the western, northern and southern portions of the allotment are bighorn source habitat, especially near the heads of drainages and in the many avalanche chutes that bisect the allotment. There are some large contiguous patches of bighorn source habitat along the western boundary of the allotment.

Total herd contact rates from the Risk of Contact Tool for the Johnson Creek Allotment with each of the three herds in the Analysis area, under each of the three action alternatives, are shown above in Table 20. The estimated total herd contact rate with the Vallecito Creek Herd S-28 is 0.695 under current allotment configuration (Alternative 2). The next closest bighorn herd to the allotment, West Needles Herd S-71, has an estimated total herd contact rate of 0.113. The Cimarrona Peak Herd S-16 has a total herd contact rate of 0.132. These total herd contact rates equate to a predicted average of one contact with the allotment by an adult bighorn from the Vallecito Creek Herd S-28 every 1.44 years the allotment is grazed under the current allotment configuration (Alternative 2). For the West Needles Herd S-71 and the Cimarrona Peak Herd S-16, the contact rates equate to one contact with the allotment every 8.85 and 7.58 years, respectively. Under Alternative 3, boundary adjustments would result in total herd contact rates for bighorns from S-28, S-71 and S-16 CHHR's of 0.584, 0.112 and 0.11, respectively. These total herd contact rates equate to one contact with the allotment every 1.71, 8.93 and 9.09 years, respectively. Table 20, above, does not display total herd contact rates for Alternative 4 because the allotment is proposed to be closed to domestic sheep grazing under Alternative 4.

Using a moderate estimate of one out of four (25%) contacts resulting in a disease transmission event with potential for subsequent bighorn mortality event (USDA Forest Service 2010a), the bighorn contact rate under current management (Alternative 2) from the S-28 CHHR equates to a disease transmission with potential for subsequent bighorn mortality event once every 5.8 years (Table 20, above). When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) the total herd contact rate for S-28 under Alternative 2 equates to a disease transmission event with potential for a subsequent bighorn mortality event once every 14.4 years. The total herd contact rates for the West Needles Herd S-71 equates to a disease return interval of every 35.4 years with a 25% disease transmission probability, and return interval of 85.5 years with a 10% disease transmission probability. The total herd contact rates for the Cimarrona Peak Herd S-16 equates to a disease return interval of every 30.3 years with a 25% disease transmission probability, and return interval of 75.8 years with a 10% disease transmission probability.

Under the allotment configuration proposed in Alternative 3, a moderate estimate of one out of four (25%) contacts (USDA Forest Service 2010a) and a total herd contact rate of 0.584 for the S-28 bighorn herd results in a disease transmission event with potential for subsequent bighorn mortality event once every 6.8 years (Table 20, above). When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) the total herd contact rate for S-28 under Alternative 3 equates to a disease transmission event with potential for a subsequent bighorn mortality event once every 17.1 years. The total herd contact rate for the West Needles Herd S-71 (0.112) equates to a disease return interval of every 35.7 years with a 25% disease transmission probability, and return interval of 89.3 years with a 10% disease transmission probability. The total herd contact rates for the Cimarrona Peak Herd S-16 (0.11) equates to a disease return interval of every 36.4 years with a 25% disease transmission probability, and return interval of 90.9 years with a 10% disease transmission probability.

When comparing total herd contact rates for the Johnson Creek Allotment for all bighorn herds combined, under Alternative 2 there is predicted to be one bighorn contact with the allotment every 1.06 years (Table 20, above). Using a moderate estimate of one out of four (25%) contacts (USDA Forest Service 2010a) results in a disease transmission event with potential for subsequent bighorn mortality event once every 4.2 years. When the probability of contact resulting in disease transmission is assumed to be low (one out of 10, or 10%) the total herd contact rate for all bighorn herds combined under Alternative 2 equates to a predicted disease transmission event once every 10.6 years. Under the allotment boundary configuration proposed for Alternative 3 there is predicted to be one bighorn contact with the allotment every 1.24 years. The total herd contact rate for all bighorn herds combined under Alternative 3 equates to a disease transmission interval of every 5 years with a 25% disease transmission probability. With a 10% disease transmission probability, there is a predicted disease transmission interval of every 12.4 years. Therefore the boundary adjustment made under Alternative 3 results in a slight (about 15%) reduction in the predicted rate of contact with the allotment. However, under the boundary configuration proposed in Alternative 3 the potential disease transmission interval remains high (every 12 years) even when the presumed rate of disease transmission is low (10%).

The closest distance from the Johnson Creek Allotment to the Vallecito Creek Herd S-28 CHHR, under current configuration (Alternative 2), is 0.1 miles away at its closest point (Table 21, above). The Risk of Contact Tool assumes a distribution frequency that equates to nearly all adult bighorn sheep on a foray are predicted to reach this distance away from their CHHR (USDA Forest Service 2010c). The next nearest bighorn CHHR to the allotment is the West Needles Herd S-71, which is 3.38 miles away at its closest point under current allotment configuration. This equates to about 60% of rams and 35% of ewes on a foray are expected to reach this distance away from their CHHR. The nearest distance to S-16, the Cimarrona Peak Herd CHHR, is 10.26 miles away. This equates to less than 20% of rams and 15% of ewes on a foray are expected to reach this distance away from their CHHR.

Due to adjustments made in the allotment boundary under Alternative 3, the shortest distance from the allotment to all three bighorn herds was slightly increased under Alternative 3, compared to Alternative 2 (see Table 21, above). Because of the slight increase in distance, especially to S-28 CHHR, there was also a slight decrease in the percentage of adult bighorns that would be expected to reach the allotment while on a foray. For S-28, S71 and S-16, the distance to each bighorn CHHR was 0.39, 3.38 and 10.27 miles, respectively.

Based on the information presented above, a rank of **High Risk** was assigned to the Johnson Creek Allotment under Alternatives 2 and 3, but a rank of **Low Risk** was assigned under Alternative 4. The reasons for assigning a rank of High Risk to the Johnson Creek Allotment under Alternatives 2 and 3 and rank of Low Risk under Alternative 4 are:

- Although there is no direct overlap of the allotment with the Vallecito Creek Herd S-28 CHHR under current configuration (Alternative 2), the allotment is immediately adjacent to the CHHR. For the reason of immediate proximity to the S-28 CHHR under Alternative 2 and very close proximity under Alternative 3, it is concluded that under both allotment boundary configurations there is high risk for physical contact, with potential for disease transmission and subsequent bighorn mortality event, with bighorns from the S-28 CHHR.
- The allotment is proposed to be closed to domestic sheep grazing under Alternative 4, and thus there is low risk for physical contact between the species under Alternative 4.
- Under current configuration (Alternative 2), the total herd contact rate from the Risk of Contact Tool with the Vallecito Creek Herd S-28 is high (0.695, equating to one contact every 1.4 years) and thus risk of contact with S-16 is predicted to be high (Table 20, above). For the West Needles Herd S-71, the total herd contact rate is moderate (0.113, equating to one contact per 8.85 years) and thus risk of contact with S-71 is predicted to be moderate. For the Cimarrona Peak Herd S-16, the total herd contact rate is moderate (0.132, equating to one contact per 7.58 years) and thus risk of contact with S-16 is predicted to be moderate.
- Under Alternative 3, the total herd contacts rates from the Risk of Contact Tool decrease slightly for all three bighorn herds, compared to Alternative 2, especially for the S-28 bighorn herd. Despite slight decrease in total herd contact rates, the potential for contact between bighorns from the S-28 CHHR and the allotment remains high risk. The risk remains moderate for S-71 and S-16 under the allotment boundary configuration proposed for Alternative 3.
- The boundary adjustment made under Alternative 3 for the forage reserve allotment results in a slight (about 15%) reduction in the predicted rate of contact with the allotment for all bighorn herds combined. However, under the boundary configuration proposed under Alternative 3 the potential disease transmission interval remains high (every 12 years) even when the presumed rate of disease transmission is low (10%).
- Moderate separation from S-16 and S-71 in terms of distance (3.38 and 10.26 miles, respectively; Table 21 above). However, there is strong connectivity with S-16 in terms of source habitat for dispersal of bighorns from S-16 to the allotment.
- A relatively high amount (about 52%) of suitable domestic sheep grazing range overlaps with bighorn source habitat in the allotment under current configuration (Alternative 2; Table 21, above). This indicates higher likelihood that foraging bighorns reaching the allotment might find and contact domestic sheep on suitable range. Under the boundary configuration proposed in Alternative 3, the rate of overlap with domestic sheep range is slightly reduced (48%).
- Under current configuration (Alternative 2), nearly all adult bighorn sheep on a foray are predicted to reach the distance away from their CHHR that is equal to the distance from S-28 to the allotment (0.1 miles; Table 21, above). About 60% of rams on a foray and about 35% of ewes on a foray from S-71 are predicted to reach the distance away from their CHHR that is equal to the distance to the allotment (3.38 miles). This indicates a moderate risk for bighorns contacting the allotment. For S-16, about 20%

of rams and 15% of ewes on a foray are expected to reach this distance from their CHHR (10.26 miles). This indicates a low risk for bighorns contacting the allotment.

- Much of the western, northern and southern portions of the allotment are bighorn source habitat, especially near the heads of drainages and in the many avalanche chutes that bisect the allotment. There are some large contiguous patches of bighorn source habitat along the western boundary of the allotment. This indicates a higher likelihood that contact would occur if domestic sheep and bighorn sheep were present in the allotment during the same season.
- Bighorn sheep have not been reported within the allotment during the summer grazing season and no reports of bighorn observations along the Vallecito Creek or Johnson Creek trails have been received.
- Project design criteria applied under Alternative 3 (Appendix 1, EA Table 2-3, below), when fully and completely implemented, are expected to enhance the effectiveness of separation between the species, although the amount of improvement in effectiveness is not known with certainty.

Summary of Risk Rating for Johnson Creek Allotment:

Risk Rating: Alternative 2 – High
 Alternative 3 – High
 Alternative 4 – Low

Leviathan Allotment (vacant sheep allotment):

Table 22. Risk of Contact Tool estimated total herd contact rates for the Leviathan Allotment for individual bighorn sheep herds under each action alternative (Alternatives 2, 3 and 4).

Leviathan Allotment	Annual Herd Contact Rates via Foray				1 Contact Per X Years
	S-16 Cimarrona Peak Herd	S-28 Vallecito Creek Herd	S-71 West Needles Herd	Total	
Alternative 2	0.117073	0.484716	0.112247	0.714035	1.40
Alternative 3	0.116830	0.484493	0.112832	0.714155	1.40
Alternative 4	Allotment Proposed Closed				N/A

CHHR Intersects With Allotment
 Allotment Proposed Closed
 N/A: Too Far From Allotment
 CHHR = Bighorn Core Herd Home Range

Table 23. Acreage statistics for the Leviathan Allotment for domestic sheep grazing range, bighorn sheep summer source habitat, and acres of overlap between domestic sheep and bighorn sheep grazing acres under each action alternative (Alternatives 2, 3 and 4).

Alternative	Distance from Bighorn Core Herd Home Range (CHHR)	Total Allotment Acres	Suitable Domestic Sheep Grazing Acres (% of Allotment)	Bighorn Summer Source Habitat Acres (% of Allotment)	Acres of Overlap Between Suitable Grazing Acres and Bighorn Source Habitat (% Overlap)
Alternative 2	0.89 mi – S-28 3.73 mi – S-71 9.94 mi – S-16	6,530	824 (13%)	5,307 (81%)	243 (29%)
Alternative 3	Same Distance	6,530	824 (13%)	5,307 (81%)	243 (29%)
Alternative 4	Allotment Proposed Closed				

The Leviathan Allotment is located in the north-central portion of the Weminuche Landscape. It is located entirely on the west side of the Vallecito Creek drainage. The entire allotment is located within the Weminuche Wilderness. There is no direct overlap with bighorn CHHR for any of the bighorn herds in the analysis area. Although there is no direct overlap of the allotment with bighorn CHHR under current configuration (Alternative 2), the allotment is in close proximity to the Vallecito Creek Herd S-28 CHHR.

Under current management (Alternative 2) the Leviathan Allotment is considered a vacant domestic sheep allotment that could be restocked administratively at any time. Under Alternative 3, it is proposed to be combined with portions of the Johnson Creek Allotment and about two thirds of the Rock Creek Allotment to form a single domestic sheep forage reserve allotment. This would allow domestic sheep grazing for a maximum of three out of any ten consecutive years. Under Alternative 4 the allotment would be permanently closed to all livestock grazing. The boundary of the Leviathan Allotment would not change between any alternative.

Bighorn sheep have not been reported within the allotment during the summer grazing season and no reports of have been received of bighorn observations along the portion of the Vallecito Creek Trail that is within or near the allotment. In the early to mid-1900's, the Leviathan Allotment was grazed together with the Rock Creek Allotment. The two allotments were separated into their current boundaries in 1932. Domestic sheep were almost certainly grazed in what is now the Leviathan Allotment beginning in the early 1900's. The allotment was grazed annually through 1966, was vacant from 1967 through 1969, then grazed for the last time in 1970. Transects done in 1960 indicated that the major part of the allotment was in poor condition due to heavy use. The same report stated the allotment was being used in excess of 200% capacity. A file letter dated in 1974 stated that reasons the allotment was not being used included the importance of recreation use in the area, the limited amount of usable range and its fragile condition, as well as the difficulty in accessing the area due to its long stock driveway.

The Leviathan Allotment includes all of the drainages of Leviathan and Sunlight Creeks from their headwaters to their confluence with Vallecito Creek, and a portion of Vallecito Creek. Elevations on the allotment range between 9,500 and 14,000 feet on Sunlight Peak. Much of

the allotment is on steep slopes that form the west side of the Vallecito Creek drainage and sides of the Leviathan and Sunlight Creek drainages, with many long open avalanche chutes bisecting the landscape from top to bottom of the slopes. Much of the allotment, especially on the west and north ends, is above timberline in the alpine zone, but the lower slopes are mostly in spruce-fir forests.

Under current configuration (Alternative 2) the Leviathan Allotment has 6,530 acres within the allotment, of which approximately 824 acres (13%) are suitable domestic sheep grazing range (Table 23, above). There is a relatively large amount of bighorn source habitat in the allotment, 5,307 acres or 81% of the allotment. There is substantial overlap in the allotment between suitable domestic sheep range and bighorn summer source habitat, with 29% of suitable domestic sheep range (243 acres) also bighorn summer source habitat. Most of the western, northern and southern portions of the allotment are bighorn source habitat, especially near the heads of drainages and in the many avalanche chutes that bisect the allotment. Most of the allotment is dominated by large contiguous patches of bighorn source habitat.

Total herd contact rates from the Risk of Contact Tool for the Leviathan Allotment with each of the three herds in the Analysis area, under each of the three action alternatives, are shown above in Table 22. The estimated total herd contact rate with the Vallecito Creek Herd S-28 is 0.484 under current allotment configuration (Alternative 2). The next closest bighorn herd to the allotment, West Needles Herd S-71, has an estimated total herd contact rate of 0.112. The Cimarrona Peak Herd S-16 has a total herd contact rate of 0.117. These total herd contact rates equate to a predicted average of one contact with the allotment by an adult bighorn from the Vallecito Creek Herd S-28 every 2.07 years the allotment is grazed under the current allotment configuration (Alternative 2). For the West Needles Herd S-71 and the Cimarrona Peak Herd S-16, the contact rates equate to one contact with the allotment every 8.93 and 8.55 years, respectively. The allotment boundary would not change under Alternative 3, and therefore the predicted rates of contact from the Risk of Contact Tool also do not change between Alternatives 2 and 3. Table 22, above, does not display total herd contact rates for Alternative 4 because the allotment is proposed to be closed to domestic sheep grazing under Alternative 4.

Using a moderate estimate of one out of four (25%) contacts resulting in a disease transmission event with potential for subsequent bighorn mortality event (USDA Forest Service 2010a), the bighorn contact rate under current management (Alternative 2) from the S-28 CHHR equates to a disease transmission with potential for subsequent bighorn mortality event once every 8.3 years (Table 22, above). When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) the total herd contact rate for S-28 under Alternative 2 equates to a disease transmission event with potential for a subsequent bighorn mortality event once every 20.7 years. The total herd contact rates for the West Needles Herd S-71 equates to a disease return interval of every 35.7 years with a 25% disease transmission probability, and return interval of 89.3 years with a 10% disease transmission probability. The total herd contact rates for the Cimarrona Peak Herd S-16 equates to a disease return interval of every 35.2 years with a 25% disease transmission probability, and return interval of 85.5 years with a 10% disease transmission probability. Because the allotment boundary would not change from Alternative 2 to Alternative 3, the estimated total herd contact probabilities also would not change between Alternatives 2 and 3.

When comparing total herd contact rates for the Leviathan Allotment for all bighorn herds combined, under Alternative 2 there is predicted to be one bighorn contact with the allotment every 1.4 years (Table 22, above). Using a moderate estimate of one out of four (25%) contacts (USDA Forest Service 2010a) results in a disease transmission event with potential for subsequent bighorn mortality event once every 5.6 years. When the probability of contact resulting in disease transmission is assumed to be low (one out of 10, or 10%) the total herd contact rate for all bighorn herds combined under Alternative 2 equates to a predicted disease transmission event once every 14.0 years. Because the allotment boundary would not change from Alternative 2 to Alternative 3, the estimated disease transmission interval for all bighorn herds combined also would not change between Alternatives 2 and 3. For this reason, the potential disease transmission interval for the allotment would be high (every 14 years) even when the presumed rate of disease transmission is low (10%).

The closest distance from the Leviathan Allotment to the Vallecito Creek Herd S-28 CHHR, under current configuration (Alternative 2), is 0.89 miles away at its closest point (Table 23, above). The Risk of Contact Tool assumes a distribution frequency that equates to nearly all adult bighorn sheep on a foray are predicted to reach this distance away from their CHHR (USDA Forest Service 2010c). The next nearest bighorn CHHR to the allotment is the West Needles Herd S-71, which is 3.73 miles away at its closest point under current allotment configuration. This equates to about 55% of rams and 20% of ewes on a foray are expected to reach this distance away from their CHHR. The nearest distance to S-16, the Cimarrona Peak Herd CHHR, is 9.94 miles away. This equates to less than 20% of rams and 15% of ewes on a foray are expected to reach this distance away from their CHHR. Because the allotment boundary would not change from Alternative 2 to Alternative 3, the minimum distance between the allotment and bighorn CHHR's also would not change between Alternatives 2 and 3.

Based on the information presented above, a rank of **High Risk** was assigned to the Leviathan Allotment under Alternatives 2 and 3, but a rank of **Low Risk** was assigned under Alternatives 4. The reasons for assigning a rank of High Risk to the Leviathan Allotment under Alternatives 2 and 3 and rank of Low Risk under Alternative 4 are:

- Although there is no direct overlap of the allotment with the Vallecito Creek Herd S-28 CHHR under current configuration (Alternative 2), the allotment is in close proximity to the CHHR. For the reason of close proximity to the S-28 CHHR under Alternatives 2 and 3, it is concluded that there is high risk for physical contact, with potential for disease transmission and subsequent bighorn mortality event, with bighorns from the S-28 CHHR.
- The allotment is proposed to be closed to domestic sheep grazing under Alternative 4, and thus there is low risk for physical contact between the species under Alternative 4.
- Under current configuration (Alternative 2) and Alternative 3, the total herd contact rate from the Risk of Contact Tool with the Vallecito Creek Herd S-28 is high (0.484, equating to one contact every 2.1 years) and thus risk of contact with S-16 is predicted to be high (Table 22, above). For the West Needles Herd S-71, the total herd contact rate is moderate (0.112, equating to one contact per 8.9 years) and thus risk of contact with S-71 is predicted to be moderate. For the Cimarrona Peak Herd S-16, the total herd contact rate is moderate (0.117, equating to one contact per 8.6 years) and thus risk of contact with S-16 is predicted to be moderate.

- Under the current configuration (Alternative 2) and Alternative 3, the predicted rate of contact with the allotment for all bighorn herds combined is high (every 1.4 years) and results in a predicted high disease transmission interval (one every 14 years) even when the presumed rate of disease transmission is low (10%).
- Moderate separation from S-16 and S-71 in terms of distance (3.73 and 9.94 miles, respectively; Table 23 above). However, there is strong connectivity with S-16 in terms of source habitat for dispersal of bighorns from S-16 to the allotment.
- A relatively high amount (about 29%) of suitable domestic sheep grazing range overlaps with bighorn source habitat in the allotment under current configuration (Alternative 2; Table 23, above). There is also a much larger amount of the allotment that is bighorn source habitat (81%), compared to suitable domestic sheep range (13%). This indicates higher likelihood that foraging bighorns reaching the allotment might find and contact domestic sheep on suitable range.
- Under current configuration (Alternative 2), nearly all adult bighorn sheep on a foray are predicted to reach the distance away from their CHHR that is equal to the distance from S-28 to the allotment (0.1 miles; Table 21, above). About 55% of rams on a foray and about 20% of ewes on a foray from S-71 are predicted to reach the distance away from their CHHR that is equal to the distance to the allotment (3.73 miles). This indicates a moderate risk for bighorns from S-71 contacting the allotment. For S-16, about 20% of rams and 15% of ewes on a foray are expected to reach this distance from their CHHR (9.94 miles). This indicates a low risk for bighorns from S-16 contacting the allotment.
- Much of the western, northern and southern portions of the allotment are bighorn source habitat, especially near the heads of drainages and in the many avalanche chutes that bisect the allotment. There are large contiguous patches of bighorn source habitat in the allotment. This indicates a higher likelihood that contact would occur if domestic sheep and bighorn sheep were present in the allotment during the same season.
- Bighorn sheep have not been reported within the allotment during the summer grazing season and no reports have been received of bighorn observations along the Vallecito Creek Trail in or near the allotment.
- Project design criteria applied under Alternatives 3 and 4 (Appendix 1, EA Table 2-3, below), when fully and completely implemented, are expected to enhance the effectiveness of separation between the species, although the amount of improvement in effectiveness is not known with certainty.

Summary of Risk Rating for Leviathan Allotment:

Risk Rating: Alternative 2 – High
Alternative 3 – High
Alternative 4 – Low

Pine River Allotment (vacant sheep allotment):

Table 24. Risk of Contact Tool estimated total herd contact rates for the Pine River Allotment for individual bighorn sheep herds under each action alternative (Alternatives 2, 3 and 4).

Pine River Allotment	Annual Herd Contact Rates via Foray				1 Contact Per X Years
	S-16 Cimarrona Peak Herd	S-28 Vallecito Creek Herd	S-71 West Needles Herd	Total	
Alternative 2	1.00	1.00	0.034590	2.034590	0.49
Alternative 3	Allotment Proposed Closed				N/A
Alternative 4	Allotment Proposed Closed				N/A

CHHR Intersects With Allotment
 Allotment Proposed Closed
 N/A: Too Far From Allotment
 CHHR = Bighorn Core Herd Home Range

Table 25. Acreage statistics for the Pine River Allotment for domestic sheep grazing range, bighorn sheep summer source habitat, and acres of overlap between domestic sheep and bighorn sheep grazing acres under each action alternative (Alternatives 2, 3 and 4).

Alternative	Distance from Bighorn Core Herd Home Range (CHHR)	Total Allotment Acres	Suitable Domestic Sheep Grazing Acres (% of Allotment)	Bighorn Summer Source Habitat Acres (% of Allotment)	Acres of Overlap Between Suitable Grazing Acres and Bighorn Source Habitat (% Overlap)
Alternative 2	Overlap – S-28 Overlap – S-16 12.93 mi – S-71	38,843	14,512 (37%)	15,105 (39%)	4,361(30%)
Alternative 3	Allotment Proposed Closed				
Alternative 4	Allotment Proposed Closed				

The Pine River Allotment is located on east side of the Weminuche Landscape. It is located at the headwaters of the Pine River drainage. The entire allotment is located within the Weminuche Wilderness. This is one of the oldest domestic sheep allotments on the Columbine Ranger District, and is also the largest sheep allotment on the District. The Pine River Allotment directly overlaps with CHHR for the Vallecito Creek Herd S-28 and CHHR for the Cimarrona Peak Herd S-16. Under current configuration (Alternative 2) there is about 10,104 acres of overlap with the S-28 CHHR, about 26 percent of the allotment. This area of overlap is in southern portions of the allotment. Within this overlap area, about 1,489 acres (15%) is suitable domestic sheep grazing range. Also within this overlap area, about 3,107 acres (31%) is bighorn summer source habitat. Within this area of overlap, smaller areas are also mapped by CPW as bighorn summer concentration area and production area. Bighorn sheep are known to use all these portions of the allotment during spring, summer and fall, and for lambing. Bighorns have been documented in the area since at least the 1940s and continue to be documented in this area every summer. There is an additional 4,080 acres of

overlap with the S-16 CHHR in the northeast portion of the allotment. The area of overlap is about 11% of the allotment. Bighorns are also known to use this area of overlap in the allotment.

The Pine River Allotment includes most of the Pine River drainage, and all of Rincon La Osa, North Fork, Rincon La Vaca, Canon Paso, South Canyon, Pope Creek, Sierra Vandera, Blue Spruce Canyon, and Lost Canyon drainages. Elevations on the allotment range between 8,500 and 13,600 feet. Much of the higher elevations of the allotment, especially in northwest portions of the allotment are above timberline with wide alpine basins and hillsides. At slightly lower elevations, spruce-fir forests dominate steep hillsides, and aspen and mixed aspen-conifer forests dominate lower elevations. Within the past five to eight years, spruce beetle mortality has increased rapidly in the headwaters of the Pine River drainage with some areas experiencing mortality of overstory mature trees in excess of 80%. The spruce beetle outbreak is continuing to rapidly expand to the south and west.

Domestic sheep grazing in what is now the Pine River Allotment probably began in the late 1800's. This allotment is made up of several old allotments that changed names and boundaries multiple times. In 1978 the La Osa, Snowslide-La Vaca, and Divide Paso allotments were combined to form the current Pine River allotment. This was done to enable a portion of the area to be rested every year, in order to accommodate increasing recreation demands. The 1978 memo states that if available forage were the only consideration, this allotment had the capacity to graze twice the number of sheep actually authorized. Heavy recreation use was the limiting factor. The Divide-Paso Allotment made up the bulk of the combined Pine River allotment. It went from just north of Blue Spruce Canyon to just north of Canyon Paso. Historical use (since 1949) for the Divide-Paso area was by the Southern Ute Sheep Association. The last record for this permittee in this area was in 1974, with the permit in nonuse. The Southern Ute Sheep Association was also the last permittee for the Snowslide - La Vaca area, with the last year of grazing in 1974. The earliest record for this portion of the allotment was for the SUSA in 1949. The La Osa portion of the Allotment is one of the oldest sheep allotments on the Columbine Ranger District, and grazing use pre-dates the creation of the National Forest by several years. Beginning in the 1930's, seasons were shortened and numbers of sheep were gradually reduced, through 1951, when the use stabilized and remained the same until consolidation into the Pine River Allotment in 1978. The main reason indicated for these reductions was conflict with recreation use of this area. The La Osa portion of the allotment was used annually at capacity from 1949 through to 1971, was vacant 1972 through 1973, vacant again from 1981 through 1983, and no grazing permit has been issued for the area since then.

Under current management (Alternative 2) the Pine River Allotment is considered a vacant domestic sheep allotment that could be restocked administratively at any time. Under Alternatives 3 and 4 the allotment is proposed to be permanently closed to domestic sheep grazing.

Under current condition (Alternative 2) there is about 10,104 acres of overlap with the S-28 CHHR (26 percent of the allotment), and 4,079 acres of overlap with the S-16 CHHR (11% of the allotment). Within the area of overlap with S-28, about 1,489 acres (15%) is suitable domestic sheep grazing range. Also within the area of overlap with S-28, CPW has mapped 4,920 acres as bighorn summer concentration area, of which about 119 acres are classified as suitable domestic sheep range. Also within the area of overlap with S-28, CPW has mapped 742 acres as bighorn production area, of which 147 acres are classified as suitable domestic sheep range. Within the area of overlap with S-16, about 1,744 acres (43%) is

suitable domestic sheep grazing range. Under Alternatives 3 and 4, the entire area of overlap with the S-28 and S-16 CHHR's, including the bighorn summer concentration and production areas within S-28, would be closed to domestic sheep grazing.

Under current configuration (Alternative 2) the Pine River Allotment has 38,843 acres within the allotment, of which approximately 14,512 acres (37%) are suitable domestic sheep grazing range (Table 25, above). There is a relatively large amount of bighorn source habitat in the allotment, 15,105 acres or 39% of the allotment. There is substantial overlap in the allotment between suitable domestic sheep range and bighorn summer source habitat, with 30% of suitable domestic sheep range (4,361 acres) also bighorn summer source habitat. Much of the northern, central and southern portions of the allotment are bighorn source habitat, especially near the heads of drainages and along ridge crests such as the Continental Divide. There are large contiguous patches of bighorn source habitat throughout the allotment.

Total herd contact rates from the Risk of Contact Tool for the Pine River Allotment with each of the three herds in the Analysis area, under each of the three action alternatives, are shown above in Table 24. There is substantial overlap between the allotment and portions of the CHHR for the Vallecito Herd S-28 and therefore a total herd contact rate of 1.0 (contact predicted to occur at least once every year) is assumed for this bighorn herd. There is also a smaller area of overlap in the northwest portion of the allotment with the CHHR for the Cimarrona Peak Herd S-16. Therefore the total herd contact rate of for S-16 is also 1.0 (contact predicted to occur at least once every year). The West Needles Herd S-71 has an estimated total herd contact rate of 0.035. For the West Needles Herd S-71, the total herd contact rate equate to one contact with the allotment every 28.57 years. Table 24, above, does not display total herd contact rates for Alternatives 3 and 4 because the allotment is proposed to be closed to domestic sheep grazing under Alternatives 3 and 4.

Using a moderate estimate of one out of four (25%) contacts resulting in a disease transmission event with potential for subsequent bighorn mortality event (USDA Forest Service 2010a), the bighorn contact rate under current management (Alternative 2) from the S-28 CHHR equates to a disease transmission with potential for subsequent bighorn mortality event at least once every 4.0 years (Table 24, above). The predicted disease transmission interval for S-16 is also at least once every 4.0 years. The disease transmission interval for these two herds could be more frequent under Alternative 2 because overlap exists with their CHHR's and there could be multiple contacts per year. When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) the total herd contact rate for S-28 and S-16 equates to a disease transmission event with potential for a subsequent bighorn mortality event at least once every 10 years. The total herd contact rates for the West Needles Herd S-71 equates to a disease transmission interval of every 114.3 years with a 25% disease transmission probability, and return interval of 285.7 years with a 10% disease transmission probability. The total herd contact rates for the Cimarrona Peak Herd S-16 equates to a disease return interval of every 23.1 years with a 25% disease transmission probability, and return interval of 57.8 years with a 10% disease transmission probability.

The total herd contact rate for the Pine River Allotment for all bighorn herds combined is predicted to be one bighorn contact with the allotment every 0.49 years (Table 24, above). Using a moderate estimate of one out of four contacts (25%; USDA Forest Service 2010a), there is predicted to be a disease transmission event with potential for subsequent bighorn mortality event once every 1.9 years. When the probability of contact resulting in disease

transmission is assumed to be low (one out of 10, or 10%) the total herd contact rate for all bighorn herds combined under Alternative 2 equates to a predicted disease transmission event once every 4.9 years. Under Alternative 2, the potential disease transmission interval remains high (every 4.9 years) even when the presumed rate of disease transmission is low (10%).

As stated earlier, the Pine River Allotment directly overlaps portions of the Vallecito Creek Herd S-28 CHHR and portions of the Cimarrona Peak S-16 CHHR under current configuration (Alternative 2). For this reason the Risk of Contact Tool assumes at least one contact per year occurs within each of the zones of overlap. The CHHR for the West Needles Herd S-71 is 12.93 miles away at its closest point under current allotment configuration (Alternative 2). The Risk of Contact Tool assumes a distribution frequency that equates to 10% of rams and 5% of ewes on a foray are expected to reach this distance away from their CHHR (USDA Forest Service 2010c).

Based on the information presented above, a rank of **High Risk** was assigned to the Pine River Allotment under Alternative 2, but a rank of **Low Risk** was assigned under Alternatives 3 and 4. The reasons for assigning a rank of High Risk to the Pine River Allotment under Alternatives 2 and rank of Low Risk under Alternatives 3 and 4 are:

- Under current configuration (Alternative 2) about 26% of the allotment directly overlaps the Vallecito Creek Herd S-28 bighorn CHHR, and an additional 15% of the allotment overlaps with the Cimarrona Peak Herd S-16 CHHR. Because of this substantial overlap with known bighorn use areas it is assumed that multiple bighorn contacts with the allotment per year are possible, and thus there is high risk for physical contact with potential for disease transmission and subsequent bighorn mortality event within both the S-28 and S-16 CHHR's.
- The allotment is proposed to be closed to domestic sheep grazing under Alternatives 3 and 4, and thus there is low risk for physical contact between the species under Alternatives 3 and 4.
- Under current configuration (Alternative 2), the allotment directly overlaps portions of the S-28 and S-16 CHHR's and therefore the risk of contact within the zones of overlap is high. For the West Needles Herd S-71, the total herd contact rate is low (0.035, equating to one contact per 28.6 years) and thus risk of contact with S-71 is predicted to be low.
- Under Alternative 2, the total herd contact rate for the Pine River Allotment for all bighorn herds combined is predicted to be at least one bighorn contact with the allotment every 0.49 years (Table 24, above). This equates to a predicted disease transmission interval of at least one event every 4.9 years, assuming a moderate (25%) probability of disease transmission. The disease transmission interval remains high (every 4.9 years) even when the presumed rate of disease transmission is low (10%).
- There is high separation from the S-71 CHHR in terms of distance (12.93 miles, Table 25 above). There is also poor connectivity with S-71 in terms of source habitat for dispersal of bighorns from S-71 to the allotment.
- A relatively high amount (30%) of suitable domestic sheep grazing range overlaps with bighorn source habitat in the allotment (Table 25, above). There is also a slightly larger amount of the allotment that is bighorn source habitat (39%), compared to suitable domestic sheep range (37%). This indicates higher likelihood that foraging bighorns reaching the allotment might find and contact domestic sheep on suitable range.

- About 10% of rams on a foray and about 5% of ewes on a foray from S-71 are predicted to reach the distance away from their CHHR that is equal to the distance to the allotment (12.93 miles). This indicates a low risk for bighorns contacting the allotment from S-71, in part due to poor connectivity of bighorn source habitat with the allotment.
- Much of the northern, central and southern portions of the allotment are bighorn source habitat, especially near the heads of drainages and along ridge crests such as the Continental Divide. There are large contiguous patches of bighorn source habitat throughout the allotment. This indicates a higher likelihood that contact would occur if domestic sheep and bighorn sheep were present in the allotment during the same season.
- Bighorn sheep are known to regularly occur during the summer grazing season within the portions of the allotment that overlap with the S-28 and S-71 CHHR's. Portions of these areas of overlap are also mapped by CPW as bighorn summer concentration areas and production areas. Therefore there is high risk for physical contact if domestic sheep and bighorn sheep were present in the allotment during the same season.

Summary of Risk Rating for Pine River Allotment:

Risk Rating: Alternative 2 – High
 Alternative 3 – Low
 Alternative 4 – Low

Rock Creek Allotment (vacant sheep allotment):

Table 26. Risk of Contact Tool estimated total herd contact rates for the Rock Creek Allotment for individual bighorn sheep herds under each action alternative (Alternatives 2, 3 and 4.

Rock Creek Allotment	Annual Herd Contact Rates via Foray				1 Contact Per X Years
	S-16 Cimarrona Peak Herd	S-28 Vallecito Creek Herd	S-71 West Needles Herd	Total	
Alternative 2	0.172703	1.00	0.083010	1.255714	0.80
Alternative 3	0.133589	0.358963	0.070643	0.563194	1.78
Alternative 4	Allotment Proposed Closed				N/A

CHHR Intersects With Allotment
 Allotment Proposed Closed
 N/A: Too Far From Allotment
 CHHR = Bighorn Core Herd Home Range

Table 27. Acreage statistics for the Rock Creek Allotment for domestic sheep grazing range, bighorn sheep summer source habitat, and acres of overlap between domestic sheep and bighorn sheep grazing acres under each action alternative (Alternatives 2, 3 and 4).

Alternative	Distance from Bighorn Core Herd Home Range (CHHR)	Total Allotment Acres	Suitable Domestic Sheep Grazing Acres (% of Allotment)	Bighorn Summer Source Habitat Acres (% of Allotment)	Acres of Overlap Between Suitable Grazing Acres and Bighorn Source Habitat (% Overlap)
Alternative 2	Overlap – S-28	10,880	3,188 (29%)	8,952 (82%)	2,046 (64%)
	4.66 mi – S-71 6.31 mi – S-16				
Alternative 3	1.13 mi – S-28	7,344	2,176 (30%)	6,336 (86%)	1,561 (72%)
	4.66 mi – S-71				
	8.27 mi – S-16				
Alternative 4	Allotment Proposed Closed				

The Rock Creek Allotment is located in the north-central portion of the Weminuche Landscape. It is located at the headwaters of the Vallecito Creek drainage. The entire allotment is located within the Weminuche Wilderness. Roughly the southern third of the allotment overlaps with CHHR for the Vallecito Creek Herd S-28. Under current configuration (Alternative 2) there is about 829 acres of overlap with the S-28 CHHR, about 8 percent of the allotment. Within this overlap area, about 55 acres (7%) is suitable domestic sheep grazing range. Also within this overlap area, about 816 acres (98%) is bighorn summer source habitat. Bighorn sheep are known to use these portions of the allotment during summer. Although there is no overlap of the allotment with areas mapped by CPW as bighorn summer concentration area, this portion of the allotment is in close proximity (less than 0.25 miles) to mapped bighorn summer concentration areas. Bighorns have been documented in the area since at least the 1940s. The 1969 range management plan for the Rock Creek Allotment states there were possibly bighorn sheep in this area. Reduced use in the Rocky Benches and Hunchback portions of the allotment was suggested to protect the area for bighorn sheep.

Bighorn sheep have not been reported during the summer grazing season within that portion of the allotment proposed to remain open as a forage reserve allotment. No reports have been received of bighorn observations along the portion of the Vallecito Creek Trail that is within or near the allotment, including along the lower Rock Creek Trail.

Under current management (Alternative 2) the Rock Creek Allotment is considered a vacant domestic sheep allotment that could be restocked administratively at any time. Under Alternative 3, it is proposed that approximately the southeastern third of the allotment (3,536 acres, 33% of the allotment) would be permanently closed to livestock grazing. The remaining two thirds of the allotment (7,344 acres, 67% of the allotment) are proposed to be combined with the Leviathan Allotment and about two thirds of the Johnson Creek Allotment to form a single domestic sheep forage reserve allotment. This would allow domestic sheep grazing for a maximum of three out of any ten consecutive years. Under Alternative 4 the allotment would be permanently closed to all livestock grazing.

Domestic sheep grazing in what is now the Rock Creek Allotment began in the early 1900's. Originally, this allotment included the current Leviathan allotment, but was separated from it in 1932. At that time a third allotment, known as Vallecito, was divided into east and west and shared by Rock Creek and Leviathan Allotments. In 1947 both sides of the Vallecito allotment were incorporated into the Rock Creek Allotment. The combining of Rock Creek and Vallecito allotments, with reduced numbers of sheep, was in response to overuse due to herders' failure to move animals and follow the management plan. The areas mentioned in inspection reports as overused were still in a poor condition class in 1960. Overall however, most of the allotment (66%) was being used under capacity, with only specific areas being overused. The allotment was grazed annually through 1966, was vacant through 1969, and grazed for the final year in 1970.

The Rock Creek Allotment includes the head waters of Vallecito Creek and all of the drainages of Rock Creek to their confluence with Vallecito Creek. The northeastern boundary of the allotment is the crest of the Continental Divide. Elevations on the allotment range from 10,500 to 13,600 feet. For the most part the terrain in this allotment is steep and rocky. An assessment in 1969 indicated that heavily timbered areas existed and were suitable for grazing, but those may be covered and too shaded for forage now. Grazing was being used to maintain these forage areas. Shallow unstable soils are a general rule over most of the allotment. Much of the allotment, especially on the north end, is above timberline in the alpine zone, but much of the lower slopes are in spruce-fir forests.

Under current condition (Alternative 2) there is about 829 acres of overlap with the S-28 CHHR, about 8 percent of the allotment. Within this area of overlap, about 55 acres (7%) is suitable domestic sheep grazing range. Under Alternatives 3 and 4, the entire area of overlap with the S-28 CHHR would be closed to domestic sheep grazing.

Under current configuration (Alternative 2) the Rock Creek Allotment has 10,880 acres within the allotment, of which approximately 3,188 acres (11%) are suitable domestic sheep grazing range (Table 27, above). There is a relatively large amount of bighorn source habitat in the allotment, 8,952 acres or 82% of the allotment. There is substantial overlap in the allotment between suitable domestic sheep range and bighorn summer source habitat, with 64% of suitable domestic sheep range (2,046 acres) also bighorn summer source habitat. Much of the northern, central and southern portions of the allotment are bighorn source habitat, especially near the heads of drainages and along ridge crests such as the Continental Divide. There are large contiguous patches of bighorn source habitat throughout the allotment.

Total herd contact rates from the Risk of Contact Tool for the Rock Creek Allotment with each of the three herds in the Analysis area, under each of the three action alternatives, are shown above in Table 26. The allotment overlaps a portion of the CHHR for the Vallecito Herd S-28 and therefore a contact rate of 1.0 (contact predicted to occur at least once every year) is assumed for this bighorn herd (Table 26, above). The next closest bighorn herd to the allotment, West Needles Herd S-71, has an estimated total herd contact rate of 0.083. The Cimarrona Peak Herd S-16 has a total herd contact rate of 0.173. These total herd contact rates equate to a predicted average of one contact with the allotment by an adult bighorn from the Vallecito Creek Herd S-28 every year the allotment is grazed under the current allotment configuration (Alternative 2). For the West Needles Herd S-71 and the Cimarrona Peak Herd S-16, the contact rates equate to one contact with the allotment every 12.1 and 5.78 years, respectively.

Under Alternative 3, boundary adjustments would result in total herd contact rates for bighorns from S-28, S-71 and S-16 CHHR's of 0.359, 0.071 and 0.134, respectively. These total herd contact rates equate to one contact with the allotment every 2.79, 14.08 and 7.46 years, respectively. Table 26, above, does not display total herd contact rates for Alternative 4 because the allotment is proposed to be closed to domestic sheep grazing under Alternative 4.

Using a moderate estimate of one out of four (25%) contacts resulting in a disease transmission event with potential for subsequent bighorn mortality event (USDA Forest Service 2010a), the bighorn contact rate under current management (Alternative 2) from the S-28 CHHR equates to a disease transmission with potential for subsequent bighorn mortality event at least once every 4.0 years (Table 26, above). Disease transmission could be more frequent under Alternative 2 because overlap exists with the S-28 CHHR and thus the Risk of Contact Tool assumes at least one contact per year is occurring within that portion of the allotment where overlap occurs. When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) the total herd contact rate for S-28 under Alternative 2 equates to a disease transmission event with potential for a subsequent bighorn mortality event at least once every 10 years. The total herd contact rates for the West Needles Herd S-71 equates to a disease return interval of every 48.2 years with a 25% disease transmission probability, and return interval of 120.5 years with a 10% disease transmission probability. The total herd contact rates for the Cimarrona Peak Herd S-16 equates to a disease return interval of every 23.1 years with a 25% disease transmission probability, and return interval of 57.8 years with a 10% disease transmission probability.

Under the allotment configuration proposed in Alternative 3, a moderate estimate of one out of four (25%) contacts (USDA Forest Service 2010a) and a total herd contact rate of 0.359 for the S-28 bighorn herd results in a disease transmission event with potential for subsequent bighorn mortality event once every 11.1 years (Table 26, above). When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) the total herd contact rate for S-28 under Alternative 3 equates to a disease transmission event with potential for a subsequent bighorn mortality event once every 27.9 years. The total herd contact rate for the West Needles Herd S-71 (0.071) equates to a disease return interval of every 56.3 years with a 25% disease transmission probability, and return interval of 140.8 years with a 10% disease transmission probability. The total herd contact rate for the Cimarrona Peak Herd S-16 (0.134) equates to a disease return interval of every 29.9 years with a 25% disease transmission probability, and return interval of 74.6 years with a 10% disease transmission probability.

When comparing total herd contact rates for the Rock Creek Allotment for all bighorn herds combined, under Alternative 2 there is predicted to be one bighorn contact with the allotment every 0.80 years (Table 26, above). Using a moderate estimate of one out of four (25%) contacts (USDA Forest Service 2010a) results in a disease transmission event with potential for subsequent bighorn mortality event once every 3.2 years. When the probability of contact resulting in disease transmission is assumed to be low (one out of 10, or 10%) the total herd contact rate for all bighorn herds combined under Alternative 2 equates to a predicted disease transmission event once every 8.0 years.

Under the allotment boundary configuration proposed for Alternative 3, there is predicted to be one bighorn contact with the allotment every 1.78 years. The total herd contact rate for all bighorn herds combined under Alternative 3 equates to a disease transmission interval of every 7.1 years with a 25% disease transmission probability. With a 10% disease

transmission probability, there is a predicted disease transmission interval of every 17.8 years. Therefore the boundary adjustment made under Alternative 3 results in a substantial (about 55%) reduction in the predicted rate of contact with the allotment. However, under the boundary configuration proposed in Alternative 3 the potential disease transmission interval remains high (every 17.8 years) even when the presumed rate of disease transmission is low (10%).

It should be noted that under all alternatives the Risk of Contact Tool predicted much higher total herd contact rates with the Cimarrona Peak Herd S-16 than with the West Needles Herd S-71, in spite of the fact that S-71 is much closer (about half the distance) to the allotment than S-16. The Cimarrona Peak Herd S-16 is 6.31 miles away from the allotment at its closest point, compared to the West Needles Herd S-71, which is about half the distance, 4.66 miles, from the allotment at its closest point. Under the allotment boundary adjustment proposed under Alternative 3, the distance to S-16 increases substantially to 8.27 miles. The reason for the higher predicted total herd contact rate with S-16 is its greater population size than S-71, and greater bighorn source habitat connectivity between the allotment and the CHHR for S-16, compared to that with S-71. Connectivity of bighorn source habitat with S-16 CHHR is fair, and that with S-71 CHHR is poor, despite its closer proximity.

As stated earlier, the Rock Creek Allotment directly overlaps a portion of the Vallecito Creek Herd S-28 CHHR under current configuration (Alternative 2) therefore the Risk of Contact Tool assumes at least one contact per year occurs within the zone of overlap. The next nearest bighorn CHHR to the allotment is the West Needles Herd S-71, which is 4.66 miles away at its closest point under current allotment configuration (Alternative 2). The Risk of Contact Tool assumes a distribution frequency that equates to about 55% of rams and 25% of ewes on a foray are expected to reach this distance away from their CHHR (USDA Forest Service 2010c). The nearest distance to S-16, the Cimarrona Peak Herd CHHR, is 6.31 miles away. This equates to about 35% of rams and 15% of ewes on a foray are expected to reach this distance away from their CHHR. Under the allotment boundary adjustments proposed in Alternative 3, the distance to S-71 remains unchanged (Table 27, above), but the distance to S-16 increases substantially to 8.27 miles. This equates to about 25% of rams and 15% of ewes on a foray are expected to reach this distance away from their CHHR.

Based on the information presented above, a rank of **High Risk** was assigned to the Rock Creek Allotment under Alternatives 2 and 3, but a rank of **Low Risk** was assigned under Alternative 4. The reasons for assigning a rank of High Risk to the Rock Creek Allotment under Alternatives 2 and 3 and rank of Low Risk under Alternative 4 are:

- About 8% of the allotment directly overlaps the Vallecito Creek Herd S-28 bighorn CHHR under current configuration (Alternative 2). For this reason, it is assumed that under current allotment configuration multiple bighorn contacts with the allotment per year are possible, and thus there is high risk for physical contact with potential for disease transmission and subsequent bighorn mortality event within the S-28 CHHR.
- Under boundary changes proposed in Alternative 3, the portion of the allotment with direct overlap with S-28 CHHR would be closed to all livestock grazing. However, the allotment remains in close proximity (1.1 miles) to the S-28 CHHR and closely connected by bighorn source habitat. For the reason of close proximity and good bighorn habitat connections to the S-28 CHHR under Alternative 3, it is concluded that there is high risk for physical contact, with potential for disease transmission and subsequent bighorn mortality event, with bighorns from the S-28 CHHR under Alternative 3.

- The allotment is proposed to be closed to domestic sheep grazing under Alternative 4, and thus there is low risk for physical contact between the species under Alternative 4.
- Under current configuration (Alternative 2), the allotment directly overlaps a portion of the Vallecito Creek Herd S-28 CHHR and therefore the risk of contact within the zone of overlap is high. For the West Needles Herd S-71, the total herd contact rate is moderate (0.083, equating to one contact per 12.0 years) and thus risk of contact with S-71 is predicted to be moderate (Table 26, above). For the Cimarrona Peak Herd S-16, the total herd contact rate is moderate (0.173, equating to one contact per 5.8 years) and thus risk of contact with S-16 is predicted to be moderate.
- Under Alternative 3, the total herd contacts rates from the Risk of Contact Tool decrease for all three bighorn herds, compared to Alternative 2, especially for the S-28 bighorn herd. Despite decrease in total herd contact rates, the potential for contact between bighorns from the S-28 CHHR and the allotment remains high. The risk remains moderate for S-71 and S-16 under the allotment boundary configuration proposed for Alternative 3.
- The boundary adjustment made under Alternative 3 for the forage reserve allotment results in a slight (about 15%) reduction in the predicted rate of contact with the allotment for all bighorn herds combined. However, under the boundary configuration proposed under Alternative 3 the potential disease transmission interval remains high (every 17.8 years) even when the presumed rate of disease transmission is low (10%).
- There is moderate separation from S-16 and S-71 in terms of distance (4.66 and 6.31 to 8.27 miles, respectively; Table 27 above). However, there is good connectivity with S-16 in terms of source habitat for dispersal of bighorns from S-16 to the allotment.
- A relatively high amount (64% to 72%) of suitable domestic sheep grazing range overlaps with bighorn source habitat in the allotment (Table 27, above). There is also a much larger amount of the allotment that is bighorn source habitat (82%), compared to suitable domestic sheep range (29%). This indicates higher likelihood that foraging bighorns reaching the allotment might find and contact domestic sheep on suitable range.
- Under current configuration (Alternative 2), the allotment directly overlaps a portion of the Vallecito Creek Herd S-28 CHHR and therefore the risk of contact within the zone of overlap is high. About 55% of rams on a foray and about 25% of ewes on a foray from S-71 are predicted to reach the distance away from their CHHR that is equal to the distance to the allotment (4.66 miles). This indicates a moderate risk for bighorns contacting the allotment, in part due to poor connectivity of bighorn source habitat with the allotment. For S-16, about 25% of rams and 15% of ewes on a foray are expected to reach this distance from their CHHR (8.27 miles). This indicates a moderate risk for bighorns contacting the allotment, in part due to good connectivity of bighorn source habitat with the allotment.
- Much of the northern, central and southern portions of the allotment are bighorn source habitat, especially near the heads of drainages and along ridge crests such as the Continental Divide. There are large contiguous patches of bighorn source habitat throughout the allotment. This indicates a higher likelihood that contact would occur if domestic sheep and bighorn sheep were present in the allotment during the same season.
- Bighorn sheep have not been reported during the summer grazing season within the portion of the allotment that would be used as a forage reserve. No reports have been received of bighorn observations along the portion of the Vallecito Creek Trail that is within or near the allotment, including along the lower Rock Creek Trail.

- Project design criteria applied under Alternative 3 (Appendix 1, EA Table 2-3, below), when fully and completely implemented, are expected to enhance the effectiveness of separation between the species, although the amount of improvement in effectiveness is not known with certainty.

Summary of Risk Rating for Rock Creek Allotment:

Risk Rating: Alternative 2 – High
 Alternative 3 – High
 Alternative 4 – Low

Spring Gulch Allotment (active sheep allotment):

Table 28. Risk of Contact Tool estimated total herd contact rates for the Spring Gulch Allotment for individual bighorn sheep herds under each action alternative (Alternatives 2, 3 and 4).

Spring Gulch Allotment	Annual Herd Contact Rates via Foray				1 Contact Per X Years
	S-16 Cimarrona Peak Herd	S-28 Vallecito Creek Herd	S-71 West Needles Herd	Total	
Alternative 2		0.016529	0.004877	0.021405	46.72
Alternative 3		0.016209	0.004786	0.020995	47.63
Alternative 4		0.016209	0.004786	0.020995	47.63

CHHR Intersects With Allotment
 Allotment Proposed Closed
 N/A: Too Far From Allotment
 CHHR = Bighorn Core Herd Home Range

Table 29. Acreage statistics for the Spring Gulch Allotment for domestic sheep grazing range, bighorn sheep summer source habitat, and acres of overlap between domestic sheep and bighorn sheep grazing acres under each action alternative (Alternatives 2, 3 and 4).

Alternative	Distance from Bighorn Core Herd Home Range (CHHR)	Total Allotment Acres	Suitable Domestic Sheep Grazing Acres (% of Allotment)	Bighorn Summer Source Habitat Acres (% of Allotment)	Acres of Overlap Between Suitable Grazing Acres and Bighorn Source Habitat (% Overlap)
Alternative 2	7.68 mi – S28 10.12 mi – S71 22.52 mi – S-16	2,285	2,060 (90%)	87 (4%)	85 (4%)
Alternative 3	Same Distance	2,285	2,060 (90%)	87 (4%)	85 (4%)
Alternative 4	Same Distance	2,285	2,060 (90%)	87 (4%)	85 (4%)

The Spring Gulch Allotment is located south of the Weminuche Landscape, south of Lemon Reservoir. There is no overlap between the Spring Gulch Allotment and bighorn CHHR for any bighorn sheep herd under any alternative. It is primarily a trailing allotment, providing a

brief period of forage enroute to and returning from high country allotments. None of the allotment is located within the Weminuche Wilderness. Elevations on the allotment vary between 7,400 and 10,000 feet. The suitable sheep grazing range is on moderately steep slopes, while unsuitable areas are on steep slopes or have too little forage. The major vegetative communities are ponderosa pine with Gambel oak in the understory. As elevation increases on the allotment, fir and aspen replace the pine and oak. In 2002 the Missionary Ridge fire burned the majority of the allotment.

The allotment was managed by BLM until 1983 when it was transferred to the Forest Service. The allotment was stocked with cattle through 1986, was vacant from 1987 through 1989, and again from 1994 through 1996. In 1997 the permit was waived back to the Forest Service. In 2004 the allotment was converted to a sheep trailing allotment, using the allotment in addition to leased private lands within the allotment. After the 2005 grazing season, use of the allotment was limited to no more than 10 days in the spring and no more than 6 days in the fall. The short-duration of use was based in part on lack of water for long periods across most of the allotment. There is no fence separating NFS lands from private lands.

Compared to other allotments in the Weminuche Landscape, the Spring Gulch Allotment has a relatively high percentage of the allotment suitable for domestic sheep grazing (90% of the Allotment; 2,260 acres; see Table 29, above). There is very little bighorn source habitat in the allotment (87 acres, 4% of the allotment). Although there is a relatively large amount of suitable domestic sheep grazing range in the allotment (2,060 acres), there is a relatively low amount of overlap of that suitable range with bighorn source habitat (4% of suitable domestic sheep range is bighorn source habitat).

Estimated total herd contact rates from the Risk of Contact Tool for the Spring Gulch Allotment with each of the three herds in the Analysis area, under each of the three action alternatives, are shown above in Table 28. The herd closest to the allotment, Vallecito Creek S-28, has an estimated total herd contact rate of 0.017 under current allotment configuration (Alternative 2) and 0.016 under Alternatives 3 and 4. These estimates equate to a predicted average of one contact with the allotment by an adult bighorn from S-28 every 58.82 years the allotment is grazed under the current allotment configuration (Alternative 2). Under the allotment configuration of Alternatives 3 and 4 there is estimated to be one bighorn contact with the allotment every 62.5 years.

The next nearest bighorn herd, West Needles Herd S-71, has a total herd contact rate from the Risk of Contact Tool of 0.005 under all alternatives. This estimate equates to a predicted average of one contact with the allotment by an adult bighorn from S-71 every 200 years the allotment is grazed. The Risk of Contact Tool did not provide total herd contact estimates for the Cimarrona Peak Herd S-16 because the CHHR is too far from the allotment (greater than 25 miles).

Using a moderate estimate of one out of four (25%) contacts resulting in a disease transmission event with potential for subsequent bighorn mortality event (USDA Forest Service 2010a), these allotment contact rates equate to a disease transmission with potential for subsequent bighorn mortality event once every 235 years under current allotment configuration (Alternative 2), and once every 250 years under Alternatives 3 and 4. When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) these allotment contact rates equate to disease transmission events with potential for a

subsequent bighorn mortality event once every 588 years under current allotment configuration (Alternative 2), and once every 625 years under Alternatives 3 and 4.

When comparing total herd contact rates for the Spring Gulch Allotment for all bighorn herds combined, under Alternative 2 there is predicted to be one bighorn contact with the allotment every 46.7 years (Table 28, above). Using a moderate estimate of one out of four (25%) contacts (USDA Forest Service 2010a) results in a disease transmission event with potential for subsequent bighorn mortality event once every 187 years. When the probability of contact resulting in disease transmission is assumed to be low (one out of 10, or 10%) the total herd contact rate for all bighorn herds combined under Alternative 2 equates to a predicted disease transmission event once every 467 years. Under Alternatives 3 and 4 there is predicted to be one bighorn contact with the allotment every 47.6 years. The total herd contact rate for all bighorn herds combined under Alternatives 3 and 4 equates to a disease return interval of every 190.4 years with a 25% disease transmission probability. With a 10% disease transmission probability, there is a predicted disease return interval of every 476 years. For all Alternatives, the potential disease return interval is low (every 187 to 476 years).

The nearest bighorn CHHR to the Spring Gulch Allotment is the Vallecito Creek Herd S-28. The distance to the S-28 CHHR is 7.68 miles away at its closest point (Table 29, above). The Risk of Contact Tool assumes a distribution frequency that equates to about 25% of rams on a foray and about 15% of ewes on a foray predicted to reach this distance away from their CHHR (USDA Forest Service 2010c). The nearest distance to S-71, the West Needles Herd CHHR, is 10.12 miles away, with about 15% of rams and 15% of ewes on a foray expected to reach this distance from their CHHR. The nearest distance to S-16, the Cimarrona Peak Herd CHHR, is 22.52 miles away, with about 1% of adult bighorns on a foray expected to reach this distance from their CHHR. The distances from the allotment to all three bighorn CHHR's did not change between Alternative 2 and Alternatives 3 and 4.

Based on the information presented above, a rank of **Low Risk** was assigned to the Spring Gulch Allotment for all alternatives. The reasons for assigning a rank of Low Risk for all alternatives to the Spring Gulch Allotment are:

- There is no direct overlap of the allotment with bighorn CHHR under any alternative.
- There are low total herd contact rates (less than about 0.08; Table 28, above) from the Risk of Contact Tool for all bighorn herds and action alternatives, resulting in extended lengths of time between potential for bighorn contact with the allotment (once per 59 to 200 years).
- Under Alternatives 3 and 4, the potential disease return interval is low (235 to 580 years) when the presumed rate of disease transmission is moderate (25%), resulting in extended lengths of time between estimated disease transmission events.
- There is good separation from the nearest bighorn's CHHR (S-28 and S-71) in terms of both distance (7.68 to 10.12 miles; Table 29, above) and geographic terrain, with poor connectivity between bighorn source habitat and CHHR's for dispersal of bighorns from S-28 and S-71 to the allotment.
- There is a relatively low amount (about 4%) of suitable domestic sheep grazing range that overlaps with bighorn source habitat under all alternatives (Table 29, above). This indicates low likelihood that foraging bighorns reaching the allotment might find and contact domestic sheep on suitable range.

- About 25% of rams on a foray and about 15% of ewes on a foray from S-28 are predicted to reach the distance away from their CHHR (Table 29, above) that is equal to the distance to the nearest allotment (S-28, 7.68 miles). About 15% of rams and 15% of ewes on a foray are predicted to reach the distance away from the S-71 CHHR to the allotment (10.12 miles). This indicates low risk for bighorns from S-71 contacting the allotment.
- The allotment is dominated by lower elevation forested habitat types, and the few areas that are mapped as bighorn source habitats are generally small in size with poor connectivity to larger blocks of habitat and with bighorn CHHR's.
- The domestic sheep permittees report they have not seen bighorn sheep in the allotment, and no reports have been received from the public of bighorn sheep observed in the allotment during the summer grazing season.
- Project design criteria applied under Alternatives 3 and 4 Appendix 1, EA Table 2-3, below), when fully and completely implemented, are expected to enhance the effectiveness of separation between the species, although the amount of improvement in effectiveness is not known with certainty.

Summary of Risk Rating for Spring Gulch Allotment:

Risk Rating: Alternative 2 – Low
 Alternative 3 – Low
 Alternative 4 – Low

Tank Creek Allotment (active sheep allotment):

Table 30. Risk of Contact Tool estimated total herd contact rates for the Tank Creek Allotment for individual bighorn sheep herds under each action alternative (Alternatives 2, 3 and 4.

Tank Creek Allotment	Annual Herd Contact Rates via Foray				1 Contact Per X Years
	S-16 Cimarrona Peak Herd	S-28 Vallecito Creek Herd	S-71 West Needles Herd	Total	
Alternative 2	0.007927	0.111652	1.00	1.119578	0.89
Alternative 3	0.008954	0.124522	0.197306	0.330782	3.02
Alternative 4	0.008954	0.124522	0.197306	0.330782	3.02

CHHR Intersects With Allotment
 Allotment Proposed Closed
 N/A: Too Far From Allotment
 CHHR = Bighorn Core Herd Home Range

Table 31. Acreage statistics for the Tank Creek Allotment for domestic sheep grazing range, bighorn sheep summer source habitat, and acres of overlap between domestic sheep and bighorn sheep grazing acres under each action alternative (Alternatives 2, 3 and 4).

Alternative	Distance from Bighorn Core Herd Home Range (CHHR)	Total Allotment Acres	Suitable Domestic Sheep Grazing Acres (% of Allotment)	Bighorn Summer Source Habitat Acres (% of Allotment)	Acres of Overlap Between Suitable Grazing Acres and Bighorn Source Habitat (% Overlap)
Alternative 2	Overlap – S-71	10,954	6,452 (59%)	4,118 (38%)	2,686 (42%)
	8.06 mi – S-28 18.07 mi – S-16				
Alternative 3	0.82 mi – S-71 7.71 mi – S-28 17.69 mi – S-16	8,353	6,223 (75%)	4,895 (59%)	2,858 (46%)
	Same Distance				
Alternative 4	Same Distance	8,353	6,223 (75%)	4,895 (59%)	2,858 (46%)

The Tank Creek Allotment is located along the northeastern edge of the Weminuche Landscape and directly overlaps the CHHR for the West Needles Herd S-71. A boundary adjustment proposed under Alternatives 3 and 4 would eliminate the entire zone of overlap from the allotment and close this zone of overlap to domestic sheep grazing.

Domestic sheep grazing began in the Tank Creek Allotment in the early 1900's. Stocking rates were highest in the 1930's, gradually reduced in the 1940's, then stabilized in the 1950's and 60's. In the mid-1970's, Tank Creek was combined into a single allotment with the West Virginia and Virginia Gulch areas. The original allotment boundaries were restored in 1986 and have remained in that configuration through today. A range analysis in 1991 indicated the Tank Creek Allotment was being overgrazed in some areas, while other areas were not being impacted. In 1992 the number of permitted sheep was slightly reduced and set to the number permitted today.

The Tank Creek Allotment is in the Animas river watershed and consists primarily of the Tank Creek, Canyon Creek, Grasshopper Creek, and Crazy Woman Gulch drainages. Elevations on the allotment vary from 7,500 to 12,800 feet on the northern edge allotment. A little less than one quarter of the allotment along its northern boundary is within the Weminuche Wilderness. About 60% of the allotment is either too steep or produces too little forage to be suitable for grazing. Most of the suitable grazing range is located at the higher elevations near or above timberline, and in old spruce-fir harvest areas.

Under current condition (Alternative 2) there is about 1,356 acres of overlap with the S-71 CHHR, about 13 percent of the allotment. All of the overlap area is on the east side of the Animas River. Within this overlap area, about 95 acres (7%) is suitable domestic sheep grazing range. Also within this overlap area, about 606 acres (45%) is bighorn summer source habitat. There is no mapped summer concentration area within the area of mapped overlap. Under Alternatives 3 and 4, this area of overlap with the S-71 CHHR would be removed from the allotment and closed to domestic livestock grazing.

Under current configuration (Alternative 2) the Tank Creek Allotment has 10,954 acres within the allotment, of which approximately 6,452 acres (59%) are suitable domestic sheep grazing range (Table 31, above). There are substantial amounts of bighorn source habitat in the allotment, 4,118 acres or 38% of the allotment. There is substantial overlap in the allotment between suitable domestic sheep range and bighorn summer source habitat, with 42% of suitable domestic sheep range (2,686 acres) also bighorn summer source habitat. Much of the bighorn source habitat is in medium to small patches scattered across the allotment, but bighorn habitat patches are relatively evenly distributed across the allotment.

Estimated total herd contact rates from the Risk of Contact Tool for the Tank Creek Allotment with each of the three herds in the Analysis area, under each of the three action alternatives, are shown above in Table 30. The allotment overlaps a portion of the CHHR for the Vallecito Herd S-28 and therefore a contact rate of 1.0 (contact predicted to occur at least once every year) is assumed for this bighorn herd (Table 30, above). The next closest bighorn herd to the allotment, Vallecito Creek Herd S-28, has an estimated total herd contact rate of 0.112 under current allotment configuration (Alternative 2). The Cimarrona Peak S-16 herd has a total herd contact rate of 0.008. These estimates equate to a predicted average of one contact with the allotment by an adult bighorn from S-28 every 8.93 years the allotment is grazed under the current allotment configuration (Alternative 2). For the Cimarrona Peak Herd S-16, the contact rate equates to one contact with the allotment every 125 years.

Under Alternatives 3 and 4, boundary adjustments would eliminate the zone of overlap with the S-71 CHHR, resulting in total herd contact rates for bighorns from S-71, S-28 and S-16 CHHR's of 0.197, 0.125 and 0.009, respectively. These total herd contact rates equate to one contact with the allotment every 5.08, 8.0 and 111 years, respectively.

Using a moderate estimate of one out of four (25%) contacts resulting in a disease transmission event with potential for subsequent bighorn mortality event (USDA Forest Service 2010a), the bighorn contact rate under current management (Alternative 2) from the S-71 CHHR equates to a disease transmission with potential for subsequent bighorn mortality event at least once every 4.0 years (Table 30, above). Disease transmission could be more frequent under Alternative 2 because overlap exists with the S-71 CHHR and thus the Risk of Contact Tool assumes at least one contact per year is occurring within that portion of the allotment where overlap occurs. When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) the total herd contact rate for S-71 under Alternative 2 equates to a disease transmission event with potential for a subsequent bighorn mortality event at least once every 10 years. The total herd contact rates for the Vallecito Creek Herd S-28 equates to a disease return interval of every 35.7 years with a 25% disease transmission probability, and return interval of 89.3 years with a 10% disease transmission probability. The total herd contact rates for the Cimarrona Peak Herd S-16 equates to a disease return interval of every 500 years with a 25% disease transmission probability, and return interval of 1,250 years with a 10% disease transmission probability.

Under the allotment configuration proposed in Alternatives 3 and 4, a moderate estimate of one out of four (25%) contacts (USDA Forest Service 2010a) and a total herd contact rate of 0.197 for the S-71 bighorn herd results in a disease transmission event with potential for subsequent bighorn mortality event once every 20.3 years (Table 30, above). When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) the total herd contact rate for S-71 under Alternative 3 equates to a disease transmission event with potential for a subsequent bighorn mortality event once every 50.8 years. The total herd contact rate for the Vallecito Herd S-28 (0.125) equates to a disease

return interval of every 32 years with a 25% disease transmission probability, and return interval of 80 years with a 10% disease transmission probability. The total herd contact rate for the Cimarrona Peak Herd S-16 (0.009) equates to a disease return interval of every 444 years with a 25% disease transmission probability, and return interval of 1,111 years with a 10% disease transmission probability.

When comparing total herd contact rates for the Tank Creek Allotment for all bighorn herds combined, under Alternative 2 there is predicted to be one bighorn contact with the allotment every 0.89 years (Table 30, above). Using a moderate estimate of one out of four (25%) contacts (USDA Forest Service 2010a) results in a disease transmission event with potential for subsequent bighorn mortality event once every 3.6 years. When the probability of contact resulting in disease transmission is assumed to be low (one out of 10, or 10%) the total herd contact rate for all bighorn herds combined under Alternative 2 equates to a predicted disease transmission event once every 8.9 years.

Under the allotment boundary configuration proposed for Alternatives 3 and 4, there is predicted to be one bighorn contact with the allotment every 3.02 years. The total herd contact rate for all bighorn herds combined under Alternatives 3 and 4 equates to a disease transmission interval of every 12.1 years with a 25% disease transmission probability. With a 10% disease transmission probability, there is a predicted disease transmission interval of every 30.2 years. Therefore the boundary adjustments made under Alternatives 3 and 4 results in a substantial (about 70%) reduction in the predicted rate of contact with the allotment. However, under the boundary configuration proposed in Alternatives 3 and 4 the potential disease transmission interval remains high (every 30.2 years) even when the presumed rate of disease transmission is low (10%).

As stated earlier, the Tank Creek Allotment directly overlaps a portion of the West Needles Herd S-71 CHHR under current configuration (Alternative 2) therefore the Risk of Contact Tool assumes at least one contact per year occurs within the zone of overlap. The next nearest bighorn CHHR to the allotment is the Vallecito Creek Herd S-28, which is 8.06 miles away at its closest point under current allotment configuration (Table 31, above). The Risk of Contact Tool assumes a distribution frequency that equates to about 25% of rams and 15% of ewes on a foray are expected to reach this distance away from their CHHR (USDA Forest Service 2010c). The nearest distance to S-16, the Cimarrona Peak Herd CHHR, is 18.07 miles away. This equates to less than 5% of all adult bighorns on a foray are expected to reach this distance away from their CHHR.

Due to allotment boundary adjustments made under Alternatives 3 and 4, the shortest distance from the allotment to all three bighorn herds was somewhat reduced under Alternatives 3 and 4, compared to Alternative 2 (see Table 31, above). Because of the slight reduction in distance to each of the three bighorn herd CHHR's under Alternatives 3 and 4, there was also a slight increase in the percentage of adult bighorns that would be expected to reach the allotment while on a foray. For S-71, S-28 and S-16, the distance to each bighorn CHHR was 0.82, 7.71 and 17.69 miles, respectively.

Based on the information presented above, a rank of **High Risk** was assigned to the Tank Creek Allotment under Alternatives 2, 3 and 4. The reasons for assigning a rank of High Risk to the Tank Creek Allotment under Alternatives 2, 3 and 4 are:

- About 13% of the allotment directly overlaps the West Needles Herd S-71 bighorn CHHR under current configuration (Alternative 2). For this reason, it is assumed that

under current allotment configuration multiple bighorn contacts per year with the allotment are possible, and thus there is high risk for physical contact with potential for disease transmission and subsequent bighorn mortality event within the S-71 CHHR.

- Under boundary changes proposed in Alternatives 3 and 4, the portion of the allotment with direct overlap with S-71 CHHR would be closed to domestic sheep grazing. However, the allotment remains in close proximity (0.89 miles) to the S-71 CHHR and moderately connected by bighorn source habitat. For the reason of close proximity and moderate bighorn habitat connections to the S-71 CHHR under Alternatives 3 and 4, it is concluded that there is high risk for physical contact, with potential for disease transmission and subsequent bighorn mortality event for bighorns from the S-71 CHHR under Alternatives 3 and 4.
- Under current configuration (Alternative 2), the allotment directly overlaps a portion of the West Needles Herd S-71 CHHR and therefore the risk of contact within the zone of overlap is high (Table 30, above). For the Vallecito Creek Herd S-28, the total herd contact rate is moderate (0.112, equating to one contact per 8.9 years) and thus risk of contact with S-71 is predicted to be moderate. For the Cimarrona Peak Herd S-16, the total herd contact rate is low (0.008, equating to one contact per 125 years) and thus risk of contact with S-16 is predicted to be low.
- Under Alternatives 3 and 4, the total herd contacts rates from the Risk of Contact Tool decrease for all three bighorn herds, compared to Alternative 2, especially for the S-71 bighorn herd. Despite decrease in total herd contact rates, the potential for contact between bighorns from the S-71 CHHR and the allotment remains high. The risk remains moderate for S-28 and low for S-16 under the allotment boundary configuration proposed for Alternatives 3 and 4.
- The boundary adjustments made under Alternatives 3 and 4 results in a substantial (about 70%) reduction in the predicted rate of contact with the allotment for all bighorn herds combined. However, under the boundary configuration proposed under Alternatives 3 and 4, the potential disease transmission interval remains high (every 30.2 years) even when the presumed rate of disease transmission is low (10%).
- There is good separation from S-28 and S-16 in terms of distance (8.06 and 18.07 miles, respectively; Table 31 above). However, there is moderate connectivity with S-28 in terms of source habitat for dispersal of bighorns from S-28 to the allotment.
- A moderate amount (42% to 46%) of suitable domestic sheep grazing range that overlaps with bighorn source habitat in the allotment (Table 31, above). This indicates higher likelihood that foraging bighorns reaching the allotment might find and contact domestic sheep on suitable range.
- Under current configuration (Alternative 2), the allotment directly overlaps a portion of the West Needles Herd S-71 CHHR and therefore the risk of contact within the zone of overlap is high. Under the boundary adjustments made in Alternatives 3 and 4, the nearest distance to S-71 CHHR is about 0.82 miles. Nearly all adult bighorns on a foray from S-71 are predicted to reach this distance away from their CHHR. This indicates a high risk for bighorns from S-71 contacting the allotment. For S-28 and S-16 under Alternatives 3 and 4, about 25% of rams and 15% of ewes on a foray are expected to reach this distance away from their CHHR (7.71 and 17.69 miles, respectively). This indicates a moderate risk for bighorns contacting the allotment from S-28, and low risk for bighorns from S-16.
- Much of the bighorn source habitat is in medium to small patches scattered across the allotment, but bighorn habitat patches are relatively evenly distributed across the

allotment. This indicates a moderate likelihood that contact would occur if domestic sheep and bighorn sheep were present in the allotment during the same season.

- The domestic sheep permittees report they have not seen bighorn sheep in the allotment, and no reports have been received from the public of bighorn sheep observed in the allotment during the summer grazing season.
- Project design criteria applied under Alternatives 3 and 4 (Appendix 1, EA Table 2-3, below), when fully and completely implemented, are expected to enhance the effectiveness of separation between the species, although the amount of improvement in effectiveness is not known with certainty.

Summary of Risk Rating for Tank Creek Allotment:

Risk Rating: Alternative 2 – High
 Alternative 3 – High
 Alternative 4 – High

Virginia Gulch Allotment (active sheep allotment):

Table 32. Risk of Contact Tool estimated total herd contact rates for the Virginia Gulch Allotment for individual bighorn sheep herds under each action alternative (Alternatives 2, 3 and 4.

Virginia Gulch Allotment	Annual Herd Contact Rates via Foray				1 Contact Per X Years
	S-16 Cimarrona Peak Herd	S-28 Vallecito Creek Herd	S-71 West Needles Herd	Total	
Alternative 2	0.047869	0.322239	0.175825	0.545932	1.83
Alternative 3	0.048000	0.300912	0.181345	0.530258	1.89
Alternative 4	0.048000	0.300912	0.181345	0.530258	1.89

CHHR Intersects With Allotment
 Allotment Proposed Closed
 N/A: Too Far From Allotment
 CHHR = Bighorn Core Herd Home Range

Table 33. Acreage statistics for the Virginia Gulch Allotment for domestic sheep grazing range, bighorn sheep summer source habitat, and acres of overlap between domestic sheep and bighorn sheep grazing acres under each action alternative (Alternatives 2, 3 and 4).

Alternative	Distance from Bighorn Core Herd Home Range (CHHR)	Total Allotment Acres	Suitable Domestic Sheep Grazing Acres (% of Allotment)	Bighorn Summer Source Habitat Acres (% of Allotment)	Acres of Overlap Between Suitable Grazing Acres and Bighorn Source Habitat (% Overlap)
Alternative 2	2.27 mi – S-71 2.22 mi – S-28 12.51 mi – S-16	12,373	7,150 (58%)	7,171 (58%)	4,002 (56%)
Alternative 3	1.47 mi – S-71 3.69 mi – S-28 13.74 mi – S-16	12,679	7,182 (57%)	7,375 (58%)	4,004 (56%)
Alternative 4	Same Distance	12,679	7,182 (57%)	7,375 (58%)	4,004 (56%)

The Virginia Gulch Allotment is located on the west central portion of the Weminuche Landscape. It is located between the Florida River and Lime Mesa. The entire allotment is located within the Weminuche Wilderness. There is no direct overlap with bighorn CHHR for any of the bighorn herds in analysis area. Bighorn sheep have not been reported within the allotment during the summer grazing season.

Grazing by domestic sheep took place on this allotment before designation of the National Forest (1908). This allotment was once at least four separate allotments. In 1974, the larger area was divided into present day Virginia Gulch, Tank Creek, and East Silver Mesa Allotments. Two of the three allotments were grazed with a band of 1,025 head each year, while the third was rested. This policy continued until 1986. The allotment boundaries and permitted number have remained the same since then. The sheep band typically uses the allotment in a two year rotation pattern: clock-wise rotation in year one and counter clock-wise rotation in year two. Herder camps are typically used every year and bedgrounds used every other year to allow for recovery. The herder moves camps about every 7 days.

The allotment is entirely within the Florida River watershed and includes Virginia, West Virginia and Missouri Gulches to their headwaters, and Trimble Pass. Elevations on the allotment vary from 9,400 feet to 13,300 feet. About a third of the allotment is either too steep or produces too little forage to be suitable for grazing. Most of the suitable grazing range is located above timberline.

Under current management (Alternative 2) the Virginia Gulch Allotment is an active domestic sheep allotment. Under Alternatives 3 and 4, the allotment would remain an active domestic sheep allotment.

Under Alternatives 3 and 4, there would be minor adjustments to the northern and eastern boundaries of the allotment to reflect actual use areas, and better reflect topographic features of the area. Portions of the northeast section of the allotment near City Reservoir would be added to the East Silver Mesa Allotment to provide a more functional allotment arrangement for the permittee. A small portion of the northwestern edge of the allotment

would be expanded to include portions of the Gem Lake area of the currently closed Needles Mountains Allotment to better reflect actual use by the band, and better reflect topographic features of the area.

Under Alternative 2 the Virginia Gulch Allotment has 12,373 acres within the allotment, of which approximately 7,150 acres (58%) are suitable domestic sheep grazing range (Table 33, above). There is a relatively large amount of bighorn source habitat in the allotment, 7,171 acres or 58% of the allotment. There is substantial overlap in the allotment between suitable domestic sheep range and bighorn summer source habitat, with 56% of suitable domestic sheep range (4,002 acres) also bighorn summer source habitat. Larger blocks of bighorn source habitat occur in the northeast and northwest portions of the allotment.

Under Alternatives 3 and 4 the allotment would be slightly expanded to a total of 12,679 acres in size (Table 33, above), due to boundary adjustments and additions from the Needles Mountains Allotment. Although these expansion areas also happen to be in areas of bighorn summer source habitat, the percentage of bighorn source habitat in the allotment remains unchanged under Alternatives 3 and 4 (58% of the allotment). Also, the percentage of overlap between domestic sheep suitable grazing range and bighorn source habitat remains unchanged (58% of suitable sheep grazing range is also bighorn source habitat).

Total herd contact rates from the Risk of Contact Tool for the Virginia Gulch Allotment with each of the three herds in the Analysis area, under each of the three action alternatives, are shown above in Table 32. The estimated total herd contact rate with the Vallecito Creek Herd S-28 is 0.322 under current allotment configuration (Alternative 2). The next closest bighorn herd to the allotment, West Needles Herd S-71, has an estimated total herd contact rate of 0.175. The Cimarrona Peak Herd S-16 has a total herd contact rate of 0.048. These total herd contact rates equate to a predicted average of one contact with the allotment by an adult bighorn from the Vallecito Creek Herd S-28 every 3.1 years the allotment is grazed under the current allotment configuration (Alternative 2). For the West Needles Herd S-71 and the Cimarrona Peak Herd S-16, the contact rates equate to one contact with the allotment every 5.71 and 119 years, respectively.

Due to allotment boundary adjustments proposed under Alternatives 3 and 4, total herd contact rates increase slightly for the West Needles Herd S-71, decrease slightly for the Vallecito Creek Herd S-28, but remain unchanged for the Cimarrona Peak Herd S-16 (Table 32, above). Total herd contact rates for S-71 increased because boundary adjustments would expand the allotment, primarily along the western and northern ends, closer to S-71, and would expand in an area with higher amounts of bighorn source habitat thereby increasing connectivity to S-71 via bighorn source habitat. Total herd contact rates would decline for S-28 because boundary adjustments would remove portions of the allotment along the eastern side around City Reservoir, increasing the distance away from S-28, and removing areas with bighorn source habitat thereby reducing connectivity to S-28 via bighorn source habitat.

Under current allotment configuration (Alternative 2), using a moderate estimate of one out of four (25%) contacts resulting in a disease transmission event with potential for subsequent bighorn mortality event (USDA Forest Service 2010a), the bighorn contact rate from the S-28 CHHR (0.322) equates to a disease transmission with potential for subsequent bighorn mortality event once every 12.4 years (Table 32, above). When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) the total herd contact rate for S-28 under Alternative 2 equates to a disease transmission event with potential for a subsequent bighorn mortality event once every 31.1 years. The total herd

contact rate for the West Needles Herd S-71 (0.175) equates to a disease return interval of every 22.9 years with a 25% disease transmission probability, and return interval of 57.1 years with a 10% disease transmission probability. The total herd contact rates for the Cimarrona Peak Herd S-16 (0.048) equates to a disease return interval of every 83.3 years with a 25% disease transmission probability, and return interval of 208 years with a 10% disease transmission probability.

Under the allotment configuration in Alternatives 3 and 4, a moderate estimate of one out of four (25%) contacts (USDA Forest Service 2010a) and a total herd contact rate of 0.301 for the S-28 bighorn herd results in a disease transmission event with potential for subsequent bighorn mortality event once every 13.3 years (Table 32, above). When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) the total herd contact rate for S-28 under Alternatives 3 and 4 equates to a disease transmission event with potential for a subsequent bighorn mortality event once every 33.2 years. The total herd contact rate for the West Needles Herd S-71 (0.181) equates to a disease return interval of every 22.1 years with a 25% disease transmission probability, and return interval of 55.2 years with a 10% disease transmission probability. The total herd contact rates for the Cimarrona Peak Herd S-16 (0.048) equates to a disease return interval of every 83.3 years with a 25% disease transmission probability, and return interval of 208.3 years with a 10% disease transmission probability.

When comparing total herd contact rates for the Virginia Gulch Allotment for all bighorn herds combined, under Alternative 2 there is predicted to be one bighorn contact with the allotment every 1.83 years (Table 32, above). Using a moderate estimate of one out of four (25%) contacts (USDA Forest Service 2010a) there is predicted to be a disease transmission event with potential for subsequent bighorn mortality once every 7.3 years. When the probability of contact resulting in a disease outbreak is assumed to be low (one out of 10, or 10%) the total herd contact rate for all bighorn herds combined under Alternative 2 equates to a predicted disease transmission event once every 18.3 years.

Under the allotment boundary configuration proposed for Alternatives 3 and 4 there is predicted to be one bighorn contact with the allotment every 1.89 years. The total herd contact rate for all bighorn herds combined under Alternatives 3 and 4 equates to a disease return interval of every 7.5 years with a 25% disease transmission probability. With a 10% disease transmission probability, there is a predicted disease return interval of every 18.9 years. Therefore the boundary adjustments made under Alternatives 3 and 4 result in only a minor (about 3%) reduction in the predicted rate of contact with the allotment. Under all boundary configurations, the potential disease return interval remains high (every 18.9 years) even when the presumed rate of disease transmission is low (10%).

The closest distance from the Virginia Gulch Allotment to the Vallecito Creek Herd S-28 CHHR, under current configuration (Alternative 2), is 2.22 miles away at its closest point (Table 15, above). The Risk of Contact Tool assumes a distribution frequency that equates to about 80% of rams and 35% of ewes on a foray are expected to reach this distance away from their CHHR (USDA Forest Service 2010c). The next nearest bighorn CHHR to the allotment is the West Needles Herd S-71, which is 2.27 miles away at its closest point under current allotment configuration. This equates to about 80% of rams and 35% of ewes on a foray are expected to reach this distance away from their CHHR. The nearest distance to S-16, the Cimarrona Peak Herd CHHR, is 12.51 miles away, with about 25% of all adult bighorns on a foray expected to reach this distance from their CHHR.

Due to allotment boundary adjustments made under Alternatives 3 and 4, the shortest distance from the allotment to S-71 was reduced, but the distance to S-28 and S-16 was increased under Alternatives 3 and 4, compared to Alternative 2 (see Table 33, above). Because of the slight reduction in distance to the S-71 CHHR under Alternatives 3 and 4, there was also a slight increase in the percentage of adult bighorns that would be expected to reach the allotment while on a foray. For S-28, S-71 and S-16, the distance to each bighorn CHHR under Alternatives 3 and 4 was 1.47, 3.69 and 13.74 miles, respectively.

It should be noted that under all alternatives the Risk of Contact Tool predicted much higher total herd contact rates with the Vallecito Creek Herd S-28 than with the West Needles Herd S-71, in spite of the fact that S-71 is equal or much closer (about half the distance) to the allotment than S-28. Under Alternatives 3 and 4, S-28 is 3.69 miles away from the allotment at its closest point with a total herd contact rate of 0.301, compared to S-71 which is about half the distance, 1.47 miles, from the allotment at its closest point with a total herd contact rate of 0.181. The reason for the higher predicted total herd contact rate with S-28 is its greater population size than S-71, and greater bighorn source habitat connectivity between the allotment and the CHHR for S-28, compared to that with S-71. Connectivity of bighorn source habitat with S-28 CHHR is good, and that with S-71 CHHR fair, despite its closer proximity.

Based on the information presented above, a rank of **High Risk** was assigned to the Virginia Gulch Allotment under Alternative 2, and a rank of **High Risk** was assigned under Alternatives 3 and 4. The reasons for assigning a rank of High Risk to the Virginia Gulch Allotment under Alternative 2 and under Alternatives 3 and 4 are:

- Although there is no direct overlap of the allotment with any bighorn CHHR under current configuration (Alternative 2), the allotment has moderate proximity to the CHHR for S-71 and S-28. For the reasons of moderate proximity to the S-71 and S-28 CHHR and good connectivity of bighorn source habitat with the S-28 CHHR, it is concluded that under current allotment configuration there is high risk for physical contact, with potential for disease transmission and subsequent bighorn mortality event, with bighorns from the S-28 CHHR.
- Under Alternatives 3 and 4, the proximity of the allotment becomes slightly closer to the S-71 CHHR, but becomes somewhat less to S-28. Good connectivity of the allotment to the S-28 CHHR via bighorn source habitat would be somewhat reduced under Alternatives 3 and 4, while moderate connectivity to the S-71 CHHR would be somewhat increased under Alternatives 3 and 4. This is due boundary adjustments that reduce the distance to the S-71 CHHR and increase the amount of bighorn source habitat within the allotment under Alternatives 3 and 4. For these reasons, the risk of contact with foraging bighorns from the S-71 and S-28 CHHR's remains high under Alternatives 3 and 4, compared to Alternative 2.
- Under current condition (Alternative 2), the total herd contact rate from the Risk of Contact Tool with the Vallecito Creek Herd S-28 is high (0.322), equating to one contact every 3.1 years) and thus risk of contact with S-28 is predicted to be high (Table 32, above). For the West Needles Herd S-71, the total herd contact rate is moderate (0.176, equating to one contact per 5.68 years) and thus risk of contact with S-71 is predicted to be Moderate. For the Cimarrona Peak Herd S-16, the total herd contact rate is low (0.048, equating to one contact per 20.83 years) and thus risk of contact with S-16 is predicted to be low.

- Under Alternatives 3 and 4, the total herd contacts rates from the Risk of Contact Tool increase slightly for S-71, decrease slightly for S-28 and remain the same for S-16, compared to Alternative 2. Despite the decrease in total herd contact rate for S-28, the potential for contact between bighorns from the S-28 CHHR and the allotment remains high risk, the risk remains moderate for S-71, and the risk remains low for S-16. The slight increase in potential for contact with S-71 CHHR is due to allotment boundary adjustments under Alternatives 3 and 4 expanding the allotment, primarily along the western and northern ends, which also have higher amounts of bighorn source habitat. The increased total herd contact rate for S-71 is due to better connectivity across larger blocks of bighorn source habitat, a slight reduction in the distance from the new allotment boundary to the CHHR, and the new allotment boundary including more bighorn source habitat in the northern portion of the allotment, which provides better bighorn habitat connectivity to the CHHR for S-71.
- The boundary adjustments made under Alternatives 3 and 4 results in a minor (about 5%) decrease in the predicted rate of contact with the allotment for all bighorn herds combined. Under all boundary configurations, the potential disease return interval remains high (every 18.9 years) even when the presumed rate of disease transmission is low (10%).
- Low separation from the Vallecito Creek Herd S-28 CHHR (2.22 miles) in terms of distance. Moderate separation from S-71 (2.27 miles) and high separation from S-16 (12.51 miles) in terms of distance (Table 33 above). However, there is good connectivity with S-28 and moderate connectivity with S-71 in terms of source habitat for dispersal of bighorns from these two CHHR's to the allotment.
- Boundary adjustments made under Alternatives 3 and 4 reduce the degree of separation from S-71 by reducing the minimum distance from the allotment to the CHHR. The potential for foraging bighorns from S-71 to contact the allotment is increased under Alternatives 3 and 4, compared to Alternative 2, because the adjusted allotment boundary includes more bighorn source habitat in the northern portion of the allotment, which improves connectivity to the S-71 CHHR.
- Relatively high amount (about 56%) of suitable domestic sheep grazing range overlaps with bighorn source habitat in the allotment under current configuration (Alternative 2; Table 33, above). This indicates higher likelihood that foraging bighorns reaching the allotment might find and contact domestic sheep on suitable range.
- Due to boundary adjustments under Alternatives 3 and 4, the amount of overlap between domestic sheep suitable range and bighorn source habitat increases, but the percent of overlap would remain stable at 56% of the domestic sheep range in the allotment. This high amount of overlap of domestic sheep range and bighorn source habitat under Alternatives 3 and 4 indicates an increased risk that foraging bighorns that reach the allotment might find and contact domestic sheep on suitable range.
- About 80% of rams on a foray and about 35% of ewes on a foray from S-28 and S-71 are predicted to reach the distance away from their CHHR (Table 33, above) that is equal to the distance to the allotment. This indicates a high risk for bighorns from both CHHR's contacting the allotment. For S-16, the distance is 12.51 miles, indicating less than about 25% of all adult bighorns on a foray are expected to reach the allotment from their CHHR. This indicates a low risk for bighorns contacting the allotment.
- Due to boundary adjustments under Alternatives 3 and 4, the distance between the allotment and the S-71 would be reduced, compared to Alternative 2. Because of the reduction in distance from the allotment to CHHR under Alternatives 3 and 4, there

would be a slight increase in the percentage of adult bighorns that would be expected to reach the allotment while on a foray.

- Substantial portions of northern and eastern parts of the allotment are bighorn source habitats with some large contiguous patches of bighorn source habitat. This indicates a higher likelihood that contact would occur in those portions of the allotment if domestic sheep and bighorn sheep were present in the allotment during the same season.
- The domestic sheep permittees report they have not seen bighorn sheep in the allotment, and no reports have been received from the public of bighorn sheep observed in the allotment during the summer grazing season.
- Project design criteria applied under Alternatives 3 and 4 (Appendix 1, EA Table 2-3, below), when fully and completely implemented, are expected to enhance the effectiveness of separation between the species, although the amount of improvement in effectiveness is not known with certainty.

Summary of Risk Rating for Virginia Gulch Allotment:

Risk Rating: Alternative 2 – High
Alternative 3 – High
Alternative 4 – High

DISCUSSION

Alternative Comparison:

Tables 34 and 35, below, compare the qualitative ratings of risk of physical contact between bighorn and domestic sheep, and the relative rankings of the three action alternatives (Alternatives 2, 3 and 4) proposed in the EA, based on a variety of quantitative and qualitative analysis factors.

Table 34. Summary of Qualitative ratings of risk of physical contact between domestic and bighorn sheep in each allotment under Alternative 2 (current management), Alternative 3 (forage reserves), and Alternative 4 (proposed action) in the Weminuche Landscape grazing analysis area.

Allotment	Overlap with *CHHR? Acres (%)	Allotment Status	Risk under Alternative 2	Risk under Alternative 3	Risk under Alternative 4
Burnt Timber	No	Active	Moderate	Moderate	Moderate
Canyon Creek	S-71 1,005 (16%)	Vacant	High	Low - Closed	Low - Closed
Cave Basin	S-28 19,574 (87%)	Vacant	High	Low - Closed	Low - Closed
East Silver Mesa - Renamed Endlich Mesa	No	Active	High	High	High
Fall Creek	No	Vacant	High	Low - Closed	Low - Closed
Flint Creek	S-28 9,009 (55%)	Vacant	High	Low - Closed	Low - Closed
Johnson Creek	No	Vacant	High	High – Forage Reserve	Low - Closed
Leviathan	No	Vacant	High	High – Forage Reserve	Low - Closed
Pine River	S-16 4,079 (11%) S-28 10,104 (26%)	Vacant	High	Low - Closed	Low - Closed
Rock Creek	S-28 829 (8%)	Vacant	High	High – Forage Reserve	Low - Closed
Spring Gulch	No	Active	Low	Low	Low
Tank Creek	S-71 1,236 (11%)	Active	High	High	High
Virginia Gulch	No	Active	High	High	High

*CHHR = Bighorn Core Herd Home Range

CHHR Intersects With Allotment

Table 35. Relative Ranking of Alternatives Based on a Multiple Measures of Separation Between Domestic Sheep and Bighorn Sheep

Alt.	Active, Vacant or Forage Reserve Allotments Overlap With Bighorn CHHR* Acres (% of Landscape)	Suitable Domestic Sheep Grazing Range in Active, Vacant or Forage Reserve Allotments Acres (% of Allotments)	Bighorn Summer Source Habitat in Active, Vacant or Forage Reserve Allotments Acres (% of Habitat)	Bighorn Summer Source Habitat Overlap With Suitable Domestic Sheep Grazing Range Acres (% of Habitat)	Average Distance from Allotments to Nearest Bighorn CHHR*	Number of Allotments Ranked High Risk for Physical Contact	Average Years to Allotment Contact, from Risk of Contact Tool	Relative Ranking of Alternatives for Providing Separation between Domestic Sheep and Bighorn Herds
1	0	0	0	0	N/A	0	N/A	1
2	46,053 (28%)	57,984 (100%)	82,151 (100%)	20,666 (100%)	6.7 miles	11	3.8	4
3	0	28,629 (49%)	37,591 (46%)	12,333 (60%)	7.4 miles	6	9.7	3
4	0	24,700 (43%)	18,758 (23%)	10,082 (49%)	9.0 miles	3	17.9	2

Rank Order: 1 = Greatest Separation, 4 = Least Separation.

CHHR: Bighorn Core Herd Home Range

CHHR Intersects With Allotment

Comparison of Alternatives:

Of the 13 allotments analyzed in the Weminuche Landscape EA, under current allotment configuration (Alternative 2) six allotments overlap with mapped bighorn CHHR (see Figure 2, below). Because of direct overlap with bighorn CHHR, all six allotments were rated as having “High Risk” for contact with bighorn sheep, including the vacant allotments due to the potential they could be restocked administratively at any time. Allotments in close proximity to bighorn CHHR’s (generally less than about 3 miles) were also given a rating of “High Risk” due to expected high percentages of bighorns on a foray predicted to reach the allotment from the nearby CHHR (USDA Forest Service 2010c). One allotment was rated “Moderate Risk” for contact due to substantial separation from bighorn CHHR’s and reduced connectivity with CHHR’s via bighorn source habitat within and near the allotment that might facilitate foraging bighorns reaching the allotment. One allotment was rated “Low Risk” for contact due to substantial separation from bighorn CHHR’s and reduced connectivity with CHHR’s via bighorn source habitat within and near the allotment that might facilitate foraging bighorns reaching the allotment.

Under Alternative 3 (see Figure 3, below), all areas of direct overlap with bighorn CHHR are proposed to be closed to domestic sheep grazing, including all of four vacant sheep allotments (Canyon Creek, Cave Basin, Flint Creek and Pine River). In addition, the two remaining allotments that overlap with bighorn CHHR under Alternative 2 (Tank Creek and Rock Creek), would have those portions of the allotment where overlap occurred under Alternative 2 removed from the allotment and closed to domestic sheep grazing under Alternative 3. For this reason, under the allotment configuration proposed in Alternative 3,

no areas of direct overlap between bighorn CHHR and domestic sheep allotments would remain in the Weminuche Landscape.

The four sheep allotments proposed for closing to domestic sheep grazing under Alternative 3 would all receive a rating of “Low Risk” (see Table 34, above, and Figure 6, below). These allotments are Canyon Creek, Cave Basin, Flint Creek and Pine River. The single allotment with a “Low Risk” rating under Alternative 2 (Spring Gulch) would remain “Low Risk” under Alternative 3, and the single allotment with a “Moderate Risk” rating under Alternative 2 (Burnt Timber) would remain “Moderate Risk” under Alternative 3. The remaining six allotments rated as “High Risk” under Alternative 2 would remain “High Risk” under alternative 3, due primarily to close proximity to bighorn CHHR and good connectivity with CHHR’s via bighorn source habitat within and near the allotment that could facilitate foraging bighorns reaching the allotment.

Under Alternative 4 (see Figure 7, below), all portions of the three sheep forage reserve allotments are proposed to be closed to domestic sheep grazing. These allotments are Johnson Creek, Leviathan and Rock Creek. These three allotments would all receive a rating of “Low Risk” under Alternative 4 (see Table 34, above). The single allotment with a “Low Risk” rating under Alternatives 2 and 3 (Spring Gulch) would remain “Low Risk” under Alternative 4, and the single allotment with a “Moderate Risk” rating under Alternatives 2 and 3 (Burnt Timber) would remain “Moderate Risk” under Alternative 4. The three remaining allotments rated as “High Risk” under Alternatives 2 and 3 (Endlich Mesa, Tank Creek and Virginia Gulch) would remain “High Risk” under alternative 4, due to proximity with bighorn CHHR and connectivity with CHHR’s via bighorn source habitat within and near the allotment that could facilitate foraging bighorns reaching the allotment.

Under Alternative 2, there is a total of about 46,053 acres of overlap between six active and vacant domestic sheep grazing allotments and three bighorn CHHR’s (S-71, S-28, and S-16) in the Weminuche Landscape (Table 35, above). All of these areas of overlap with bighorn CHHR are proposed to be closed to sheep grazing under Alternatives 3 and 4.

Under Alternative 2, there is about 57,984 acres of suitable domestic sheep grazing range in the Weminuche Landscape (Table 35, above). Under the allotment configuration proposed in Alternative 3, the amount of suitable sheep grazing range in active and forage reserve allotments would be reduced by closure of four vacant sheep allotments, to about 28,629 acres, or 49% of that available under Alternative 2. Under Alternative 4, suitable sheep grazing range would be somewhat further reduced by closure of the three sheep forage reserve allotments, to about 24,700 acres or 43% of that available under Alternative 2.

It is important to note that the areas of suitable domestic sheep grazing range proposed for closure under Alternatives 3 and 4 are in vacant allotments, or in areas of the active allotments that are rarely used. For this reason, the amount of actively grazed domestic sheep range would change very little between the three action alternatives. The three forage reserve allotments have remained vacant since 1970. Pine River Allotment has remained vacant since 1980, and Flint Creek Allotment has remained vacant since 1972. Fall Creek, Johnson Creek, Rock Creek and Leviathan have all remained vacant since 1970. No currently active allotments would be closed under any of the alternatives.

Under Alternative 2, there is about 82,151 acres of bighorn summer source habitat within active and vacant allotments in the Weminuche Landscape (Table 35, above). Under the allotment configuration proposed in Alternative 3, the amount of bighorn source habitat in

active and forage reserve allotments would be reduced by closure of four vacant sheep allotments, to about 37,591 acres, or 46% of that under Alternative 2. Under Alternative 4, bighorn source habitat in active allotments would be further reduced by closure of the three sheep forage reserve allotments, to about 18,758 acres or 23% of that under Alternative 2. Viewed in another way, under the allotment configuration proposed in Alternative 3, about 54% of the bighorn source habitat in the Landscape would be removed from domestic sheep grazing opportunities. Under Alternative 4, 77% of the bighorn source habitat in the Landscape would be removed from domestic sheep grazing opportunities.

For this reasons discussed in the three paragraphs above, Alternative 4 provides a much greater level of separation between bighorn sheep and domestic sheep, while also having little effect on the amount of domestic sheep grazing acres in currently active allotments. Therefore Alternative 4 provides substantial benefits for bighorn sheep, much more than under Alternatives 2 or 3, while also continuing to provide existing domestic sheep permittees with the same amount of grazing range as in currently active allotments.

Under Alternative 2, there is about 26,666 acres of bighorn summer source habitat that overlaps with suitable domestic sheep range in active and vacant allotments in the Weminuche Landscape (Table 35, above). Under the allotment configuration proposed in Alternative 3, the amount of bighorn source habitat that overlaps with domestic sheep range in active and forage reserve allotments would be reduced by closure of four vacant sheep allotments, to about 12,333 acres, or 60% of that under Alternative 2. Under Alternative 4, overlap of bighorn source habitat and suitable sheep range in active allotments would be further reduced by closure of the three sheep forage reserve allotments, to about 10,082 acres or 49% of that under Alternative 2. Viewed in another way, under the allotment configuration proposed in Alternative 3, about 40% of the bighorn source habitat that overlaps with suitable domestic sheep range in the Weminuche Landscape would be removed from domestic sheep grazing opportunities. Under Alternative 4, 51% of bighorn source habitat that overlaps with suitable domestic sheep range would be removed from domestic sheep grazing opportunities. For this reason, Alternative 4 provides a much greater level of separation between bighorn and domestic sheep grazing areas, compared to Alternatives 2 and 3.

Under Alternative 2, the average distance from allotments to the nearest bighorn CHHR is 6.7 miles (Table 35, above), with 14 sets of allotment/bighorn herd combinations either in direct overlap or within close proximity (within about 3 miles). Under the allotment configuration proposed in Alternative 3, the average distance from allotments to the nearest bighorn CHHR is 7.4 miles, with no direct overlap with bighorn CHHR and only six sets of allotment/bighorn herd combinations within close proximity to bighorn CHHR's. Under Alternative 4, the average distance from allotments to the nearest bighorn CHHR is 9.0 miles, with no direct overlap with bighorn CHHR and only three sets of allotment/bighorn herd combinations within close proximity to bighorn CHHR's. Therefore Alternative 4 provides substantially greater physical separation between bighorn and domestic sheep use areas, compared to the physical separation under the allotment configurations in Alternatives 2 and 3.

The number of allotments receiving a rank of "High Risk" for physical contact between bighorn and domestic sheep in the Weminuche Landscape (Table 35, above) is 11 allotments under the configuration in Alternative 2, six allotments under Alternative 3, and three allotments under Alternative 4. For this reason, compared to Alternative 2, there is a substantial reduction in the number of allotments and areas of concern for potential of physical contact between bighorn and domestic sheep in the Weminuche Landscape under

Alternatives 3 and 4, but the areas of concern are much smaller in Alternative 4 than Alternative 3.

The average number of years to contact predicted by the Risk of Contact Tool for all sets of allotments and bighorns foraging from the three CHHR's combined is 3.8 years under Alternative 2, increases to 9.8 years under Alternative 3, and increases again to 17.9 years under Alternative 4 (Table 35, above). Therefore the allotment configuration proposed in Alternative 4 is predicted by the Risk of Contact Tool to provide the greatest temporal separation between bighorn and domestic sheep, compared to the temporal separation predicted under the configurations of Alternatives 2 and 3.

The total herd contact rates from the Risk of Contact Tool were compared across the three action alternatives, Alternative 2, 3 and 4, for each individual combination of alternative and allotment. Under Alternative 2, 17 of the 38 (44.7%) allotment/alternative combinations had values less than about 0.08. A total herd contact rate less than about 0.08 has been determined to be a domestic sheep contact rate low enough to ensure long-term bighorn sheep herd persistence (USDA Forest Service 2013c, USDA Forest Service 2010a, 2010c and 2010d). Conversely, under the allotment configuration in Alternative 2, 21 (55.2%) of the allotment/alternative combinations had Risk of Contact Tool predicted total herd contact rates in excess of about 0.08, thereby predicting a lower likelihood of ensuring long-term bighorn persistence due to the potential for more frequent physical contact with domestic sheep with the possibility of disease transmission and subsequent bighorn mortality event.

Under the allotment configuration proposed under Alternative 3, 9 of the 23 (39.1%) allotment/alternative combinations had values less than about 0.08. Conversely, under Alternative 3, 14 of the allotment/alternative combinations had Risk of Contact Tool predicted total herd contact rates in excess of about 0.08. Although the percentage of allotment/alternative combinations with a value greater than about 0.08 was greater under Alternative 3 than under Alternative 2, the total number of allotment/alternative combinations with a value greater than about 0.08 was substantially less under Alternative 3 than under Alternative 2. For this reason, the Risk of Contact Tool results predicts the allotment configuration proposed under Alternative 3 would be more likely than Alternative 2 to provide for long-term bighorn persistence in a landscape with ongoing domestic sheep grazing opportunities.

Under the allotment configuration proposed under Alternative 4, 8 of the 14 (57.1%) allotment/alternative combinations had values less than about 0.08. Conversely, under Alternative 4, 6 of the allotment/alternative combinations had Risk of Contact Tool predicted total herd contact rates in excess of about 0.08. Therefore, of the three action alternatives, Alternative 4 had the lowest total number and lowest percentage of allotment/alternative combinations with a total herd contact rate greater than about 0.08. For this reason, the Risk of Contact Tool results predicts the allotment configuration proposed under Alternative 4 would be more likely than Alternative 2 or Alternative 3 to provide for long-term bighorn persistence in a landscape with ongoing domestic sheep grazing opportunities.

As described above and shown above in Table 7, the Risk of Contact Tool predicts, that under the current allotment configuration (Alternative 2) an adult bighorn from one of the three herds would contact a domestic sheep allotment somewhere in the Weminuche Landscape about 12 times per year while foraging outside their CHHR. Under the allotment configuration proposed in Alternative 3, the combined total predicted rate of contact with an allotment by foraging adult bighorns from one of the three herds in the Weminuche

Landscape would be reduced to about 4 contacts per year. Under Alternative 4, the predicted rate of contact from one of the three bighorn herds in the Landscape would be further reduced to about 2 contacts per year.

Alternative 4 provides substantially greater spatial and temporal separation between bighorn and domestic sheep because the predicted contact rates among all allotments and bighorn sheep herds is predicted to be substantially reduced under Alternative 4, as compared to Alternative 2 or 3. The allotment boundary adjustments and allotment closures proposed to occur under Alternative 4 would substantially reduce the estimated rate of allotment contact by adult bighorns foraging outside their CHHR within the Weminuche Landscape, compared to the same rates under the allotment configurations proposed under Alternatives 2 and 3.

For all the reasons discussed in the preceding paragraphs, the order of alternatives most beneficial for bighorn sheep is Alternative 1, followed by Alternative 4, Alternative 3, then Alternative 2. For most of the quantitative and qualitative factors discussed above, Alternative 4 provides substantially more spatial and temporal separation between bighorn and domestic sheep than Alternative 3, which is substantially better for bighorn sheep than Alternative 2.

The domestic livestock permittees and agency livestock permit administrator meet each winter to discuss annual operating instructions for the upcoming grazing season. In conjunction with this meeting, if necessary, the agency wildlife biologist and CPW staff may meet with the permittee to review the effectiveness of Project Design Criteria implementation and any new bighorn sheep information obtained over the previous year. At this time, the risk assessment rating for each allotment would be reviewed as necessary, and updated with new information as appropriate. Discussion with permittees about management actions, observations, and opinions are a critical component for finding consensus based solution opportunities to new issues as they arise. The objective of these discussions would be to explore mutually acceptable ways to reduce the risk of contact between bighorn sheep and domestic sheep using a flexible adaptive approach to problem solving, and to be more responsive to the management needs of livestock permittees and the dynamic nature of a highly mobile wildlife species.

Annual reviews of risk assessment ratings and the potential for contact between domestic and bighorn sheep may be necessary because the West Needles S-71 and Cimarrona Peak S-16 herds appear to be increasing in numbers and slowly expanding in range. Additional monitoring and survey information is needed to better determine the status of the Vallecito Creek Herd S-28. Because bighorn CHHR's and populations are continuing to change, an adaptive approach to where and how domestic sheep are managed on the landscape is essential to bighorn conservation and for permittee operations.

Bighorn Herd Viability Discussion

A variety of factors have potential to influence habitat quality, quantity, and effectiveness for bighorn sheep, including recreation, fire/fuels management activities, and livestock grazing. Other agency activities such as timber management, oil and gas leasing and development, lands and special uses, watershed management, and cultural resource management are expected to have negligible influences on bighorn sheep because the vast majority of occupied summer and winter range is located in the Weminuche and South San Juan Wilderness areas where there is very limited active management. Habitat on the Forest for

bighorns outside designated Wilderness is generally in remote and rugged terrain, which also limits impacts associated from these activities.

A Forest-wide risk assessment (USDA Forest Service 2013a) concluded that domestic sheep grazing activities have the greatest potential to affect bighorn sheep herds on the San Juan NF. The risk assessment concluded that the potential interaction between bighorn sheep and domestic sheep and goats is the most influential factor with potential to affect bighorn sheep on the Forest. Physical contact between bighorn sheep and domestic sheep and goats, with the potential for subsequent disease transmission and a bighorn sheep mortality event, is the primary concern for Forest management activities to affect bighorn sheep populations.

As stated earlier, based on Risk of Contact Tool results, Alternative 4 has the greatest likelihood for maintaining bighorn sheep in the Weminuche Landscape, compared to the allotment configurations proposed under Alternatives 2 and 3. Under Alternative 4, the predicted total herd contact rates for foraging bighorns from the Cimarrona Peak Herd S-16 were all below about 0.08 and therefore low enough to have a high likelihood of individually providing for long term persistence of the S-16 herd (USDA Forest Service 2013c, USDA Forest Service 2010a, 2010c and 2010d). For bighorns foraging from the West Needles Herd S-71 and Vallecito Creek Herd S-28 CHHR's, only two of five individual allotment/bighorn herd combinations had predicted total herd contact rates below about 0.08. The remaining six individual allotment/bighorn herd combinations had predicted total herd contact rates well above 0.08. Total herd contact rates substantially above 0.08 indicate predicted contact rates in excess of one contact per 12 years with potential disease transmission intervals less than about 46 years. Disease return intervals more frequent than once every 46 years are less likely to ensure long-term bighorn herd persistence than disease return intervals exceeding about every 50 years (USDA Forest Service 2013c, USDA Forest Service 2010a, 2010c and 2010d).

In almost all cases, the total herd contact rates predicted by the Risk of Contact Tool for the Vallecito Creek Herd S-28 were higher than those for the West Needles Herd S-71, and much higher than those for the Cimarrona Peak Herd S-16. The total herd contact rates for S-28 indicate that even under the allotment configuration proposed in Alternative 4 there is concern for the potential for physical contact with the Endlich Mesa, Virginia Gulch and Tank Creek allotments, respectively. The total herd contact rates for these three allotments exceed the levels thought likely to maintain long-term bighorn herd persistence (one disease event every 46 years), even under an assumption of moderate (25%) or low (10%) disease transmission probability (USDA Forest Service 2013c, USDA Forest Service 2010a, 2010c and 2010d). By using moderate and low disease transmission probabilities, it is possible to address questions regarding the hypothesis that bighorn sheep have a high likelihood of contracting fatal respiratory disease following contact with domestic sheep.

For all alternatives, the Vallecito Creek Herd S-28 is predicted by the Risk of Contact Tool to be subject to the highest contact rates of the three bighorn CHHR's in the landscape, due to the combination of its larger population size and closer proximity to more of the allotments in the landscape. The S-28 herd had high probability of contact even when the probability of disease transmission is assumed to be low (10%).

For the West Needles Herd S-71, all total herd contact rates for active allotments in Alternative 4 were within the levels thought likely to maintain long-term bighorn herd persistence (one event every 46 years), assuming a low disease return interval (10% disease transmission probability). Under an assumption of moderate disease transmission probability

(25% disease transmission probability), two out of five allotment contact rates were within the levels thought likely to maintain long-term bighorn herd persistence (USDA Forest Service 2013c, USDA Forest Service 2010a, 2010c and 2010d). The remaining three allotment contact rates were at levels thought to only ensure short term herd persistence (USDA Forest Service 2013c, USDA Forest Service 2010a, 2010c and 2010d).

For the Cimarrona Peak Herd S-16, all total herd contact rates for active allotments in Alternative 4 were well below the levels thought likely to maintain long-term bighorn herd persistence (one event every 46 years), assuming moderate (25%) and low (10%) disease transmission probabilities. Under Alternative 3, which provides greater opportunities for contact between bighorn and domestic sheep than Alternative 4, total herd contact rates for half the allotments were below the levels thought likely to maintain long-term bighorn herd persistence, assuming a moderate (25%) disease transmission probability. Under an assumption of low disease transmission probability (10%) all active allotments had contact well below the levels thought likely to maintain long-term bighorn herd persistence.

Therefore, under Alternative 4, the action alternative most likely to maintain bighorn herd persistence in the long term, concern remains for the potential for a disease transmission event in the Weminuche Landscape due to a number of allotment/bighorn herd combinations having predicted total herd contact rates that substantially exceed the levels thought necessary to maintain herd persistence for the long term. These concerns are generally greatest in regards to the Vallecito Creek Herd S-28, which is believed to be connected biologically with the Cimarrona Peak Herd S-16 and Sheep Mountain Herd S-15 as members of the interconnected metapopulation named the Weminuche Herd RBS-20. For this reason, a disease event involving the Vallecito Creek Herd S-28 could also involve bighorn herds S-16 and S-15 through biological connections among these three herds.

There are a total of five bighorn sheep herds on the San Juan National Forest (S-15, S-16, S-28, S-31 and S-71) totaling about 625 individuals (USDA Forest Service 2013a). The Weminuche Herd RBS-20, S-15, S-16 and S-28, totals about 455 individuals, about 73% of the bighorn population on the San Juan National Forest. If a disease event involved S-28 and was to spread to S-16 and S-15 through the interconnected metapopulation structure of the Weminuche RBS-20 DAU, there is potential for a disease event to involve a high value population that comprises about 75% of the bighorn sheep population on the Forest. A bighorn mortality event involving three quarters of the Forest's bighorn herds would be a significant event for the administrative unit, though is unlikely to contribute to a trend towards federal listing.

As a sensitive species, individual bighorn sheep and habitats for bighorn sheep may be impacted, but actions should not contribute to a trend towards federal listing or a loss of viability on the planning area. A preponderance of the scientific literature supports the potential for disease to be transmitted from domestic sheep to bighorn sheep to which bighorns have little resistance, but there is uncertainty regarding the precise mechanisms of disease transmission, and uncertainty regarding the rate of physical contact that results in actual disease transmission in the wild. However, extensive scientific literature supports the relationship between disease in bighorn sheep populations and contact with domestic sheep. There is an increasing body of evidence that overwhelmingly demonstrates bighorn sheep near domestic sheep are at risk for disease transmission, even though physical contact between the species may not have been proven. The majority of literature supports the potential for disease transmission between the species, documents bighorn die-offs near domestic sheep, and supports the management goal of separating the species to prevent

disease transmission. Providing for effective separation between bighorn and domestic sheep for the purpose of preventing disease transmission and the potential for a subsequent bighorn mortality event meets conservation objectives for sensitive species to provide habitats necessary to provide for long term persistence of bighorn sheep on the administrative unit.

Alternative 4 is consistent with the conservation requirements for sensitive species. Alternative 4 removes all direct overlap between bighorn CHHR and domestic sheep allotments. It removes 77% of bighorn summer source habitats in the Weminuche Landscape from domestic sheep grazing opportunities. In addition, 51% of bighorn source habitat that overlaps with suitable domestic sheep range would be removed from domestic sheep grazing opportunities. Therefore Alternative 4 provides a much greater level of separation between bighorn sheep and domestic sheep grazing opportunities, while also having little effect on the amount of domestic sheep grazing acres in currently active allotments. Alternative 4 increases by about half the average distance from bighorn CHHR to allotments, compared to Alternatives 2 and 3. Alternative 4 also reduces the number of allotments ranked "High Risk" for physical contact between bighorn and domestic sheep by about 75%, compared to Alternative 2. Each of these factors provides demonstrates how Alternative 4 provides more effective separation between the species, compared to Alternatives 2 or 3, thereby enhancing the conservation of a designated sensitive species.

Annual rates of contact calculated by the Risk of Contact Tool in Alternative 4 predict total herd contact rates for all allotments combined for S-16, S-28 and S-71 at 0.12, 1.09 and 0.56, respectively. Obviously, the lower the probability of contact, the more likely a bighorn sheep population will persist. Assuming a low probability of disease transmission given contact (one in ten, or 10%), S-16 has a high likelihood of long term persistence (greater than 46 years) thereby meeting bighorn sheep viability requirements. S-28 and S-71 have lower likelihoods of long term persistence with predicted disease transmission intervals approximately every 10 years and 20 years, respectively. Because these intervals are predicted to result in multiple disease exposures with potential for multiple bighorn mortality events within a 46 year period, they are predicted to be less likely to maintain long term bighorn herd persistence. S-28 is predicted to have a low probability of long term persistence, and S-71 is predicted to have a moderate probability of long term persistence.

When the probability of disease transmission given contact is assumed to be moderate (one in four, or 25%), S-16 shows a moderate probability of long term persistence in Alternative 4, but S-28 and S-71 are predicted to have low probabilities of long term persistence. At disease transmission rates greater than .25, such as 1.0, the probability of long term persistence for S-16 is also low. The probability of long-term herd persistence is lower for all three bighorn herds in Alternatives 3 than Alternative 4, and lower in Alternative 2 than Alternative 3.

Uncertainty

There is uncertainty regarding the applicability of the default values suggested for use with the Risk of Contact Tool to the bighorn sheep herds of the Southern Rocky Mountains. In contrast to Hells Canyon, bighorn habitat in the Weminuche Landscape is dominated by rugged alpine terrain above timberline. There is uncertainty about the applicability of foray rates, distances, and probability assumptions in the Risk of Contact Tool developed in generally much lower elevation canyon settings compared to the generally much higher elevation alpine terrain typical of the Weminuche Landscape. There is no data from the Weminuche Landscape by which to test the models assumptions, especially those related to foraging rates and distances. For this reason, the appropriate level of confidence that should

be placed on the total herd contact rates generated by the model is not known. However, this uncertainty is unlikely to vary by alternative and thus there is no reason to believe that the uncertainty associated with the model's default foray values would favor one alternative over another. For this reason, the Tool is unlikely to bias the selection of one alternative versus another.

There is uncertainty how the Risk of Contact Tool predictions for bighorn contact with an allotment might relate to actual physical contact between individual bighorns and domestic sheep. If domestic sheep are not grazed equally across the entire allotment, there could be portions of the allotment where the potential for physical contact between the species is less or more than that predicted by the Risk of Contact Tool. Additional uncertainty results from the potential that an infected bighorn may not survive to return to its CHHR and infect other members of its home herd, and the uncertainty of infection resulting in a bighorn herd mortality event. To account for these interdependent uncertainties, the total herd contact rates were displayed with several levels of disease transmission probabilities. A "moderate" disease transmission probability was considered to be one in four contacts resulting in a disease transmission event (25% disease transmission probability), and a "low" disease transmission probability was considered to be one in ten contacts (10% disease transmission probability) resulting in a disease transmission event (C. O'Brien pers. comm., USDA Forest Service 2013c, USDA Forest Service 2010a, 2010c and 2010d). The uncertainty around these interrelated factors increase or reduce the actual risk of contact, compared to the rates predicted by the Risk of Contact Tool. For this reason, it is not known with certainty how much confidence should be placed in the precise actual total herd contact values produced by the Risk of Contact Tool. For this reason, the Risk of Contact Tool is assumed to be of highest value in terms of demonstrating the relative degree of risk of contact of the alternatives under consideration.

Uncertainty regarding the level of confidence that should be placed on the precise actual total herd contact values produced by the Risk of Contact Tool is derived from the past history of domestic sheep grazing and presumed bighorn sheep distribution and abundance patterns within the Weminuche Landscape. There is a history of apparent coexistence over the past 30 to 45+ years of most of the current bighorn sheep herds and domestic sheep allotment configuration in this landscape without evidence of a bighorn disease outbreak. Results from the Risk of Contact Tool predict that multiple contacts with active domestic sheep allotments, and multiple disease transmission events, should have occurred in this landscape during the past 30 to 45+ years. The currently active allotments and the S-28 and S-16 bighorn herds have been in essentially a stable state in their current configurations for decades with no evidence of a mortality event within the landscape's bighorn herds. For example, in 1973 Bear and Jones (1973) stated "there appears to have been very little change in the [S-16] population during the last 27 years" (about 1945-1972), which is a time when there were much higher domestic sheep stocking rates and many more active allotments than exist in the same area today. Given this appearance of a contradiction between an apparently disease free past history and the strength of the Risk of Contact Tool predictions for contact and disease transmission happening somewhere in the landscape multiple times per decade, this creates some degree of uncertainty about the efficacy of the Tool's total herd contact rate predictions.

There may be many reasons for this apparent contradiction between a 30 to 45+ year past history of no disease outbreaks, and Risk of Contact Tool predictions for multiple contacts and disease transmission events per decade. The high alpine and extremely rugged nature of many parts of the Weminuche Landscape may result in the presence of unrecognized terrain

features or geographic barriers to bighorn sheep movements that alter the foray probabilities from those predicted by the Risk of Contact Tool. The natural tendency for bighorn sheep to remain in their CHHR may be especially strong in these herds, given the nature of the landscape within which they occur. It is also possible that straying domestic sheep that might pose substantial risks for physical contact in other landscapes have lower survival rates wandering in the rugged terrain of the Weminuche Landscape, thereby preventing contact that might have otherwise occurred in other areas. It is also possible that the random nature of a very few foraging bighorn sheep on a very large and rugged landscape has produced no physical contacts; in essence, it has been a relatively long time (30 to 45+ years), but the very few bighorns out foraging have been lucky every year not encountering domestic sheep for no other reason than random chance alone. Nonetheless, this contrast between past history and strong predictions by the Risk of Contact Tool for multiple physical contacts and disease transmission events, especially involving the Vallecito Creek Herd S-28, is not readily explained and remains a source of uncertainty about how much confidence to place on the values generated by the Tool.

It must be recognized that the effectiveness of many of the project design criteria have not been tested or verified using a rigorous scientific approach. For this reason, there is uncertainty about their effectiveness. Although there is uncertainty regarding the effectiveness of project design criteria, it is logical to expect that full and complete implementation of all project design criteria has the potential to improve the effectiveness of separation of the species. Discussions with the permittees concluded that the project design criteria included as part of Alternatives 3 and 4 (Appendix 1, EA Table 2-3, below) are reasonable and feasible. These project design criteria are expected to enhance the effectiveness of separation, but the degree to which they might reduce the potential for physical contact between domestic sheep and bighorns is unknown. Because there is uncertainty about the effectiveness of project design criteria they should not be relied upon solely to achieve effective separation, particularly in areas of close association. Because of uncertainty about the effectiveness of project design criteria, application of project-level monitoring is a very important part of an adaptive management strategy to document the effectiveness of project design criteria within individual project areas. Failure to apply, monitor, and adjust management practices in an adaptive management context may result in unrealistic confidence being placed in the effectiveness of management practices, with potential for negative consequences to bighorn sheep.

There is uncertainty regarding how the behavioral attraction between domestic and bighorn sheep could increase the risk of contact within the landscape, above that predicted by the Risk of Contact Tool. The tool does not consider or attempt to model the natural attractive instincts of bighorn and domestic sheep. While on forays, because of this mutual attraction, bighorns are more likely to come into contact with domestic sheep bands. Also, domestic sheep strays are also more likely to contact bighorn sheep bands while traveling across the landscape. The effect of this mutual attraction is likely increased potential for physical contact between the species, if they are present in the same area at the same time, but the degree of increased potential for contact is not known. Because there should be equal risk under all three action alternatives from this factor, it is unlikely to suggest selection of one alternative over another.

There is uncertainty regarding stray domestic sheep and the risk of contact within and outside permitted allotments. The tool does not consider or attempt to model the movements (i.e. forays) of domestic sheep straying away from their bands and outside their permitted allotment. Straying domestic sheep are more likely to contact bighorn sheep than are

domestics that remain within their permitted allotments. The natural behavioral attraction of bighorn and domestic sheep make it more likely that straying domestic sheep may seek out and comingle with bighorn sheep when they are encountered during a stray. For this reason, straying domestic sheep increase the likelihood of physical contact occurring between the species. The presence of strays on the landscape may increase the risk of physical contact above that predicted by the Risk of Contact Tool, but the rate of domestic sheep strays is not known and thus it is not possible to determine with certainty to what degree strays might increase the risk of physical contact between domestic and bighorn sheep.

There is uncertainty regarding bighorn sheep foraging from herds in the Weminuche Landscape coming into contact with domestic sheep off NFS lands. There are risk factors outside the scope of the Forest's authority or control which may influence bighorn sheep populations in the Weminuche Landscape. For example, domestic sheep on private lands or adjacent jurisdictions may be contacted by foraging bighorns, which then return to their home herd in the landscape, potentially introducing disease to the herd and thereby affecting bighorn populations in the landscape. In some cases, adjacent private landowners or jurisdictions do not manage their lands to prevent circumstances that could lead to disease transmission to bighorn herds that share a common landscape with the SJNF. How the risk of contact between bighorn and domestic sheep is managed off NFS lands is beyond the control of the Forest. We are not aware of bands of domestic sheep on non-NFS lands within about 10 miles of the bighorn herds in the Weminuche Landscape. Further, there should be equal risk under all three action alternatives from this factor and therefore this factor is unlikely to alter which alternative would be most beneficial for bighorn sheep.

There is uncertainty regarding bighorn sheep movement across the Weminuche Landscape in response to a spruce beetle (*Dendroctonus rufipennis*) epidemic that is rapidly expanding from northern and eastern portions of the Landscape towards southern and western portions of the Landscape. Large stands of Engelmann spruce have either died or are dying, causing extensive openings in the overstory forest canopy. For example, within the past five years, the upper third of the Pine River and Vallecito Creek drainages have had extensive areas of mortality of mature Engelmann spruce trees, in some areas exceeding 80% to 90% of mature overstory trees. Within stands affected by spruce beetles, there is a high probability that most spruce trees over five inches dbh will die. Within the next five years the beetle outbreak is expected to expand down the Pine River and Vallecito Creek drainages, and is expected to increase in the upper Florida River and Missionary Ridge portions of the Weminuche Landscape.

The spruce die-offs resulting from this beetle epidemic are expected to increase forbs and grasses in the understory of previously closed-canopy stands. For this reason, the beetle epidemic has the potential to substantially alter habitat conditions for bighorn sheep, likely improving habitat connectivity for bighorn sheep in the most heavily affected areas by opening the canopy of mature closed-canopy stands, potentially greatly improving bighorn forage and travel habitats. Most forests in the landscape are mature closed-canopy spruce-fir stands that are at risk to beetles. In northern and eastern portions of the landscape that have many heavily affected forest stands, bighorn mobility across the landscape could be substantially improved thereby increasing the potential for foraging bighorns to contact active allotments and come into physical contact with domestic sheep. However, because there should be equal risk under all three action alternatives from this factor, it is unlikely to suggest selection of one alternative over another.

Conformance with Land and Resource Management Plan (Forest Plan)

This decision is consistent with direction in the 2013 Final San Juan National Forest and Proposed Tres Rios Field Office Land and Resource Management Plan (USDA Forest Service 2013e) because both Alternative 3 and 4 would eliminate all areas of overlap that exist under current condition between active domestic sheep allotments and bighorn CHHR. The proposed action (Alternative 4) would eliminate the risk of physical contact with domestic sheep on 77% of bighorn source habitat in the Weminuche Landscape, compared to eliminating the risk of contact on 54% of bighorn source habitat under Alternative 3. Adopting Alternative 2 would result in continued risk of contact on all bighorn source habitat in the Weminuche Landscape. The proposed action would maintain grazing opportunities on all currently active domestic sheep allotments in the Weminuche Landscape thereby minimizing impacts to current domestic sheep permittees while simultaneously providing substantial habitat enhancement value for bighorn sheep. Because the proposed action (Alternative 4) maintains all active domestic sheep allotments it would provide consistency and maintain economic stability for the domestic sheep industry. The proposed action also provides substantial long-term protections for wildlife watching and hunting opportunities involving bighorn sheep in the Weminuche Landscape, as well as across the San Juan NF administrative unit.

Project level and planning-level direction for land management decisions is provided by the land and resource management plan in the form of objectives, goals, standards and guidelines. The following definitions and resource direction is excerpted from the 2013 Forest Plan.

“A standard is an approach or condition that is determined to be necessary to meet desired future conditions and objectives, and/or to ensure the long-term viability of resources. A standard describes a course of action that must be followed or a level of attainment that must be reached. Deviations from standards would require analysis and documentation through a subsequent land management plan amendment.”

“A guideline is presumptively a requirement to meet desired future conditions and objectives, and/or to ensure the long-term viability of resources. Guidelines are put forward in this LRMP in recognition that there may be circumstances that could generate or require alternative, more appropriate means of meeting desired future conditions and objectives, and/or to ensure the long-term viability of resources.” “If the Responsible Official for a project decision finds that deviation from a guideline is necessary, he or she must record the reasons for deviation as part of the project decision and explain how the intent of the guideline, -as established by the desired future conditions and objectives, and/or need to ensure long-term viability of resources- is being met through alternative means. If the intent of the guideline is met through alternative means, a land management plan amendment typically would not be required.”

Only that Forest Plan direction applicable to the project and/or proposed action is discussed below.

Standard 2.3.39 **Bighorn sheep** (*Ovis canadensis*): during project-level planning on domestic sheep (*O. aries*) allotments, management options must be developed to prevent physical contact between domestic sheep and bighorn sheep. Actions may include but are not limited to boundary modification, livestock-type conversion, or allotment closures.

This standard is met by the project design criteria applied under Alternatives 3 and 4 (see EA Table 2-3, Appendix 1, below), by the allotment boundary adjustments proposed under Alternatives 3 and 4, and by the allotment closures proposed under Alternatives 3 and 4.

Standard 2.3.40 **Bighorn Sheep:** Grazing permit administration in occupied bighorn sheep habitat must utilize measures to prevent physical contact between domestic sheep and bighorn sheep. Permit administration actions may include but are not limited to use of guard dogs, grazing rotation adjustments, or relocation of salting and bed grounds.

This standard is met by the project design criteria applied under Alternatives 3 and 4 (see EA Table 2-3, Appendix 1, below).

Standard 2.3.41 **Bighorn Sheep:** Management of recreational pack goats and other domestic goats (*Capra aegagrus hircus*) must utilize measures to prevent physical contact with bighorn sheep.

This standard does not apply to this project because the use of recreational pack goats is outside the scope of this project-level decision.

Standard 2.3.42 **Bighorn Sheep:** Domestic goats used for invasive plant control must be veterinarian certified as free of pathogens transmissible to bighorn sheep, except in areas where there is no risk of contact with bighorn sheep.

This standard does not apply to this project because the use of domestic goats for invasive plant control is outside the scope of this project-level decision.

Guideline 2.3.64 **Bighorn Sheep:** Projects or activities that adversely impact bighorn sheep production areas by reducing habitat effectiveness should be limited or avoided, using access restrictions during the following periods (see Figure 2.3.3):

- Rocky Mountain bighorn sheep (*Ovis Canadensis Canadensis*): April 15-June 30.
- Desert bighorn sheep (*O.c. nelsoni*): February 1-May 1.

This guideline is met by the allotment boundary adjustments proposed under Alternatives 3 and 4 that remove all bighorn sheep production areas from active and forage reserve allotments thereby maintaining bighorn habitat effectiveness.

Guideline 2.3.65 **Bighorn Sheep:** Projects or activities that adversely impact bighorn sheep severe winter range and winter concentration areas by reducing habitat effectiveness should be limited or avoided using access restrictions during the following periods:

- Rocky Mountain bighorn sheep: November 1-April 15
- Desert bighorn sheep: December 1-April 15.

This guideline is met by the allotment boundary adjustments proposed under Alternatives 3 and 4 that remove all bighorn sheep severe winter range and winter concentration areas from active and forage reserve allotments thereby maintaining bighorn habitat effectiveness.

Standard 2.7.12 Management of domestic sheep must utilize measures to prevent physical contact with bighorn sheep.

This standard is met by the project design criteria applied under Alternatives 3 and 4 (see EA Table 2-3, Appendix 1, below), by the allotment boundary adjustments proposed under Alternatives 3 and 4, and by the allotment closures proposed under Alternatives 3 and 4.

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Figure 2. Bighorn Sheep – Domestic Sheep Overlap in the Weminuche Grazing Analysis Landscape under Alternative 2 (current configuration).

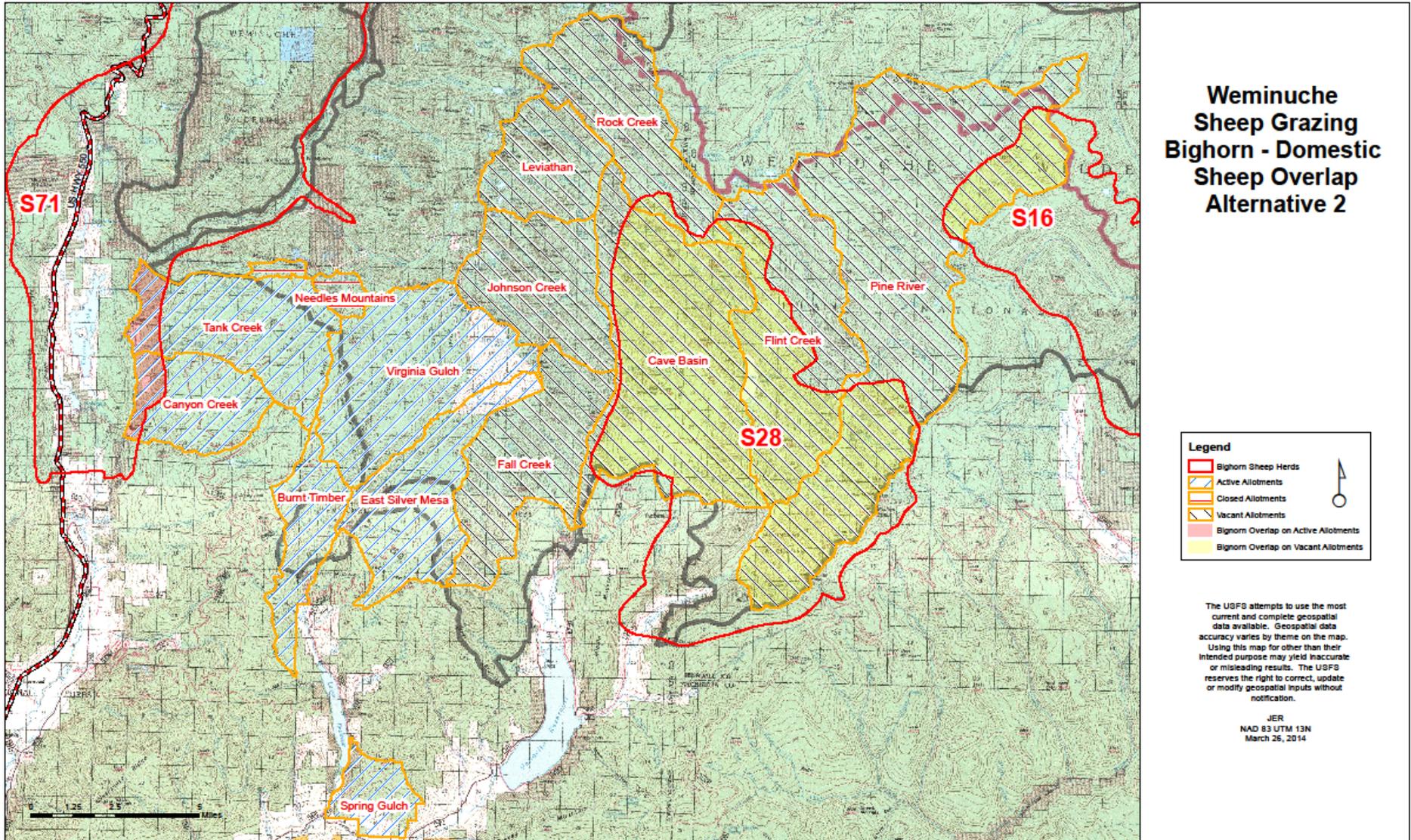


Figure 3. Bighorn Sheep – Domestic Sheep Overlap in the Weminuche Grazing Analysis Landscape under Alternative 3 (forage reserve alternative).

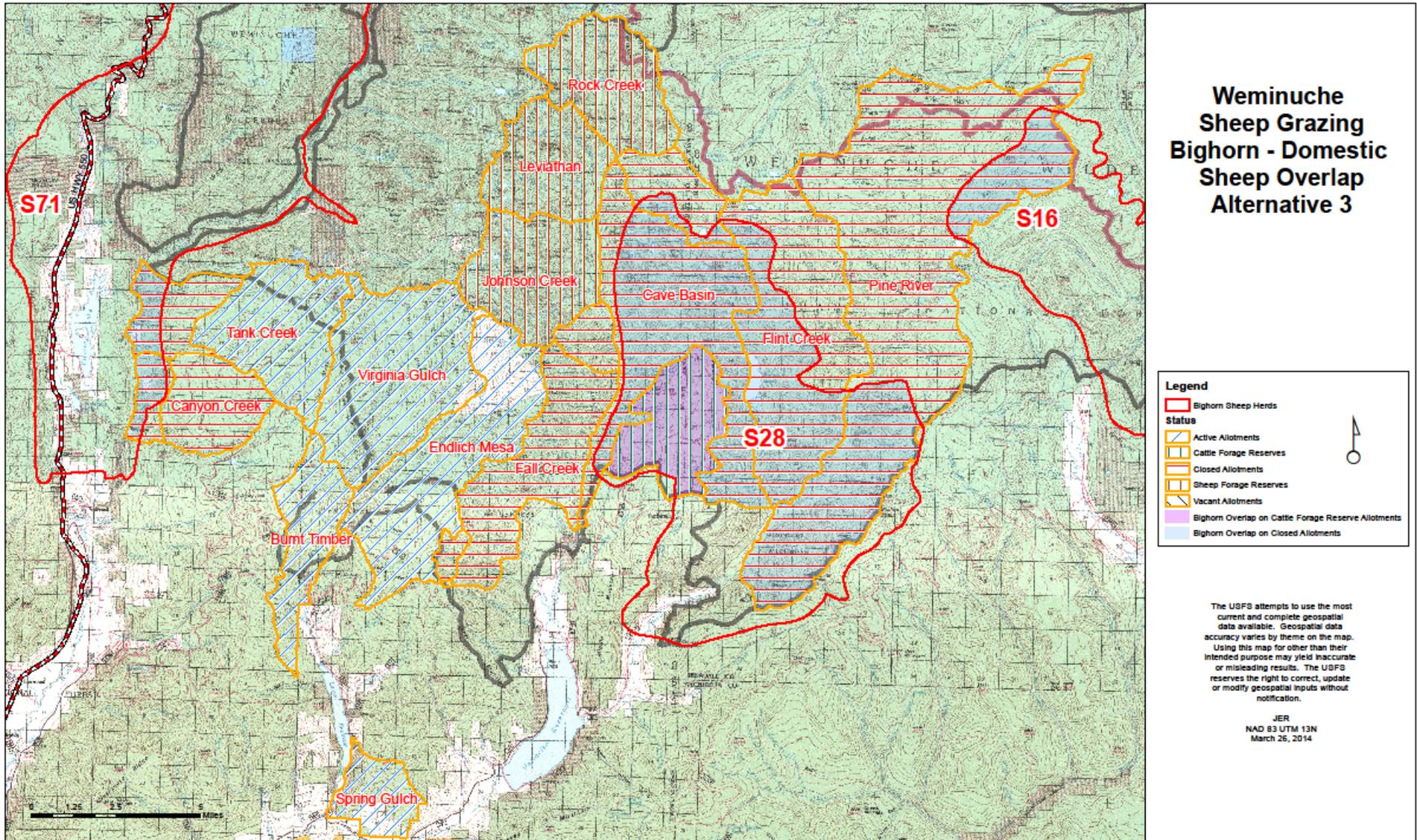


Figure 4. Bighorn Sheep – Domestic Sheep Overlap in the Weminuche Grazing Analysis Landscape under Alternative 4 (proposed action).

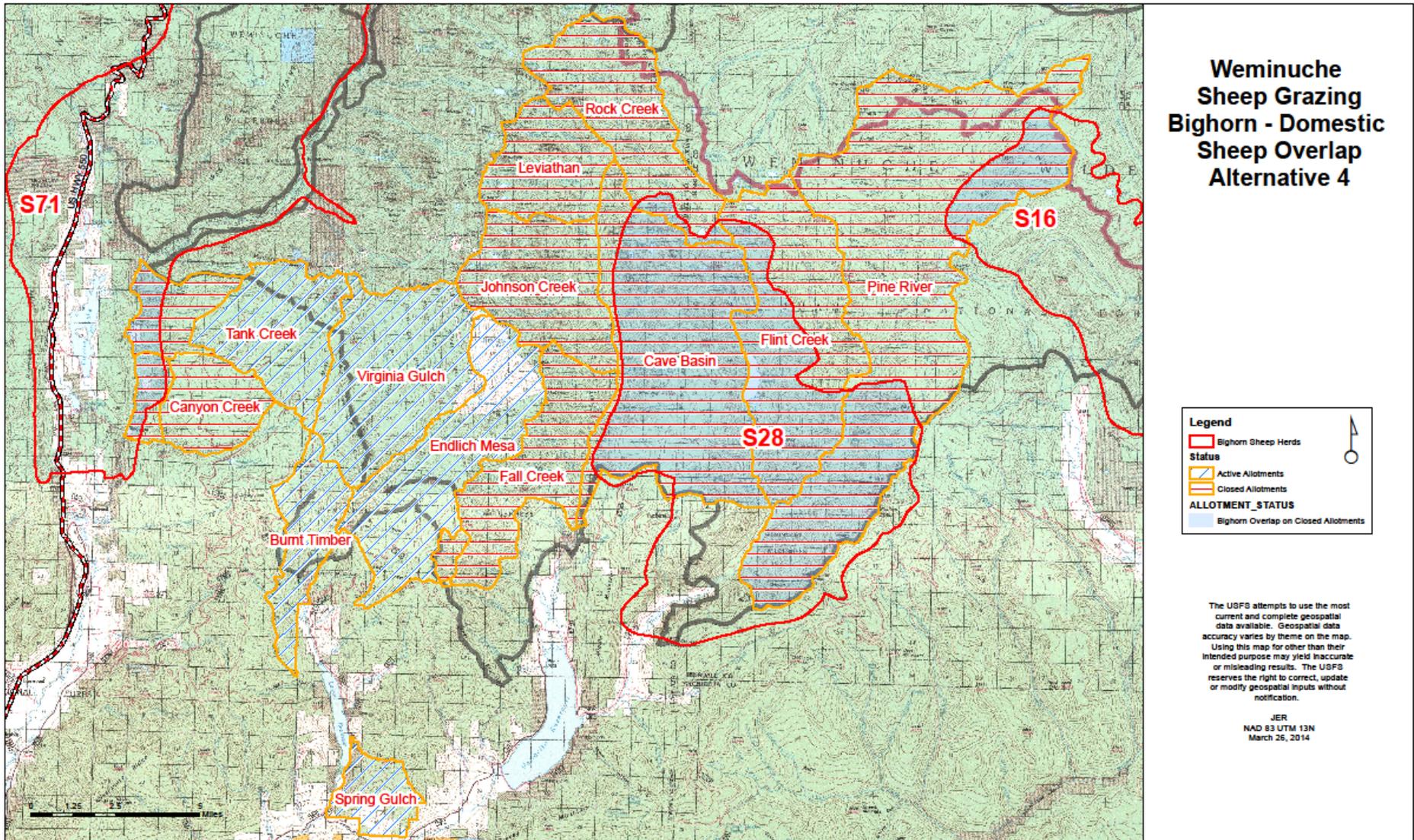


Figure 5. Ratings for Risk of Physical Contact between Bighorn Sheep and Domestic Sheep in the Weminuche Grazing Analysis Landscape under Alternative 2 (current configuration).

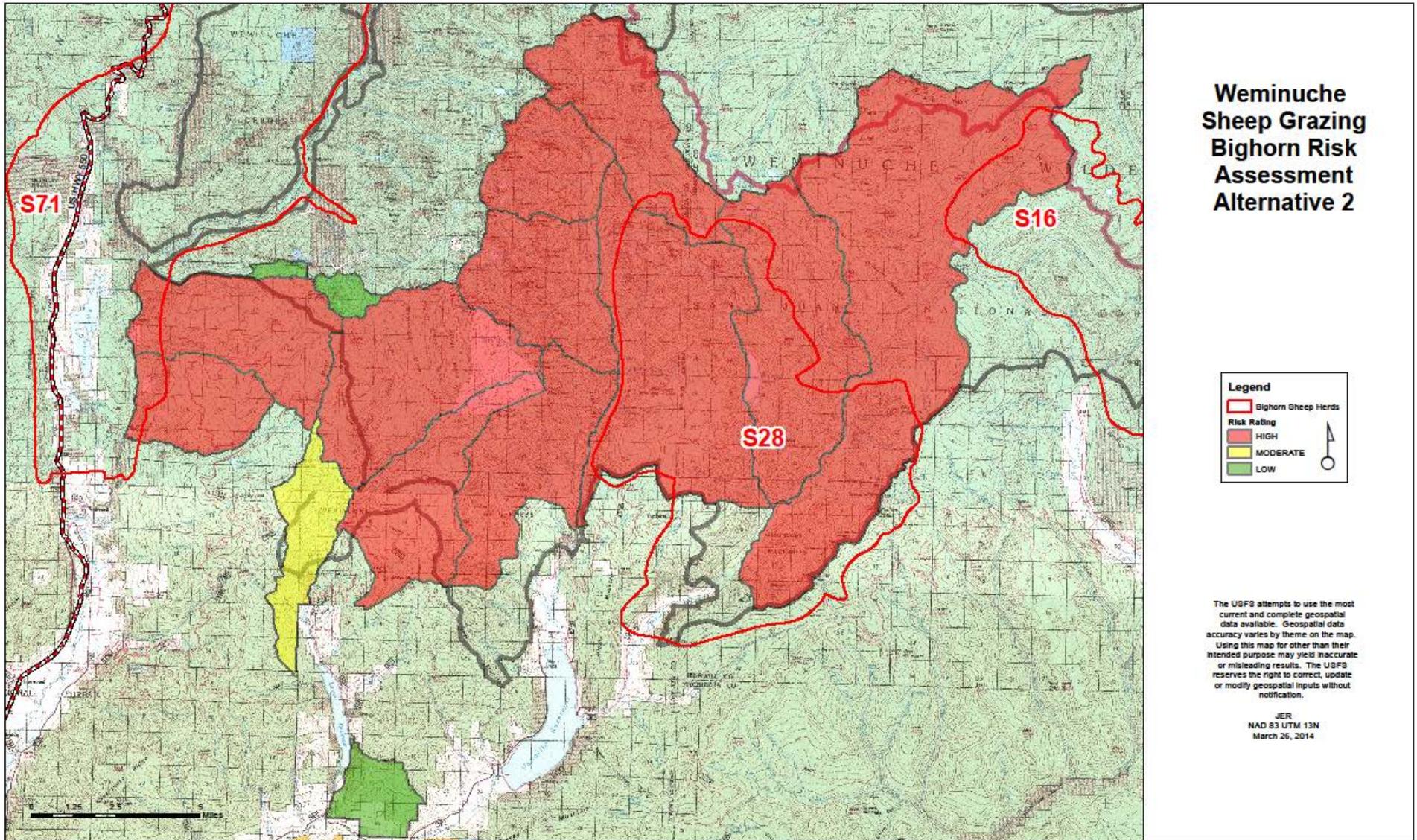


Figure 6. Ratings for Risk of Physical Contact between Bighorn Sheep and Domestic Sheep in the Weminuche Grazing Analysis Landscape under Alternative 3 (forage reserve alternative).

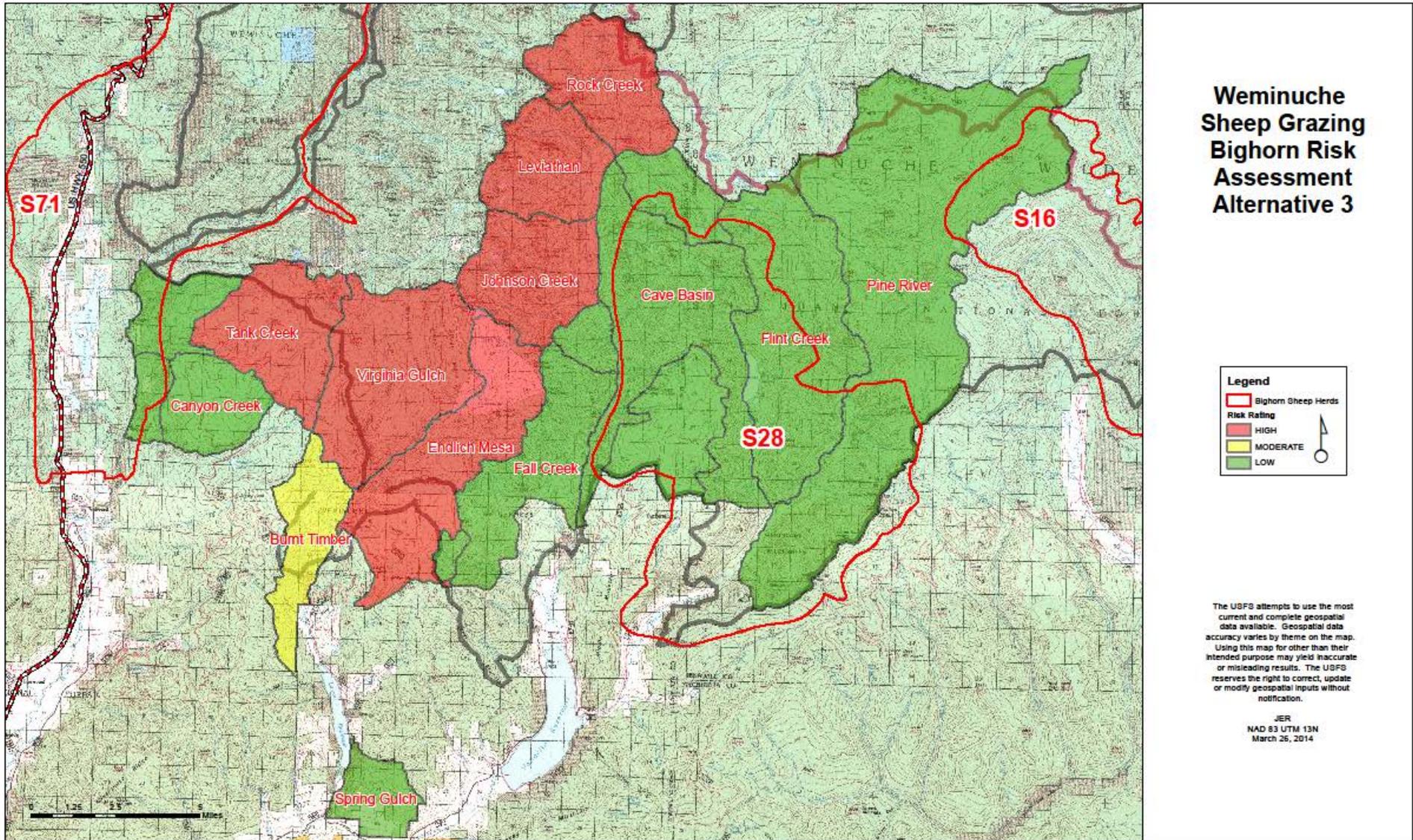
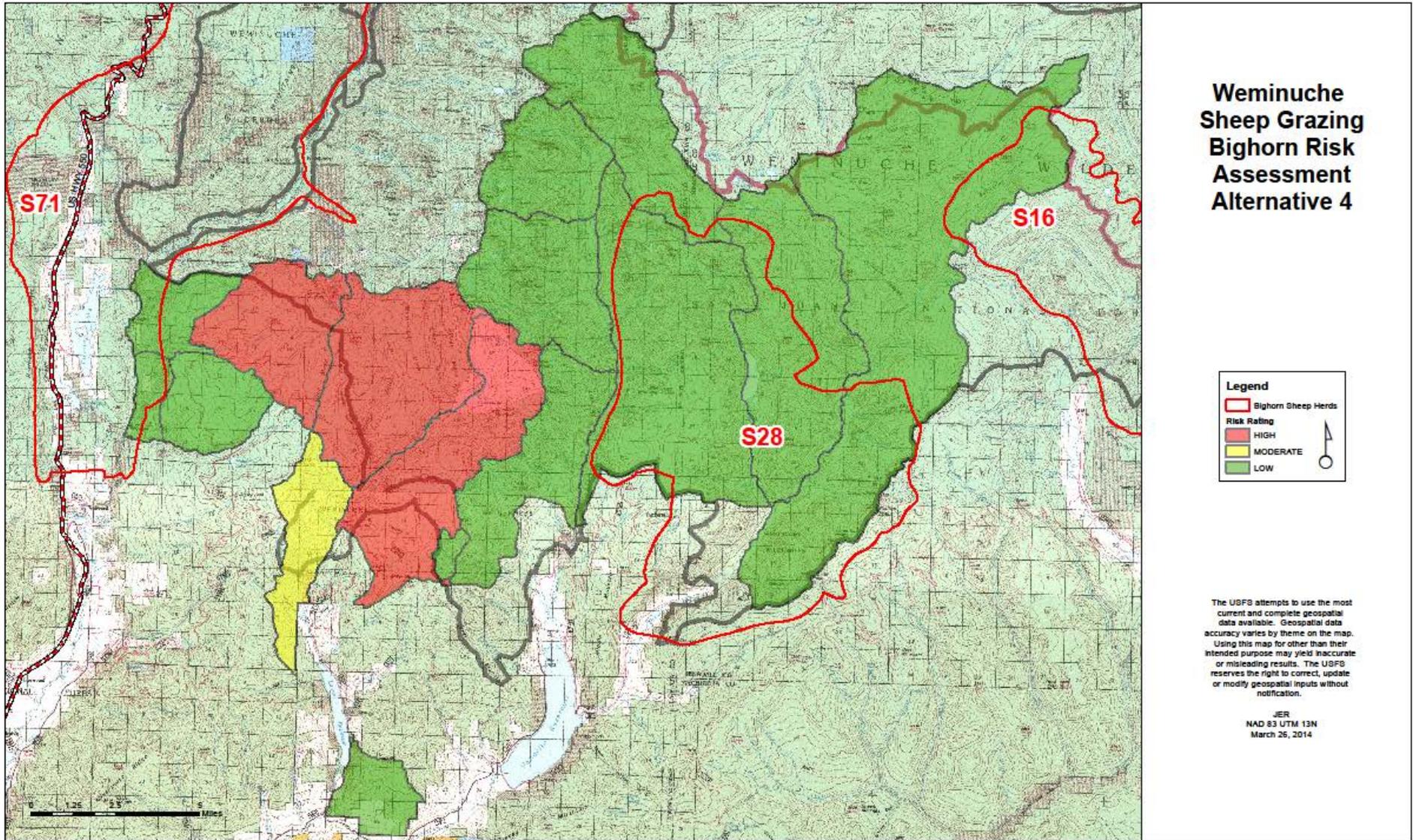


Figure 7. Ratings for Risk of Physical Contact between Bighorn Sheep and Domestic Sheep in the Weminuche Grazing Analysis Landscape under Alternative 4 (proposed action).



Appendix 1

EA Table 2-3. Project Design Criteria to minimize contact between Bighorn and Domestic Sheep.

Alternatives 3 and 4 include direction for meeting certain resource conditions using monitoring and a variety of adaptive management “tools”, or actions, to reach or maintain those conditions. Adaptive Management is designed to be flexible in regards to livestock numbers, season dates, and class of livestock. Also included in these alternatives are specific action items included in site-specific design criteria, and general project design criteria that apply everywhere across the landscape at all times.

Risk Assessments (in the project record)	Alternative		
	2	3	4
<p>High Risk Allotments</p> <p>Permitted domestic sheep and goat grazing will not be authorized within high risk areas of the allotment. In most instances, domestic sheep may still be authorized <i>within the allotment</i> but management will ensure routing and other design criteria to avoid the high risk areas. This can be accomplished through adaptive management tools. (2.1)</p> <p>Moderate Risk Allotments</p> <p>Permitted domestic sheep and goat grazing may be authorized. However, design criteria will still be implemented to strive to reduce the potential for contact even farther. (2.2)</p> <p>Low Risk Allotments</p> <p>Permitted domestic sheep and goat grazing may be authorized. Permitted domestic sheep grazing will be focused towards these areas. However, design criteria should still be implemented to strive to reduce the potential for contact even farther. (2.3)</p>		x	x
Creating More Effective Separation Between Domestic Sheep and Bighorn Sheep	Alternative		
	2	3	4
<p>Follow the response protocol for confirmed contact or threat of impending contact between permitted domestic sheep and bighorn sheep:</p> <p>Permittee</p> <p>The permittee or their agent will contact the Columbine Ranger District range personnel immediately if bighorn come into contact or there is a threat of impending contact with domestic sheep. Contact information as well as phone numbers will be included in the Annual Operating Instructions. (2.4)</p> <p>As an immediate response, the permittee and/or the herders will be authorized to haze bighorn that are threatening to make contact with domestic sheep. This will be accomplished through an agreement between the grazing permittee and the CPW. The agreement will include circumstances requiring hazing response, appropriate type of hazing and reporting requirements. (2.5)</p> <p>Forest Service</p> <p>When informed about potential bighorn/domestic sheep contact, the FS will contact the permittee immediately notifying them of the situation. At this point, the FS and the permittee will implement other design criteria if needed to prevent or reduce the threat of impending contact. At this time an alternate plan of grazing for the remainder of the season, “flexible management” may be implemented to reduce the potential for physical contact to occur. Adjustments may be extended to upcoming seasons. (2.6)</p> <p>Concurrently, as contact, or the threat of contact, is made known, the FS will contact the CPW (contact information will be provided to the FS and the permittee prior to the grazing season). Actions that the CPW will take is at their discretion concerning wildlife health intervention and management of the bighorn. CPW will inform the FS if the situation is rectified and discussion/planning will occur with the permittee to implement an alternate management strategy if needed. The CPW may implement post contact monitoring. (2.7)</p>		x	x
<p>In allotments where there is a confirmed contact, or increased risk of contact, the FS will make the particular domestic sheep band (and the area) a high priority for monitoring to determine if there is bighorn activity in the area or if the risk assessment should be revisited. (2.8)</p>		x	x

<p>The FS will work with CPW to prioritize and implement coordinated annual monitoring of bighorn sheep individuals and populations. Monitoring activities could include coordinated ground counts, aerial counts, electronic data, etc. Implement a system for immediate cross-agency sharing of bighorn sighting reports to keep all parties informed about bighorn use. (2.9)</p> <p>Annually, in conjunction with CPW and the permittee, review the effectiveness of Design Criteria implementation and new information such as recent bighorn sightings. Update the allotment Risk Assessment if necessary, and make adjustments to upcoming grazing accordingly. These adjustments may include adjacent USFS administrative units, depending on availability and feasibility. Feasibility includes the permittees' needs as well as the administrative availability of allotments on other administrative units. Adjustments will be focused on reducing the risk physical contact and creating more effective separation. (2.10)</p> <p>Sheep and goat allotments with mapped overlap of bighorn summer range will be evaluated for closure when/if permits are relinquished back to the FS. (2.11)</p>			
<p>Herding</p> <p>At least one herder is required to be with the sheep. The main flock will never be left unattended, except at night, and short periods when the herder is accomplishing other tasks in the immediate area. A herder must remain in the camp during the night. (2.12)</p>		x	x
<p>Trailing of domestic sheep will happen as much as possible during the middle of the day to avoid bighorn activity periods. In certain areas this may not be possible due to conflicts with recreational users. (2.13)</p>		x	x
<p>Sick or diseased domestic sheep and goats – post turnout</p> <p>Injured, sick or diseased livestock will not be left behind but will be removed or terminated and disposed of according to the "Disposal of Dead Livestock" requirements below and in accordance with State Statute. Sick or diseased animals will be removed or otherwise eliminated when identified. (2.14)</p>		x	x
<p>Sick or diseased domestic sheep and goats – pre turnout</p> <p>It is imperative that permittees maintain a high certainty of domestic animal health in their permitted stock. Permittees/Herders will take appropriate measures to prevent turnout of sick or diseased domestic sheep and goats on grazing allotments, on trailing routes, or in weed control or pack-stock situations. It should also be recognized that "healthy-appearing" domestic sheep and goats may still carry pathogens (harmless to them) that can be transmitted to bighorn sheep. (2.15)</p>		x	x
<p>Sick or diseased bighorn sheep</p> <p>Sick bighorn sheep or carcasses must be reported as soon as possible to CPW staff or the Columbine Ranger District range personnel. Agency personnel will then notify the CPW as soon as possible. (2.16)</p>		x	x
<p>Herder education</p> <p>It is of utmost importance that the permittees spend as much time as necessary teaching the herders the requirements attached to the grazing permit, annual operating instructions and all the applicable Project Design Criteria included here. With the implementation of "adaptive management," areas authorized for grazing as well as routing patterns and schedules may change from year to year and even within the year, along with other management techniques. Following procedures to avoid contact and prompt accurate reporting of bighorn/domestic sheep contact or impending contact is essential. Herders are crucial to ensuring proper management and in maintaining compliance to an exacting standard. Ultimately the responsibility rests upon the permittees to ensure compliance is being achieved. (2.17)</p>		x	x
<p>Salting</p> <p>Every effort should be made to deny bighorn access and consequent attraction to domestic sheep salting activities. Leaving available salt or excess salt residue in the soil or on rocks or tubs presents a salt source that may attract bighorn and may even train bighorn to follow the domestic sheep bands in search of salt. (2.18)</p> <p>Blocks of salt will be allowed and, if used, will be kept with the domestic sheep at all times. Salt will not be left behind when the domestic sheep are moved. (2.19)</p> <p>Salt or supplement will be placed only on rocky knolls, well-drained sites or in timber where excessive trampling will not destroy plant growth. Salt or supplement will not be placed closer than ¼ mile to streams, springs, water developments, or other wetlands without prior approval of the Agency Officer. Salt or supplement will not be placed near trailheads, on open roads, in natural travel routes, passes, parks, meadows, in areas of concentrated public use, or in other areas where such placement is liable to result in conflicts with other public land users. Salt or supplement will not be placed within tree regeneration areas where the smallest trees are less than three feet tall. (2.20)</p>		x	x

<p>General wildlife sighting reporting</p> <p>Permittees will be required to report wildlife sightings on the annual actual use form that must be turned in each fall to the FS; however sightings of bighorn in proximity to domestic sheep band must be reported immediately. If bighorn are seen near or on a FS sheep allotment, follow the protocol described above. (2.21)</p>	x	x
<p>Planned domestic sheep estrus cycle</p> <p>The planned breeding season for the domestic sheep operation will not occur during the permitted grazing season on federal land. This is intended to reduce the potential for attraction of bighorn rams to domestic sheep ewes in estrus. (2.22)</p>	x	x
<p>Permitted domestic sheep stray management</p>	Alternative	
	2	3
<p>Accountability of Permittee</p> <p>Extensive efforts will be made by the permittee to remove every authorized domestic sheep from the allotment following the grazing season. All sheep must be accounted for (dead or alive) as they enter and exit each allotment, and as they exit the Analysis Area at the end of the season. Special attention should be given to accounting for sheep at all times. If sheep are unaccounted for, diligent efforts should be made to locate them as quickly as possible. If the FS feels that appropriate efforts are not being implemented, a count-on/count-off inventory will be required as a condition of operation. (2.23)</p>	x	x
<p>Permittees will be required to begin searching for stray domestic sheep within 24 hours of notice by the Forest Service. Stray domestic sheep will be gathered or disposed as soon as they are located. A follow-up report (verbal or written) will be provided to the FS on time, date and action taken to resolve the matter; within four days from the notice given by the FS. Any stray sheep within the boundaries of an allotment are considered to be the property of the allotment permit-holder. (2.24)</p>	x	x
<p>Driveways and trails will be revisited within 1 week of being used to ensure domestics have not been left behind. (2.25)</p>	x	x
<p>Trailing</p> <p>Random on-site compliance monitoring to minimize strays will be conducted by the Forest Service.</p> <p>Trucking of domestic sheep and goats is preferred to trailing except in situations where risk of contact is possible (i.e., trucking drop off points in subpopulation areas). In most cases, trucking reduces the chance of stray domestics, and lessens the chance of opportunistic contact by wandering bighorn sheep.</p> <p>Domestic sheep will be kept in a tight group during trailing. (2.26)</p>	x	x
<p>Domestic sheep identification</p> <p>Permittees may be required to freshly mark (sheep paint) their sheep before they enter onto the National Forest. The FS will coordinate with the permittees annually with specific information regarding color of paint used in marking their sheep, brands used, ear tags used and colors, earmarks, and other distinguishing marks or characteristics that may be used in identifying their sheep. If a permittee does not wish to paint brand their sheep, that permittee will be assigned a region that they will be responsible for responding to all reports of stray domestic sheep (even if it is not their sheep). (2.27)</p>	x	x
<p>Permit Action</p> <p>Repeated non-compliance with domestic sheep stray management will result in appropriate permit action. (2.28)</p>	x	x