Hydrology Report for the Agriculture Research Station, Dubois, Idaho- Revised Specialist Report for Revised Draft EIS.

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for:

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Introduction

The Agricultural Research Service (ARS) proposes to continue ongoing sheep grazing, research and associated activities that have been historically occurring for the last 86 years, at the United States Sheep Experiment Station (USSES). The USSES conducts research to develop integrated methods for increasing production efficiency of sheep to improve sustainability of rangeland ecosystems (USDA ARS, 2009). Currently, the Agriculture Research Station grazes 3,000 mature sheep on their land base.

This report will discuss the effects on hydrology and soils of continuing operations of the USDA Dubois Sheep Agricultural Research Station (ARS). The purpose of the analysis is disclose the environmental effects of continued sheep grazing operations and alternatives, and to determine the proposal or alternatives would violate relevant laws and regulations. Fieldwork was performed during June and July 2008 and June and August 2009 to evaluate the current conditions on the ground.

The project area is the collective land of the ARS, collectively 47,340 acres. Lower elevations properties include the Headquarters property, Humphrey Ranch, and Henninger Ranch, which total 30,125 acres. In addition, the property includes the Sheep Stations East and West Summer Ranges, which total 17,215 acres. For the rest of this report these areas are referred to as the East and West Summer Ranges. These ranges are located in the Centennial Mountains, approximately 25 miles due west of Yellowstone National Park (Figure 1).

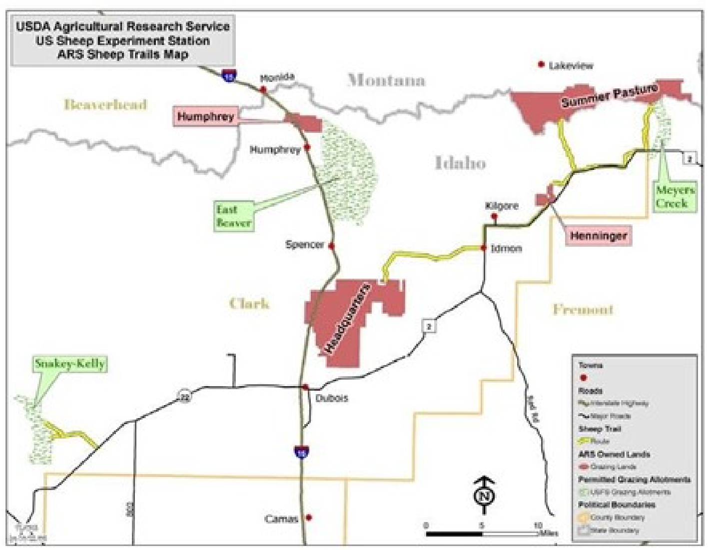

Figure 1. Location of ARS Headquarters and Associated Properties

Overview of Concerns Addressed

Concerns relevant to hydrologic resources were summarized in the 2011 Scoping comments table (USDA Forest Service, 2009). Identified hydrology-related concerns are:

- Assess the impacts on water quality
- Assess aquatic impacts
- Consider mitigation measures to reduce the impacts of sheep trails on water quality and erosion, including bridges, re-routes and closing sensitive sites to sheep
- Potential overgrazing in the North Fork of Tom's Creek and associated erosion and potential impacts downstream due to sedimentation

Methodology

Initial field visits to the project area to collect data and make observations were conducted on July 8 through July 12, and August 28 through September 2 of 2008. During these two visits periodic observations were made of ground cover, surface condition, geology, and, where applicable, stream channel stability and trend. Surface condition used soil indicators from the R4 soil quality monitoring protocol. A rating classification of soil condition and cover, with ratings 1 through 4, was devised to catalogue observations. These classifications were quantified to portray general conditions and spatial trends (USDA 2003, USDA Forest Service 2008).

- Condition Class 1 indicated ground that has severe soil disturbance and in a hydrologically impaired state. Soil conditions follow Forest Service (2003) indications for long term impairments to soil productivity with sparse ground cover, evidence of severe compaction (surface ponding), displacement, or erosion (rills, soil pedestals).
- Condition Class 2 would be ground that also had evidence of soil disturbance with marginal hydrologic functionality, and little or no sign of recent sheet wash, surface erosion. Soil ground cover and understory vegetation are adequate to resist erosion.
- Condition Class 3 indicates conditions with one-time impairment, but recovery to full hydrologic function.
- Condition Class 4 has minimal sign of impairment with complete soil and hydrologic function.

Proper Functioning Condition (PFC) surveys were also conducted at sites located within the project area. PFC surveys are used to evaluate riparian and stream channel conditions on selected reaches (USDI, 1998).

Additional locations and site visits were conducted in June and August of 2009 in coordination with other specialists. Additional PFC and site-specific information on hydrologic conditions and functions were gathered at this time.

Geographical Information System (GIS) data was used to help determine values for the measures of analysis. GIS layers were used to define 6th level watersheds, stream courses, grazing areas, ARS summer ranges and allotments, sheep trails, trails, water developments and roads. Best available science, literature reviews, discussions with local experts, and professional judgment were also used in analyzing data and developing interpretations. Field notes and photographs are in the planning file. Figure 2 summarizes the location of data points collected 2008 and 2009 respectively. Points were collected using a GPS.

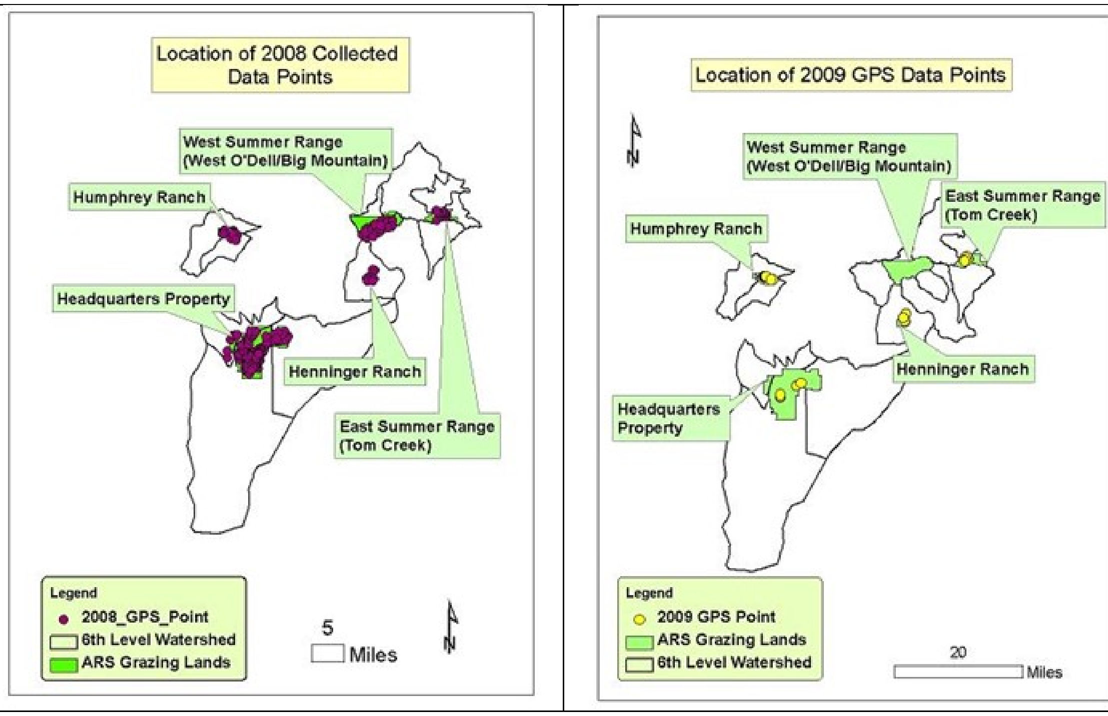

Figure 2. Locations of 2008 (left) and 2009(Right) Data Points

Affected Environment

Table 1 summarizes the watersheds involved with the project by property.

Table 1. Summary of Watersheds Involved with the Project by Grazing Property

Property	Watershed Involved with Allotment/Range by Number	Property	Watershed Involved with Allotment/Range by Number
Headquarters	170402140101 170402140401 170402140501	West Summer Range (Odell Creek/Big Mountain)	170402140606 170402140607 100200012101 100200012102 170402020801 170402020802
Humphrey Ranch	170402140404 170402140405	Snakey-Kelly	170402140601 170402150401
Henninger Ranch	170402140607	East Beaver	170402140404 170402140405 170402140406 170402140407 170402140408 170402140603
East Summer Range (Tom's Creek)	100200012101 100200012201 100200012202 170402020803	Meyers Creek	100200012101 170402020803

Figure 3 displays the ARS lands within the project area and the associated 6th order watersheds.

Climate

Idaho is influenced by Pacific Ocean maritime air borne on the prevailing westerly winds. An exception would be moist air moving from the Gulf of Mexico during the summer months, the situation prevalent in Eastern Idaho and producing the greatest rainfall (Western Regional Climate Center, 2008). Maximum monthly precipitation in the region of the ARS lands for the period of record at area weather stations (Table 2) is usually in June. The spring and summer months of April through September produces more than 50 percent of annual precipitation.

Differences between stations in annual precipitation rate are largely a matter of elevation.

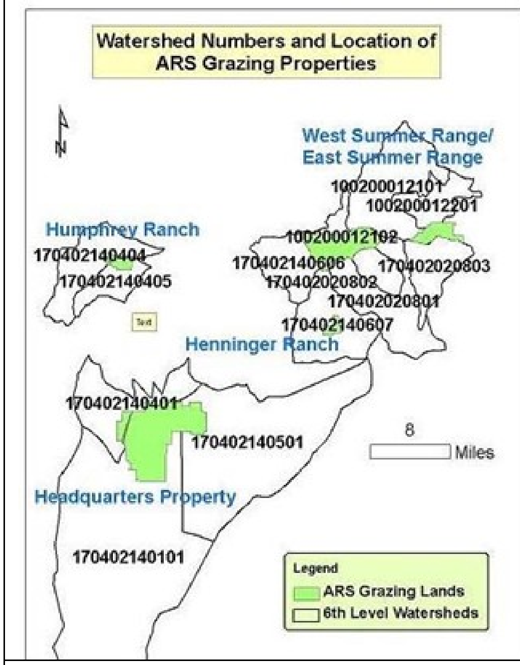

Figure 3. Locations of Watersheds Involved with ARS Grazing Lands

Average annual precipitation for the lower ARS lands (two stations near Dubois, Henninger, and Humphrey Ranch), range from 12 inches at the Dubois station (NCDC COOP #102707) to 21 inches at Kilgore (NCDC COOP #104908) which is near the Henninger Ranch (National Climate Data Center, 2008a and b). There are no stations near the higher elevation summer range or comparable stations nearby, so estimates for those properties are determined for this report from isohyetal contours from a precipitation atlas. Total annual precipitation in the summer ranges (Tom's Creek, Odell, and Big Mountain) in the Centennial Mountains is between 30 and 40 inches per year (USDA-NRCS, 2008).

Rainfall intensity rates are relatively low, more similar to coastal than more inland continental, and also quite similar across elevation ranges. High frequency storms, such as the 2-year 6-hour storm, have rainfall intensities between 0.7 and 0.9 inches per hour, and low frequency, 10-year, 6-hour storms, between 1.1 and 1.3 inches per hour, from valley to mountain crest, respectively (NOAA, 1973).

Table 2. Summary of climate data for ARS Properties

Property/Weather Station	Average Annual Precipitation	Average Precipitation (April-September)	Maximum Rainfall (2 year, 6-Hour)[a]	Period of Record
Headquarters	11.9	7.0	0.7	1925-2007
Henninger Ranch	21.1	10.4	0.9	1960-1977
Humphrey Ranch	14.0	8.8	0.8	1949-1992
Summer Range/NA[b]	30-40**	N/A	0.9	N/A

a - USDA—NRCS, National Water and Climate Center (website) ***NOAA Atlas 2 Vol. V, 1973

b - Summer Ranges are Tom's Creek, Odell, and Big Mountain

Geology

The geology varies dramatically over USSES properties. Geological discussions in this report are excerpted from Moser et al, 2008, into this report, as there has been no change between the interim and final versions of this report for geology.

Summer Ranges

Odell, Big Mountain, and Tom's Creeks

The summer range encompasses a terrain within terrain; a complex of hills and valleys between 7,500 and 9,500 feet interior to the upper reaches of the Centennial Mountains that was created first by folding of marine sediments then faulting and volcanic intrusions. Slope stability, flow regime and stream pattern throughout Odell, Big Mountain and Tom's Creek are controlled by orientation of faulting, and sedimentary bedding on the east side of the Odell fault.

The Odell grazing area is that portion of the ARS land west of Odell Creek, while Big Mountain is east of the Odell Creek, and both comprise the West Summer Range (Table 1). Within both grazing areas, the prevailing pattern of northwest to southeast trending stream valleys was created by parallel series of near vertical faults (Witikind and Prostka, 1980).

These valleys were truncated or bisected in some cases, by an anticline fold, trending from the northeast and plunging southwest, which in turn apparently changed the direction of stream flow to the north and created the present north flowing main stem Odell Creek eventually running out into the Centennial Valley.

The large Odell normal fault, somewhat parallel and just to the west of the anticline down dropped the western portion or West Odell grazing unit, leaving the young overlying Tertiary volcanic rock, and uplifted the eastern portion (Big Mountain) until the Mesozoic siltstone, mudstone and limestone were exposed. In the bottom of the lowest stream valleys of the main stem Odell and Spring Creeks have exposed the even older Paleozoic limestone.

The eastern portion of the West Odell grazing unit is broad, gentle slopes of east to southeast aspect, and wide hummocky valley bottoms, which are the result of very large earth flows from the western, upper portions of the ridges. The ground though mostly forested, has large lower slope openings, and relatively open valley bottoms with dense riparian willow. The rock type is Tertiary volcanic of rhyolitic to basalt series on upper ridge slopes and ridge tops over a Cretaceous sandstones that composes the lower slopes. The general orientation of the sandstone bedding is north to south strike dip of 20 degrees to the east.

The massive landslips on the eastern aspect of the grazing unit are typical of down slope bedding dip in moist temperate climate. The obvious existence of a contact plane between the volcanic above and sandstone below on the mid slope area, in addition to the down slope dip of bedding are reasonable inferences in themselves as the cause of the slumps. Water movement along the contact plane, and parallel to the surface slope creates a failure plane for soil and weathered rock material above.

The bedding orientation of the Big Mountain sedimentary rock east of the Odell fault is a northwest to southeast strike and southwest dip of between 10 and 24 degrees or roughly parallel to the surface slope. The southwest slopes throughout the grazing unit, including Sheep Mountain, are also characterized by massive slump topography similar to the West Odell grazing unit in cause.

Concomitantly, the northeast aspect of the ridges are moderately steep (40% gradient ±), or very steep outcrop bluffs, as is the case with Sheep Mountain.

A series of parallel faults with the same trend as the Odell fault and partially mapped are aligned with tributaries to Spring Creek, including the only perennial source of surface flow in the Spring Creek drainage. The main stem Spring Creek is perpendicular to the faulting and is intermittent.

The eastern half of Tom's Creek grazing unit is mapped as a dark, pyroxene bearing trachyte, a volcanic rock that may be locally a trachyandesite or trachybasalt (Witikind, 1976). Underneath the trachyte and exposed on the hilltop bedding area (Point. J and K, Figure 4) is exposed Shedhorn Sandstone. The western one-half is mostly the Madison Group, a light gray cliff forming limestone. The western slopes are steep, with moderate bluffs. At the crest of the hill with bedding area (point Q, Figure 4) is an exposure of the stratigraphically lower Amsden Formations. Along the upper portion, and exposed on the hilltop, are red siltstone/shales and a limestone pebble conglomerate.

The contact between the Madison and the trachyte may be a fault line, similar to other southwest to northeast trending faults in the West Odell and Big Mountain grazing units. The alignment of the upper portion of Corral Creek is along this contact. The general orientation of the Madison bedding is striking north and south with a dip to the east of around 20 to 25 degrees. Similarly to the discussion above with Big Mountain grazing unit, this bedding orientation sets up prominent large slump topography on the eastern aspect of the ridges west of Corral Creek, and steep, bluff outcrops on the west aspect. This scenario is complicated somewhat by an anticline fold trending from the northwest and plunging to the southeast in the northwest corner of the grazing unit. The plunging southeast nose of the fold, also however creates a down slope dip of bedding and promotes terrain slumping.

Figure 4. Overview of ARS summer grazing properties.

Winter Ranges

Headquarters and Henninger Ranch

The large expanse of the experiment station around the headquarters is entirely within Pleistocene flood basalts, lying more or less level, within the Snake River plain province (Link, 2008). The terrain is marked by low; broad ridges particularly where the edge of one flow has overlapped a previous one. Lower and more subtle pressure ridges form the upper crust of a flow. Pressure ridges are often a few hundred feet long, but only project upward a few feet with broad crests. One stream may be within the margin of a collapsed lava tube, on the western slope of a volcanic crater, with a thin stringer of aspen.

Henninger is quite similar to the Headquarters property in that the exposed rock is Pleistocene basalt lava flow. Topography within the basalt flow is created by subtle pressure ridges and sharper ridges of flow edges. The topographic lows, shallow valleys with incised stream channels are Quaternary alluvial fill.

Humphrey Ranch

The Humphrey Ranch is mapped within Quaternary fluveolian deposits of the Snake River Group, and Pliocene and Pleistocene gravels of lake and stream deposits (Link, 2008). Terrain is broad rounded hills composed of alternating beds of weakly cemented sandstone and shale, with the top often composed of unconsolidated alluvial gravels. Valleys are narrow and flat bottom with loamy fine-grain surface layers.

Shallow slips on the order of a few tens of feet across and one to two feet deep are consistent in the upper slopes with west aspect. Slumps appear confined to the top 1 to 2 feet of the soil column that has a high content of rounded cobble above weakly cemented (calcareous) sand and silt mixture. Material displaced usually deposits in small fan on lower slopes or at the base of a hill. Slumps scarps are frequently seasonally moist ground or seeps. Swale drainage features on hill slopes are likely very old slump areas that have reached a stable angle.

Watershed Characteristics and Conditions

In general, alluvial flats found on lower basin floors are dominated by sagebrush and underlying basalt flows. Areas underlain by basalt flows lack defined drainages due to the basalts high permeability and porosity. Adjacent lower elevation flatlands are very well drained and have moderate grassland productivity (Figure 5).Road densities by 6th level watershed are summarized in Table 3. These are all the watersheds involved in the Proposed Action. Table 4 summarizes the miles of road within 300 feet of streams on the Headquarters property. There are 2.7 miles of existing firebreak around the Headquarters buildings. The firebreak is roughly 20 feet wide and is comprised of mineral soil. The total area of the firebreak is 65 acres. No streams, springs, or wetlands are adjacent to the firebreak.

Figure 5. Views of Typical Alluvial Flats Underlain by Basalt, Headquarters Property

Table 3. Summary of Road Densities in All Watersheds Involved in the Proposed Action

Watershed	Road Density	Watershed	Road Density
100200012101	0.3	170402140603	1.4
100200012102	0.2	170402140604	1.7
100200012201	0.7	170402140606	0.8
100200012202	0.2	170402140607	1.7
170402020801	1.3	170402150104	1.6
170402020803	1.3	170402150301	3.3
170402140101	2.3	170402150401	1.4
170402140401	1.8	170402150402	0.6
170402140404	0.7	170402160101	0.1
170402140405	1.2	170402160601	1.1
170402140406	1.3	170402170101	0.8
170402140407	2.4	170402170301	0.2
170402140408	1.5	170402170302	0.2
170402140501	2.5	170402171101	0.2

Table 4. Summary of Road Miles within 300 Feet of Streams

Headquarters Area	
Road Surface Type	**Miles of Road**
Native Surface	5.4
Gravel	3.0
Paved	0.2

Table 5. Summary of Observed Surface Conditions by ARS Properties and Grazing Units

Property/Grazing Unit	Watersheds Where GPS Points were Taken	Number of Points Taken	Range of Surface Conditions	Range of Percent Total Cover/Average
Big Mountain	100200012102 170402020802	3	2-4	0-80/43
Odell	100200012102	12	2-4	0-100/64
Tom's Creek	100200012101 100200012201 10200012202	9	1-4	0-95/64
Humphrey Ranch	170402140404 170402140405	23	1-4	25-100/89
Henninger Ranch	170402140607	10	2-3	0-95/75.5
Headquarters	170402140101 170402140501	128	1-4	0-100/73.4
DOE Feedlot	No Data Taken-Industrial Area			

The summer ranges have complex stream networks that dissect the rolling ridges of the Centennial Mountains, and are characterized by relatively high productivity with intermixed grass-forb lands, sagebrush, and conifers

The 6th level watersheds, and associated grazing properties and allotments, are summarized below in Table 5.

Sheep bedding areas are found in all the grazing areas used by ARS. Traditional bed-grounds are defined only for the West Odell and Big Mountain grazing units.

However, each defined bed is not used annually. The total area used is less than one percent for Big Mountain and West Odell grazing units in Figure 5. Beds have not been mapped with GPS for the other ARS properties. Herders though try to use different sites every night, which minimizes compaction, trampling, and loss of vegetative cover. A study by Moffet, 2009, studied the hydrologic effects of sheep beds on subalpine ranges. It was determined runoff and erosion is more likely on bed grounds after use, but only under extreme rainfall conditions.

In the area, a 100-year, six-hour precipitation event is around 1.9 inches per hour; however to ensure runoff generation the study simulated rainfall at 6.2 inches per hour to ensure runoff generation. For a 30-minute rainfall event at 6.2 inches per hour, the study found erosion increased approximately ten times. Field observations made in 2008 and 2009 at various bedding areas noted no rilling, gully development, or upland-associated sediment transport with these bed areas. As a result, it was determined these areas do not affect watershed condition and are not functioning as sources of erosion and sediment transport.

Big Mountain (West Summer Range)

Watershed condition generally appeared consistent throughout this grazing area, based on the ride through in 2008. Three data points were taken, as the area was very consistent in appearance. Uplands were generally well vegetated with little evidence of surface runoff or erosion (Figure 6. No evidence of desertification was observed in the field. Desertification occurs when the amount of dry-land biological productivity is reduced. There are several reasons why desertification occurs, and grazing can be one of them, or there can be several factors causing this to occur (http://www.britannica.com/EBchedked/topic/159114/desertification).

The average of 43% cover is low as only three points were taken. One point had a total cover value of zero as it was taken on the road. The other two values were 80% and 50% cover, which are much more representative of watershed conditions in the grazing unit (). Three Proper Functioning Condition (PFC) surveys were conducted within this grazing area. Two locations received a rating of PFC and one location received a rating of Functional-at-Risk (FAR). Please refer to the “Channel, Riparian and Floodplain Conditions” section in this report.

Bare soils were primarily associated with steep southwest facing ridges and were largely due to active slip faces, which are a function of the underlying Cretaceous siltstone and sandstone geology (Figure 7). These slumps start with a convex shape, and then evolve into a concave shape, where they appear to stabilize and re-vegetate. No evidence such as trailing, trampling, or bed grounds was noted in association with these slumps. As a result, these areas of disturbance are considered “natural” and not related to grazing activities.

Bare ground was also noted in association with bed grounds (Figure 8). However, these areas were very limited spatially in extent. The main bedding area observed had a surface condition rating of two, with soil hydrology and nutrient cycling rated as fair.

Figure 6. Views of Uplands, Big Mountain Grazing Unit (Western Summer Range)

Figure 7. Views of Slumps Originating in Cretaceous Sediments, View to the North

Figure 8. Edge of Bedground, Big Mountain Grazing Area, View to Northwest

Figure 9. Revegetated Roadbed Leading to Closed Phosphate Mine, Bottom of Spring Creek Drainage

Two and one half miles of driveway are found within the West Summer Range. None of the portions of driveway in the Big Mountain grazing unit was found to be sources of sediment.

An old road leading to the J.R.Simplot mine is located in the bottom of the Spring Creek drainage. The road is confining the drainage in places, leading to increased down-cutting and increased channel confinement. Erosion of the road prism was observed in several places. However, the road surface is generally well vegetated, which acts a sediment filter.

Very little evidence of surface runoff and erosion, related to the road surface was noted (Figure 8). Road reclamation activities, such as culvert removal, were conducted in 1997 (USDA ARS, 2009).

Fieldwork was also done at and near the mine site to assess existing upland watershed conditions (Fryxell, 2008). Snow patches were present and melting at the time of the visit, resulting in bare patches of ground, but green vegetation shoots were noted, indicating vegetative growth was slow in the areas, due to melting snow. Ground cover appeared to be consistent in distribution and percentage over the area, ranging from 65-80% cover; however in the area of the mine itself ground cover minimal ground cover was much less (estimated down to 25-30%). Rock fragments were abundant on the ground surface at this location and formed a type of ground cover, likely reducing soil erosion (Figure 10). At the mine site proper, no active areas of erosion were noted, except at where a small drainage exists from the settling pond. Some relatively minor channel widening and down-cutting has occurred for a small distance downstream. Down below the mine a small drainage runs roughly east/west, which some very minor amounts of bank trampling. However, large elk herds are known to frequent the area, which are thought to be the cause of this as water is provided for the sheep, as this stream is intermittent (Figure 11). The mine road was also viewed from near this location and appeared to be consistently well vegetated and not a source of surface runoff or accelerated erosion (Figure 12)

Figure 10. View of Uplands near J.R. Simplot Phosphate Mine, Note small drainage in middle ground of photograph

Figure 11. View of Vegetation Growth Adjacent to Water Trough

In total, there are five water developments within this grazing area. Springs have been developed with permanent troughs, to provide water for ewes and lambs in low-flow areas. Wildlife is known to use these water developments. Four troughs are metal and one is rubber. These troughs cover an estimated 133.3 to 180 square feet per trough. It is estimated that there is ¼ acre, or less of disturbance per trough (Smith and Yurczyk, 2008). Based on this estimate the maximum area of disturbance associated is 1.25 acres.

Figure 12. View of Revegetated Mine Road, near J.R. Simplot Phosphate Mine

Several developed water sources were inspected during the 2008 field seasons. All appeared to be sprouting healthy vegetation covers.

This portion of the grazing area had been rested in 2007, however vegetative recovery appeared to be consistent around these water developments, indicating that detrimental compaction and degradation of soil hydrology has not occurred to the extent that it impairs vegetative growth (Figure 11).

Water rights for these developments have been claimed and have been adjudicated. Efforts are in progress to secure signature on these water rights (Yurczyk, 2009b).

Numerous slumps were noted in Cretaceous siltstones and sandstones, as found elsewhere on ARS properties. A large tension crack was noted in the top of one ridge, which like formed due to earth flow, in the Cretaceous sediments.

Figure 13. West Odell Grazing Unit (West Summer Range) Looking to the Northeast

West Odell (West Summer Range)

Watershed conditions appeared to be good and consistent within the West Odell grazing unit. No evidence of desertification was observed in the field. Twelve GPS points were taken throughout the Grazing Area. Although soil surface conditions varied from a “2” to a “4,” the average was 3.6 indicating fully hydrologic function and almost minimal signs of impairment (Table 5). For the points taken, the average total cover approached 64% and appeared to be consistent throughout the grazing unit (Figure 13). No evidence of rilling and gully, or other signs of surface overland flow were noted on uplands. Six PFC surveys were conducted and all received ratings of PFC. Please refer to the "Channel, Riparian and Floodplain Conditions" section later in this report for additional detail.

Slumping and earth flows, again related to the Cretaceous geology, were noted. As in the Big Mountain grazing unit, grazing activities were not observed to have initiated or enhanced the movement of these features.

The West Summer Range contains 2.5 miles of sheep trails. Within the West Odell grazing unit, four stream crossings, associated with these sheep trails, were evaluated (Figure 14). These points are marked as OD 4, OD 5, OD 7 and OD8.

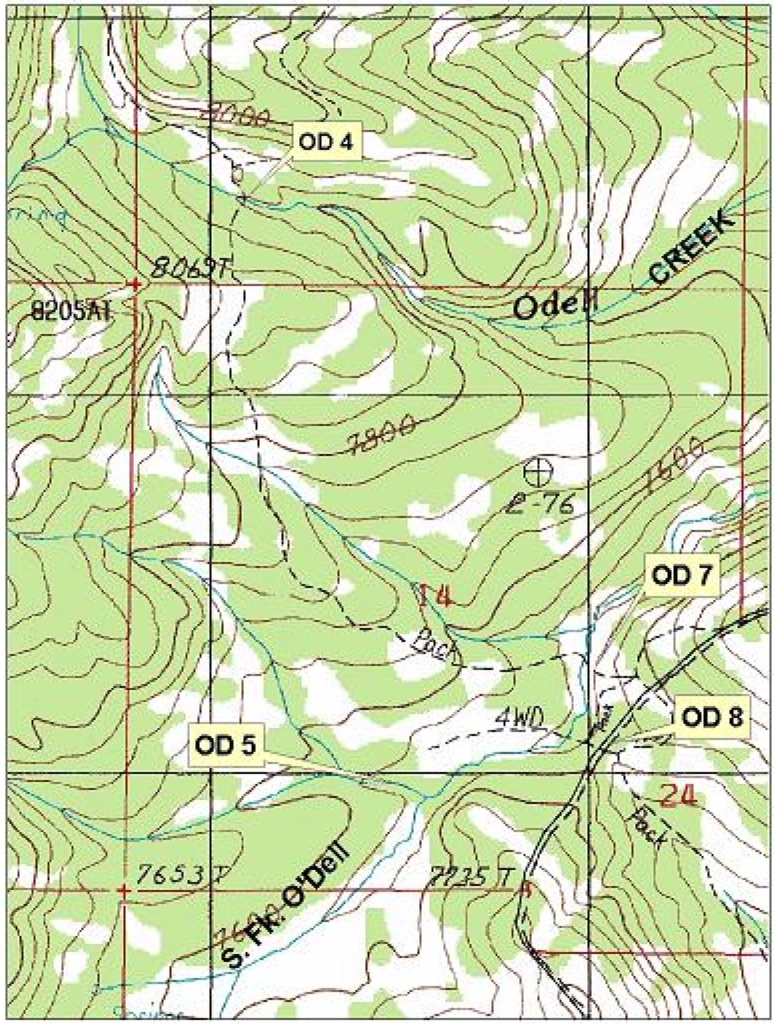

Figure 14. Locations of Field Observation Points OD 4, OD5, OD 7 and OD 89

At all four crossings streams were observed to be in proper functioning condition. No evidence was observed indicating that stream morphology has been impacted, in any significant way, up or downstream of the crossings. There were no overt indications or evidence of excessive sediment within the associated channels. In addition, there was no indication of heavy or unusual browsing on associated riparian vegetation. OD 4 is located in SW ¼, Section 11 T15S R2W, and is the major crossing of the four within the West Odell grazing unit.

A secondary crossing lies nearby to the west. At the main crossing bare ground was associated with this trail and was estimated to be 15 ft. wide and 51 ft. long on the north side of the creek, and roughly an estimated 79 ft. long and 25 ft. wide on the south side of the drainage (Figure 15).

Although soil stability, hydrology, and nutrient cycling were rated as impaired in this area, active erosion features were noted only on the far side of the crossing. Rilling and incipient gullying were noted and were adjacent to, and perpendicular to the stream crossing. Minor bank hardening was also noted. Although some extra sediment was being derived from this trail, no detrimental bimodal distribution of sediment was observed in the streambed.

Figure 15. Sheep Driveway Crossing at Odell Creek, Upstream to Readers Right

As a result, it did not appear that sediment contributions are exceeding natural sediment loads being carried by this stream. In addition, bank degradation was confined to where the driveway crosses Odell Creek.

At the secondary crossing, the trail is becoming trench-like and confined.

The other three crossings are located to the southeast of OD 4, in the SE ¼ of Section 14, T15S, and R2W. Each of these three sites involves the South Fork of Odell Creek. Disturbance at these three crossings were confined to the crossings proper and vegetation immediately adjacent was in good condition.

At OD5, the entry into the stream crossing is an estimated five feet wide with the exit onto a steeper slopped, which is largely bare of vegetation, and somewhat compacted. There were no well-developed rills or gullies leading down to the Creek (Figure 16 and Figure 17). Substrate in the stream bottom appeared not to be dominated by fines, with sub-angular siltstones to cobbles predominating. There did not appear to be a bi-modal sediment distribution.

Figure 16. Entry to Sheep Driveway, OD 5

Figure 17. Close up of Exit of Sheep Driveway, OD 5

At OD 7, minor bank degradation was present at the two stream crossing areas, with one of the crossing exhibiting revegetation. Minor sediment contributions to the stream are derived from these trampled areas. However, there were no rills or gullies observed and there was no observable bimodal sediment distribution of stream substrate, which would indicate an unusually high percentage of fines for this mountain stream. Adjacent uplands were in good health with a well-distributed groundcover of broadleaf forbs and grasses (Figure 18). The driveway crossing at OD 8 was in good shape and had not been recently used and no rilling or gullies on adjacent uplands were noted. Photographs were not taken at this site.

There are no water developments in this grazing area.

Figure 18. Driveway Crossing at OD 7

Tom's Creek

Tom's Creek grazing unit comprises the East Summer Range (Figure 19). During the summer of 2008, this grazing area was reviewed for existing conditions.

PFC surveys were conducted at three locations; all received ratings of PFC. Please refer to the "Channel, Riparian and Floodplain Conditions" section later in this report for additional detail.

Observed surface conditions ranged between Condition Classes 1 and 4. No evidence of desertification was observed in the field. The range of total percent cover varied from 0-95, with an average cover of 64 percent. Nine total GPS points were taken. Uplands were remarkably consistent in vegetative cover. No sources of upland erosion, consisting of rills and gullies were noted. Surface Condition Class is estimated to between Condition Class 3 and 4 for the grazing area except for the road to for the observed bedding areas and the road to Blair Lake. Some evidence of overland flow was noted in association with melting snow fields and was confined to within 50 feet of these areas, and no erosional features were noted in association with the melt water. Earth-flows and slumps were occasionally present and are associated with unstable stratigraphic layers.

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Figure 19. Views of Uplands in Tom's Creek Grazing Area

One area of uplands was of special interest, which is located at the head of the North Fork of Tom's Creek, which has been an area of past debate (Figure 20 and Figure 22). This area burned by a forest fire sometime between 1880 and 1930. Burned trees still stand and charcoal is still found in upper portions of the soil horizon. Slopes tend to be steep (over 10%) with poor site productivity (Jacobson, 2009a). Past debate has been regarding supposed over-grazing practices by ARS. This area was reviewed with ARS, Soil Conservation Service personnel and University of Idaho staff to review upland conditions. ARS notes on the meeting state: "Soil Conservation personnel believe grazing abuse by the Sheep Station had not occurred, that the site was as good as could be expected, that no current erosion was occurring, and the overall trend was up" (Jacobson, 2009a).

Figure 20. Vegetation and Recovery of Trailing, East Portion, North Fork Tom's Creek (Bighorn Dolomite Area)

Figure 21. Views of Intermittent Drainage, North Fork Tom's Creek, Park Shale Area

In 2009, field work was conducted again to assess this area (Fryxell, 2009). The eastern portion of this headwater supports a consistent vegetative cover, which is being re-established after grazing by both historical and ARS grazing. Relict trailing was noted, but trails are re-vegetating throughout this portion of the headwaters (Fryxell, 2009, Figure 20). This area is designated as Unit 8 Tom's Creek grazing area (Eastern Summer Range) and has had only incidental grazing since 1994 (Jacobson, 2009a, Moffet, 2009). The 2009 field inspection revealed no evidence of rilling or gullies but evidence of naturally occurring soil creep was, as indicated by trees and snags leaning into the hillslope. Soils are stony and provide a notable measure of cover. This portion of the headwaters is underlain by the Cambrian Bighorn Dolomite.

Figure 22. View Looking West to Area Underlain by Park Shale, West Half of North Fork of Tom's Creek

To the south, an abrupt and dramatic change in vegetative cover was observed, as vegetation becomes largely absent on the uppermost and steepest portions of the western half of these headwaters (Figure 21). On the lower portions of this area, where slope gradients are shallow vegetative cover becomes consistent and lush. Trees are sporadic in both the northern and southern portions of these headwaters due to poor site productivity. This area is underlain by the Cambrian Park Shale, which overlies the Bighorn Dolomite (Moffet, 2009, Fryxell 2009, Witkind, 1976). Even though cover is largely lacking there was no observed evidence of overland surface flow, rills, gullies or mass movement. To the north and west additional trailing was noticed, but as mentioned above these areas are now green due to revegetation. The North Fork of Tom's Creek appears to be ephemeral to intermittent. Channel definition increased in a downstream direction, reflecting increased flow volumes. The channel was classified as a Rosgen A3[1], characterized as a steep, entrenched, cascading, step pool stream, in proper functioning condition. Uplands were not observed to be eroding or contributing excessive amounts of sediment (Fryxell, 2009).

Several bedding areas were noted. In these areas, vegetative cover was reduced and soil disturbance increased. However, these areas were estimated not to exceed 0.5 acre and were not observed to upland sources of sediment or erosion (Moser and Fryxell, 2008).

The only areas receiving a surface Condition Class rating of 1 was the road, which starts on Forest Service-administered land, which leads towards Blair Lake. The initial portion of the road has been put to bed by the Forest Service in the summer of 2008, when it was ripped and seeded. From the ARS/Forest boundary to near Blair Lake, various degrees of rilling, rutting, and gully

[1] **Rosgen's Stream Classification System (Rosgen 1996)** The purpose of this system is to classify streams based on quantifiable field measurements to produce consistent, reproducible descriptions of stream types and conditions. There are four levels in Rosgen's classification hierarchy: geomorphic characterization (Level 1), morphological description (Level 2), stream condition assessment (Level 3), and validation and monitoring (Level 4). A more detailed description can be found at http://www.stockton.edu/~epsteinc/rosgen~1.htm. The full classification method is contained in: Rosgen, D. (1996). *Applied river morphology*. Wildlife Hydrology, Pagosa Springs, CO. (http://el.erdc.usace.army.mil/emrrp/emris/emrishelp2/rosgen_s_stream_classification_system_spatial_topics.htm)

development were observed (Figure 23). Near the ARS/Forest Service boundary, minimal slash is in place but has not been effective in diverting water from the road. Erosion and gully development are the most severe near the end of the road where there is a 15-20 percent grade. Ruts and gullies are one to three feet in depth. An area of at least 1,000 ft x 10 feet by 3 feet is estimated to be involved (Figure 24). Areas adjacent to the road are used to drive the sheep down to the stream, where they cross on their way to Blair Lake.

The Toms Creek grazing area contains approximately GIS-mapped 0.5 miles of sheep trail with minor trailing noted in other areas. Field work in 2008 showed that trails were generally in acceptable condition. Minor compaction in wet areas was noted associated with trailing leading down to Blair Lake, with the area generally looking good at the lake. At Corral Creek a trail crossed a tributary headwater stream to Hell Roaring Creek. No sheep trail-related issues were noted (Fryxell and Moser 2008).

	
Figure 23. Road Ruts on Road to Blair Lake	**Figure 24. Road and Erosion, Lower portion of Road to Blair Lake**

The road ends near a Rosgen A4 type stream (Rosgen, 1994). The road has functioned as a long term chronic source of sediment to this channel. Based on the proximity of the road to the channel and the contributions of sediment over time, this stream received a functional at risk rating. There are no water developments in this grazing area.

Humphrey Ranch

The Humphrey pastures are grazed from May to October. Some cattle grazing is also conducted on this Ranch to help control vegetation and to improve sheep range conditions. No cattle-related impacts were observed within the grazing area. Humphrey Ranch averaged 89 percent cover with a range of 25-100 percent (Table 5). Surface conditions ranged from Condition Class 1through 4. No evidence of desertification was observed in the field. A total of 23 GPS points were collected where surface condition was assessed. Only two of these points received a rating of Condition Class 1 and both of these points were associated with areas of natural disturbance, due to slumping in weakly cemented inter-bedded sand and siltstones underlying the Ranch. These areas typically revegetate after slumping with a grass, which stabilizes the head of the slump, and eliminates these areas as potential sources of erosion. Six PFC surveys were conducted. Five received ratings of PFC and one received a rating of Functional-at-Risk. Please refer to the "Channel, Riparian and Floodplain Conditions" section later in this report for additional detail.

For all other points Condition Class ratings of 3 and 4 were given. For these 21 points, the average Condition Class rating was 3.6. Uplands tended to be well vegetated as indicated by the 89 percent cover. Lushly vegetated lowlands separate the highlands, indicating areas of increased moisture and possible subsurface flow (Figure 26).

These low areas “flow” into a major lush lowland that has poorly defined drainage. Some trampling and holding of water within these areas was noted, but was considered very minor.

An earthen dam was formed to develop a watering pond for the sheep. Trailing from “upstream” and “downstream” directions was noted leading to this pond. This pond area is roughly rectangular in shape and covers an estimated 132 sq. feet. Bank trampling is present and has resulted in vertical bank development on the south side of the pond.

Bank height was variable ranging from several inches up to 18 inches or so (Figure 27). Bare and compact ground was present immediately around the pond. The pond and associated bare and compact ground is less than an estimated half-acre.

No head-cutting above the pond was noted and no down cutting below was noted. Areas below the pond were noted to be especially lush and well vegetated and included equisetum or horsetail, indicative of chronically moist soils.

Two bedding area was observed within the grazing area. One area, on the shoulder of a hilltop was an estimated 50 ft by 50 ft with no vegetation. Although vegetation was absent and the surface condition was rated as Condition Class 2, there were no observable features indicating surface overland flow, erosion, and sediment transport (Figure 25).

The second bedding area was noted immediately adjacent to the perennial stream found in the northeastern-most quarter of the grazing area, which is used for watering the sheep. Evidence of use includes bank trampling, some vertical bank development less than ten inches high, trampling in areas next to the stream and some accumulation of fines in areas where water velocity would be less during higher flow. Some channel over-widening was also observed, as were small, vegetated islands (Figure 28). Despite these indicators of use during watering, riparian vegetation was well developed with a variety of age classes, and some hedging due to browsing was noted (Figure 29). Equisetum and iris were also noted. There was no evidence of channel dewatering. Upstream from this area, the amount of use varied and channel width decreased.

Downstream from the area of use channel width also decreased and the absence of excessive fines was observed. Bank incision also decreased both up and downstream from the area of use. The channel was observed to be in proper functioning condition below and above the area of use.

Figure 25. View of Bedding Area, Humphrey Ranch, View to North/Northwest

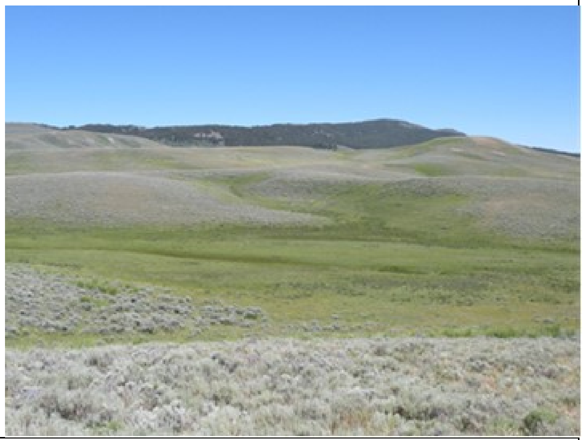

Figure 26. View of Lowlands, Humphrey Ranch

Figure 27. Disturbance around Watering Pond

Figure 28. Perennial Stream, Humphrey Ranch

Figure 29. Riparian Vegetation, Perennial Stream, Humphrey Ranch

Figure 30. Beaver Creek, Humphrey Ranch

The second perennial drainage in this grazing area is located on Beaver Creek, which is in the far western portion of the area. Beaver Creek, where it crosses the road, is a Rosgen E3/E4 channel type, roughly five feet wide, with an anastomosing channel pattern (Figure 30). These channels are defined as low gradient and meandering, characterized by little deposition, and typically found in the bottom of broad low gradient valleys with fine alluvium or lacustrine soils.

The banks were stable and well vegetated and show recovery from past over-widening (Rosgen, 1994, Moser and Fryxell, 2008). No evidence of degradation related to present grazing activities were noted. However, within the length of reach used for watering there was some decline in condition. This portion of the stream was rated as in the lower end of the proper functioning condition due to channel over-widening, development of "vegetated islands" due to trampling, minor vertical bank development and the presence of fines, due to livestock watering.

Flood irrigation is used to water sheep. This water is diverted from Modoc Creek, west of the Humphrey Ranch grazing area. The diversion is located on Modoc Creek, a few hundred yards upstream of the confluence with Beaver Creek and about seven miles upstream of the gage, located on Beaver Creek.

When sheep are moved out of the pasture, water diversion canvas dams are removed and the diversion shut off. There are about two miles of irrigation ditch at Humphrey Ranch, which has irrigation rights for 2.623 acre-ft from May 1 to October 31. The water used for irrigation falls under water rights # 31-46, 31-47 and 31-48. The amount appropriated for water right 31-46 is 4.0 CFS, while it is 1.6cfs for water rights 31-47 and 48. These three water rights total 7.2 cfs. Average irrigation season flow is 309 cfs for Modoc Creek and the range of average flow from May 1st through October 31st is 1..21-7.45 (Moser, 2011, Table 6).

Table 6. Compilation of StreamStat Data for Dry and Modoc Creeks

Watershed	Area (square mile)	Average Annual Peak Flow (cfs)	7-day, 2-year Low Flow (cfs)	Average Irrigation Season Flow (cfs)	Range of Average Flow 5/1-10/31
Dry Creek	36.9	141	5.6	7.89	1.77-25.5
Modoc Creek	19.1	35.4	1.62	3.09	1.21-7.45

Modoc Creek is an un-gaged stream and flow statistics were developed using StreamStat, a program that utilizes regional regression models to compute flow frequency statistics for any given drainage basin. For this report StreamStats results for median monthly, bankfull l (1.5 year frequency), and low flow (7-day, 2-year) were used. For the area of the ARS pastures, the standard error of estimates was as follows:

- Median monthly—approximately +100 to -50%
- Bank full--+165 to -63%
- Low flow--+43 to -30%

A flow duration curve for Beaver Creek is displayed below in Figure 31 .

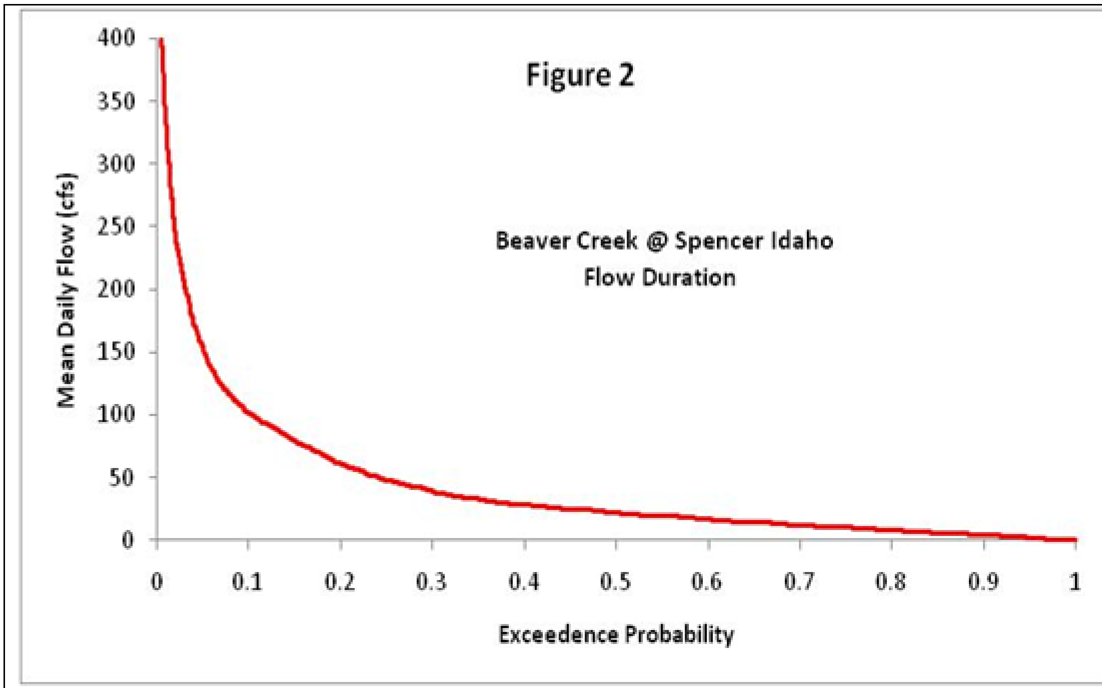

Figure 31. Flow Duration Curve from the Beaver Creek Gage, During Irrigation Season (May 1st-Oct 31st)

The X-axis of the graph is the probability of exceedance of a given flow value. The high values on the steep left hand side of graph are snow melt runoff peak values; the long low tail is mid-summer to fall values. Values from zero to 50 percent exceedance probability represent spring to early summer flows while values from 50 -100 percent exceedance probability represent late summer flows.

Flows in Beaver Creek from June through October are less than 50 cfs (cubic feet per second), with flows in mid-July less than 20 cfs (Figure 31).

At Dry Creek average irrigation season flow was estimated at 7.89 cfs and range of average flow from May 1 to October 31 is 1.77-25.5 cfs with the allocated amount to USSES being 14.2 cfs (Table 6).

Henninger Ranch

This grazing area was bought from private owners in the 1940s. During the time of private ownership, it had been a working ranch. Prior to purchase, Henning had been used for livestock production, with some cropland and hay production. Before purchase by the ARs, grazing was done at heavier rates than current ARS rates (USDA ARS, 2009). As a result, a small area (less than an acre) was noted to exhibit characteristics of desertification.

Figure 32. Arrow Leaf Balsam Root Field, Henninger Ranch

Surface conditions ranged from Condition Class 2 to Condition Class 3. Ten GPS points were collected, and the average surface condition rating was 2.1. Total ground cover ranged from 0-95 percent with an average of 75.5 percent. The Condition Class rating of 2.1 was due primarily to compaction or soil loss.

About one half of the data points were soil Condition Class 1 or 2 due to compaction or soil loss.

All of these points were on flat irrigated fields (points 2, 9 and 10, Figure 4).

Figure 33. Historical Rip-rapping, Dry Creek, Henninger Ranch

In several areas, desert-like pavement, consisting of a gravelly surface, was present. These areas lacked any vegetative diversity and consisted of only arrow leaf balsam root (Figure 32). The very low gradient surfaces may lend themselves to the effects of wind erosion (Moser and Fryxell, 2008). Two PFC surveys were conducted at this property on Moose and Dry Creeks. Both received ratings of Functional at Risk due to flow diversion and rip-rapping.

Much of the rest of the grazing area is covered by sage brush and underlain by basalts, resulting in little natural surface expression of water. The major drainage that does exist on the property is Dry Creek, which was classified as a Rosgen C4 channel type (Rosgen, 1994). A PFC survey was conducted, and a rating of Functional at Risk (FAR) with no apparent trend assigned. The FAR rating was due to alteration of channel flows due to irrigation that includes ditching, past agricultural practices, historical rip-rapping of the channel, possible influences related to the main road leading into the property.

Figure 34. Ditching and Maintenance, Henninger Ranch

Irrigation practices were ongoing at the Ranch prior to the purchase of the property by ARS, and a well-developed network of irrigation ditches is still present today (Jacobson, 2009a). The remains of an historical head-gate, located in the channel proper, are still present. Additional historical management of the channel is evidence by rip-rapping (Jacobson, 2009a). The rip-rap has been there so long that portions of it have become entrained as part of the channel bedload and pieces are found deposited within the channels banks (Figure 33).

Today, these ditches are used for irrigation and to flood pastures where sheep graze (Figure 34). Maintenance of these ditches is conducted annually. This activity is covered by an exemption from the requirement of a 404 permit by the Army Corps of Engineers (ACOE) as dictated by 33CFR 323.4(a) (3) (Yurczyk, 2009a, http://edocket.access.gpo.gov/cfr_2006/julqtr/pdf/33cfr323.4.pdf). Section 404 of the Clean Water Act establishes programs to regulate discharge of dredged or fill material in waters of the United States, including wetlands http://www.epa.gov/owow/wetlands/pdf/reg_authority_pr.pdf).

Diversion is accomplished through the use of canvas dams. Diverted water is used for watering sheep and for providing green forage for extended periods of time in dry seasons. The numbers of days that are used each year depend on water availability and grazing needs. Diversions are removed once the sheep are moved out of pasture and shut off (Smith and Yurczyk, 2008). Water rights at Henninger are Federal Reserved Right Claims (Gough, 2009).

Henninger Ranch has the right to use water from May 1 to October 31 of each year. Spring water use is not allowed until the flow in Dry Creek no longer reaches Spring Creek in mid to late June. Average past ten year use is 675 CFS with a high of 1125 CFS in 1999 and a low of 474 CFS in 2000. The average use of 675 cfs translates to 3.7 cfs per day. The low of 474 cfs translates to 2.6 cfs while the high of 1125 cfs translates to 6 cfs per day. The average use of 3.7 cfs indicates that the maximum water right amount of 14.2 allotted for use on Dry Creek is not being used.

The average irrigation season flow for Dry Creek is 7.89cfs and the range of average flow for the period of May 1 through October 31 is 1.77-25.5 cfs (Table 5).

Please refer to the "Channel Conditions" section for additional information.

Some cattle grazing is also conducted on this Ranch to help control vegetation and to improve sheep range conditions. No cattle-related impacts were observed within the grazing area.

Headquarters Property

The Headquarters property is underlain by flood basalts, resulting in an uneven topography, due to multiple flow events, pressure ridges, lava tubes, "blisters" and other Surficial expressions of volcanism. In addition, there appears to be a pattern of regular jointing or fracturing. As a result, there is little water retention and the area is dominated by sagebrush (Figure 5, Moser et al, 2008).

A total of 128 points were taken to assess surface conditions on the Headquarters property. Surface conditions ranged from Condition Class 1 to Condition Class 4. No evidence of desertification was observed. Percent ground cover ranged from 0 to 100 percent, with an average of 73.4 percent. Approximately 10 percent of 128 data points had a soil Condition Class 1or 2.

Half of these points were trails or roads, the remainder were small depressions that held surface water or remained moist due to clayey deposits and were trampled by livestock. Compaction and ponding of surface water were the most apparent disturbance (Moser et al, 2008).

No PFC surveys were conducted on this property due to the lack of drainages sustaining surface flow.

Where water is not available on Headquarters, water is trucked in to troughs, which are moved as grazing progresses across the area's pastures. An estimated 80 sites are used, with up to a quarter-acre of disturbance at each site, for a total of 20 acres of disturbance for the Headquarters property. This is equivalent to less than one percent of the total Headquarters area.

About 160 acres on average has been prescribed burned over the last thirty years (ARS, 2008b). Prescribed burn areas are evident in the northern half or one-third of the Headquarters Property. Although these areas have undergone prescribed fire, no open areas of erosion and sediment transportation were observed.

Occasionally, cattle and horses are grazed on Headquarters property to improve sheep range conditions. Numbers are determined on the area and amount of vegetation that needs to be removed (Smith and Yurczyk, 2009). No observable effects, related to cattle and horses, on watershed condition was observed.

Hydrology

Hydrological discussions in this report are excerpted from Moser et al, 2008, into this report, as there has been no change between the interim and final versions of this report for hydrology.

Stream gauge stations, operated by the U.S. Geological Survey (USGS, 2008) were maintained for various periods of record on Beaver Creek near the Headquarters property, on Odell Creek and Tom's Creek near Lakeview Montana. Beaver Creek is typical of streams in flood basalt geology and its description below is illustrative of the runoff hydrology of the lower elevation properties of the Headquarters, Henninger, and Humphrey Ranch properties. Odell and Tom's Creeks flow from the Montana side of the ARS East and West summer ranges in the Centennial Mountains and the gauging information is similarly useful in describing the hydrology of that area. Figure 7 provides summary information for the three gauges.

Table 7. Hydrologic descriptions for Creeks Located within ARS summer ranges

Station	Period of Record	Watershed Area (square miles)	Gauge Elevation	Flow Regime	Average Daily Flow (cfs)[b]	Peak Flow of Record (cfs)
Beaver	1921--1987	220.0	5150	Intermittent	25.6	858
Odell	1994--1998	17.7	6750	Perennial	46.5	506
Tom's[a]	1989[a]	6.43	6740	Intermittent	2.8	12

a--Partial year, May through September.
b--Includes dates during which there was no flow.

Peak flows in watersheds influenced by the Centennial Mountains are during late spring snowmelt, usually during May and June for all three gauges. Tom's Creek only operated May through September 1989, although it was dry at the station site July through September. Beaver Creek is consistently perennial throughout its period of record from April through June. During drought years, it may be dry at the station site July through March, only running with snowmelt runoff. During wet years, the stream flows year round at the gauge site.

Odell Creek did not operate through the winter months possibly due to freezing conditions; whether there was flow is not known. Otherwise, gauge records show consistent flow spring through fall during all the years of record.

On the Idaho side of the continental divide, the drainage in the Headquarter and Henninger Ranch properties is imprinted with a degree of disorder, with many small depressions that are possibly the result of partial collapse of tubes or blister cones within the flow, and other small basins created between ridges. The deep and regular fracturing, or joint sets, that is frequent in basalts provides excellent downward percolation of precipitation water, and potentially high volume of storage, very often creating the so called "dry mountain" effect: a terrain with marked absence or low density of drainage features, of complete lack of surface scour channels, underdeveloped low order valley form. The regular jointing is caused by shrinkage of the flow due to slow and relatively uniform cooling, and is analogous to shrink cracks in clay. Throughout these two properties, the exposed top surface of flows, usually on very broad, shallow ridges clearly shows well developed hexagonal joint patterns that likely persist deep into the rock of an individual flow layer.

Within the Humphrey Ranch property, the subdued topographic relief does not generate enough water-yield to sustain perennial flow in the smaller tributaries to Beaver Creek. These tributaries are ephemeral or have surface water expressed during base flow periods, where there are poorly drained relatively impermeable soils in the valley bottoms. Long Creek and Beaver Creek are probably both perennial based on 2008 field observations.

The summer range properties are divided between bedded sedimentary rock and felsic extrusive igneous mostly either rhyolites or trachytes. Fracturing in the felsic igneous is considerably less regular than that described above for thick basalt flows. In any case stream flow yield from the ridges of extrusive igneous in the upper portion of the Odell and east side of the Tom's Creek grazing areas, is evidently high and more analogous to granitic slopes, which because of poor transmissivity of the rock (volume of water that can be transmitted), and typical steepness, are "wet" slopes. Precipitation water does not percolate far into relatively un-weathered rock under the soil mantle, but instead travels down slope as shallow subsurface interflow in the soil to daylight frequently at major breaks in slope or geologic facies into springs and boggy seeps. In addition, the large mass of slump material filling the topographic lows of these properties may provide storage area for release during the summer baseflow. The slump slopes in the other properties have much less displacement and have not collected in such quantity in the steeper and narrow valleys.

The Spring Creek drainage network is ephemeral to intermittent in nature. A single unnamed first order draw provides the only surface flow during summer base flow season to the main stem, which is insufficient to charge the valley fill. By contrast, the Odell Creek drainage system contains abundant surface flow throughout the property. There is a clear correlation between fault lines and stream valley alignment (including the perennial tributary to Spring Creek). Un-mapped but inferred faults in the lower reach of Spring Creek act as barrier to flow with surface flow ceasing at a possible intersection of a fault (Point BM1, Figure 4).

Channel, Riparian and Floodplain Conditions

Proper Functioning Condition (PFC) surveys were used to evaluate riparian and stream channel conditions on streams that were visited in 2008 and 2009 (USDI, 1998). A total 20 sites were surveyed. Seventeen sites were rated to be in proper functioning condition, and three received ratings of Functional-at-Risk. This information is summarized below in Table 8. Additional discussion about these surveys is found under each grazing area.

Riparian vegetation, where present, was noted to have diversity of species and age groups, and was in good condition. Detail that is more specific is noted under each grazing area.

Overall, channel conditions are good to excellent on ARS grazing areas, with the exceptions noted above in Table 8 . Good and excellent are defined are as meaning that bank stability, fine grained sediment (sand size and smaller), apparent water clarity and channel morphology and pattern are within expected and acceptable limits for a given channel type.

This means that the given flow regime, valley slope and slope delivery mechanism for sediment to valley bottoms are appropriate for the channel type at each surveyed location.

Exceptions were noted at one location on Spring Creek (Big Mountain grazing area), at the point of diversion just past the confluence of Berry and Modoc Creeks on the Humphrey Ranch and at Henninger Ranch on Moose and Dry Creek’s.

Diversion has occurred on all four streams for irrigation purposes and at Berry and Modoc Creeks diversion appears to have been used in order to route only one channel under the Interstate.

Diversion has resulted in alteration of floodplain and channel function for all four channels, and on Modoc Creek, small levee type features were on either side of the channel/ditch.

Table 8. Summary of Proper Functioning Condition Surveys Conducted on ARS Grazing Areas

Property/Grazing Area	Point ID	Rating	Comments
Big Mountain Grazing Unit	BM1	FAR	Stream eroding into road prism at Spring Creek
	BM3	PFC	A3 channel type
	BM4	PFC	A2 channel type
West Odell Grazing Unit	OD2	PFC	B3 channel type
	OD4	PFC	B3 channel type; North Fork Tom's Creek
	OD5	PFC	A/B4 channel type
	OD7	PFC	B3 channel type
	OD8	PFC	C3 channel type
	OD15	PFC	E4 channel type
Tom's Creek Grazing Unit	Pt M	PFC	Corral Ck; A3/A4
	Pt G	PFC	Stream near Blair Lake (below stream crossing)
	Pt J	PFC	A4
Humphrey Ranch	H15	FAR	Ditch-Modoc Creek/Berry Creek
	H14	PFC	E3 channel type
	H2	PFC	E3/34 channel type
	JF2	PFC	E3/34 channel type
	H1	PFC	E3/34 channel type
	JFPT 3	PFC	G4/5 channel type-middle portion of stream at lower end of PFC
Henninger Ranch	HEN8	FAR	F4 channel type; Alteration of flow, rip-rapping, irrigation; Dry Creek
	HEN1	FAR	C4 channel type; Alteration of flow; rip-rapping; Moose Creek
Headquarters	No Surface Flowing Drainages		
DOE Feedlot	No Data Taken-Industrial Area		

Summer Range

Channels within the East Summer Range (Tom's Creek Grazing Area) and the West Summer Range (West Odell Grazing and Big Mountain Grazing Areas) are relatively steep, wide and shallow streams with gravel/cobble substrates. In the Rosgen classification system, all channels were estimated as primarily A3 and 4 or B3 and 4, with some reaches of steeper C3b and C4b type in the broader Odell Creek valley. All were rated as proper functioning condition, with the exception of Spring Creek.

West Summer Range-Odell Creek

Odell Creek is a Rosgen A2--3 within the gorge cut into Mesozoic sedimentary at the northern boundary of the ARS range. A disused road, which at one time provided access to the J.R. Simplot phosphate mine, which was active from 1956-1958 (USDA ARS, 2009). The road was built in the bottom of the stream valley, but does not appear to have impeded its lateral migration very much due to steepness and natural confinement of its channel and boulder substrate. Within the summer range, Odell Creek is primarily a B3 to C3 channel; substrate is fairly well imbricated with particles that are sub-round to round in shape. By nature of its channel type there is not an associated floodplain.

Riparian vegetation is dense willow or forest, depending on valley structure and whether it is influenced by large slumps, which promote open forbs, grassy meadows and brushy riparian corridors. Flow in the main stem was estimated at time of visit (July 29—August 1, 2008) at between 15 and 30 cfs depending on location and watershed area above a point (Moser and Fryxell, 2008). Several crossings mapped by ARS staff were examined and all were rated in proper functioning condition. Some minor rutting on hillside leading to a crossing at point OD7 was observed, and bank trampling noted at OD7 and OD8, where sheep trails crossed the stream (Figure 4, Figure 14). The scale of these disturbances was on the order of tens of feet. There was no evidence that these disturbances impacted stream morphology in any significant way up or downstream of the impact. There was no overt evidence of overburden of sediment in the channel, other than normal particle distribution of the substrate, or heavy, or unusual browse on riparian vegetation.

Degraded banks (from livestock trampling) occur in short sections (10s of feet), where crossings were on sheep trails. There is no evidence that these degraded sections have had a major effect on channel morphology or function. No depositional bars were observed downstream of the sheep trails that would indicate increased levels of sediment contribution. Nor was there the appearance of embedded substrate, which would indicate transport and deposition of excessive amounts of fine sediment.

West Summer Range-Spring Creek

Spring Creek is largely an intermittently flowing channel, probably only reliably flowing during snowmelt in later spring/early summer. A short reach on the main stem of the drainage is fed by a perennially flowing low order draw. Flow is probably fault related. The first 0.4 to 0.5 miles of Spring Creek, up from the confluence with Odell Creek, is dry. The next 0.3 miles is flowing at the time of visit, all water issuing from an unnamed tributary (point BM2, Figure 4). This reach is probably perennial with variation in length year to year depending on precipitation amount and pattern. The channel above the confluence with that tributary is dry.

Along the Spring Creek valley bottom is the one-time access road to the Simplot phosphate mine that is located high on the upper slopes of Sheep Mountain. The mine operated from 1956 through 1958, and since then the road has not been used or maintained. The remaining road prism has confined the stream that has led to a small to moderate degree of degradation of the bed (1 to 2 feet) and some erosion of the road fill/bank on the south side.

The steam condition was rated functional at risk due to the road prism influence. The same road is on the east side of Odell Creek between Spring Creek and the ARS boundary. However, due to the steepness of the canyon, perennial flow in Odell Creek (estimated at 30 cubic feet per second on 7/29/08), and preponderance of bedrock substrate and banks, the channel if it was ever constrained by the road prism, has cleared an adequate and now well vegetated floodplain.

The lower dry portion of the channel was rated functional at risk, due to the presence of the mine access road. The road is inactive, and vegetated with grasses and forbs, but occupies a large part of the valley bottom, impeding the lateral movement of the channel.

Other Properties

Humphrey Ranch-Beaver Creek

Beaver Creek through the Humphrey Ranch is a perennial stream with Rosgen classification of E3 or E4. Gradient is moderate, sinuosity very high and at flood stage, over bank, there is essentially no confinement to flow. The valley bottom/floodplain is occasionally inundated, probably biannual frequency at least over long term and the floodplain is considered to be functioning properly. Banks are loam and floodplain height was about one foot above water level on date of visit (July 12, 2008). Riparian vegetation is primarily grass and forbs although judging from isolated and mature willow clumps was probably at one-time mostly woody species, eliminated through grazing. Ground cover through live vegetation is nearly 100 percent.

Small drainages outside of Beaver and Modoc Creek are intermittent in nature, with small channels narrowly incised in loamy soils, or swales without channeling that is probably wet seasonally or only after very wet, prolonged conditions. Floodplains were not associated with this channel.

In Humphrey Ranch, on the west side of Interstate 15, flow from Modoc and Berry Creeks has been diverted from natural channels by road ditches that bisect the creek, diverting flow from the north side into a ditch that parallels the highway on the south side. A high levee on the west of the ditch prevents any water overflowing the now mostly dry natural channel from entering the ditch, or backing up against the highway fill. The ditch is directed under the highway at a single point and hence conveyed to Beaver Creek. The alteration of the streams drainage structure and path may have been part of a highway project whose purpose was to manage flow on the upstream side of the highway into a single discrete underpass. This alteration resulted in a Functional at Risk rating for this portion of the stream.

Humphrey Ranch-Long Creek

Long Creek, at the confluence with Beaver Creek is very similar to Beaver Creek in form, though smaller. Long Creek flows into Beaver Creek immediately east of Interstate 15 and the railroad, but of which bisect the western quarter of the property. Flow was estimated at about 0.5 cfs at the time of the field visit, so the stream may be intermittent in the late summer and early fall.

Corral Creek

The upper reach of Corral Creek bisects a sheep driveway. The channel is a Rosgen A3—4 stream type. The channel bifurcates just upstream of the crossing, at the toe of a debris fan. Bank height at the crossing was low in stony loamy material.

Channel substrate is relatively loose sub-angular gravel/cobble. Long profile was step-pool type with bed control imposed by large woody debris and tree roots. Rating was proper functioning condition. Trailing through forest cover was noted. No detrimental disturbance.

Headquarters Property

There is virtually no expression of surface runoff in valley/swale development or channeling throughout the Headquarters property area, except for the far western portion of the property, where Beaver Creek is located. The area is dominated by flood basalts, which typically have a very regular fracturing pattern, or joint set. Ground level is also frequently the top of the flow. Infiltration into the soil layer, or fracture pattern, along with continued downward percolation of precipitation is probably very rapid, with considerable storage. Drainage for the Headquarters property, with the exception of the northwest corner that contains Beaver Creek in basalt gorge, is akin to deranged drainage patterns found in glacial till. Low pressure ridges in the basalt flow have created a somewhat random flow path to the area, and frequent small basins without discernible outlets are common.

Beaver Creek flows though the western margin of the Humphrey Ranch property. At the USGS gage site at the bridge (exit 172 from I-15) (Point Q, Figure 4), the stream at the time of the site visit was dry (July 10, 2008). The general appearance and category in the Rosgen classification are the same from this point upstream to just below the gravel pit. The stream is completely confined within a deep basalt gorge. It is a relatively straight channel, with a simple structure of riffles and glides at regular intervals. Bar development is minimal and there are few pools. There is not a readily defined floodplain, rather more of a consistent debris fan at the foot of the cliff walls that is occasionally inundated. Riparian vegetation community is sparse. An ocular assessment of Rosgen classification is an F3 (Rosgen, 1996).

At a point 1.04 miles upstream of the gage the stream was running at the time of the site visit an estimated 15 to 20 cubic feet per second (cfs), the structure of the channel was similar and valley was similar to the above description. At 1.77 mile upstream of the gage, the gorge is less deep and the valley bottom has widened. The Rosgen classification is C3. There is increased channel sinuosity, an identifiable floodplain and riparian vegetation community. At the gravel pit the valley widens out considerably, and gradient decreases, most likely due to control enforced by evident bedrock substrate. Because of gradient change, a prodigious quantity of gravel/cobble material has been deposited in this reach. Below the vehicle, crossing the stream bifurcates around a large and high gravel island. Upstream of the crossing the channel is a single thread, but with equally elevated floodplain. Riparian Vegetation is very dense and high willow. Rosgen classification is C3. Floodplain function was intact.

Henninger Ranch Property

This property is very similar in terms of stream development when compared to the Headquarters property. The Dry Creek channel bisects the property. Headwaters for this drainage are found on the southern slope of the Centennial Mountains. The stream is intermittent through Henninger Ranch in a C4 channel, which was rated as functioning-at-risk (July 12, 2008). Moose Creek, which crosses the northern portion of the Ranch was classified as an F4 channel and rated as function-at risk. Floodplains are not associated with this channel type.

Springs and Wetlands

No springs were observed during field work in 2008 and 2009.

Field reconnaissance was conducted during the summer 2008 and 2009. Based on field observations water-influenced soils were only found associated with flowing streams or at Blair Lake. The width of water-influence appeared to be limited and often reflected by the presence of *Salix spp*. and *Equisetum fluviatile*.

Wet meadow conditions were observed in the Humphrey Ranch adjacent to Beaver Creek and in several swale areas on the Ranch.

These low-lying areas lacked developed channel morphology, but appeared to have seasonally wet conditions or have wet conditions that were sustained after periods of precipitation.

Water-influence soils around Blair Lake were observed to have limited trampling and compaction. These areas were limited to driveway crossings and areas around Blair Lake where sheep access the water for drinking. At sheep trail crossings and around Blair Lake adjacent vegetation and water-influenced soils did not appear to be disturbed or otherwise compromised.

No bedding areas were observed in areas of water-influenced soils. These field observations support information provided by USSES personnel that sheep prefer to congregate on slopes and ridge tops and avoid wetland and riparian areas.

Water Quality

303(d)/305(b) Report

The Clean Water Act (CWA), of 1972, and subsequent amendments of 1977 and 1987, is the primary federal law that governs water pollution in the United States. Under the act states are required to set water quality criteria standards. A biennial report, under section 305(b), is prepared for congress by the states and Environmental Protection Agency. Within that report a list of impaired water bodies within the state (section 303(d) of the CWA) is required.

Since the project area includes parts of Montana and Idaho both States Integrated Reports for 303(d) and 305(b) information was reviewed. Water quality criteria and standards for both States are tiered to designated beneficial uses. For the State of Idaho these are: aquatic life, recreation, domestic water supply, wildlife habitat and aesthetics (State of Idaho, 2009). The State of Montana's designated beneficial uses are public water supplies, wildlife, fish and aquatic life, agriculture, industry, recreation and other beneficial uses (State of Montana, 2006a). The State of Montana defines impaired as "a water body or stream segment for which sufficient credible data shows that the water body or stream segment is failing to achieve compliance with applicable water quality standards" (http://data.opi.mt.gov/bills/mca/75/5/75-5-103.htm).

Waters in the integrated 303(d)/305(b) reports are classified by category, denoting their compliance with applicable water quality standards. Table 9 and Table 10 refer to category 4a, and 5. Category 4a waters Impaired water bodies are placed in Category 4a when a total maximum daily load (TMDL) is developed by DEQ and approved by EPA such that, when implemented, full attainment of the water quality standards is expected for the specific impairment (e.g., sediment) for which the TMDL was developed. If the water body has any other impairment(s), then it may be included in other categories of the Integrated Report (State of Idaho, 2010). Category 4c indicates that that non-support of water quality standard(s) is not due to a pollutant. Category 5 streams are defined as waters where one or more applicable beneficial uses are impaired or threatened, and a TMDL is required to address the factors causing the impairment or threat (State of Idaho 2014, State of Montana 2014). These waters make up the 303(d) list for a state (State of Montana, 2014). Each state proposes which reaches would have TMDL's developed and the year to be completed.

Table 9. Summary of State of Idaho Impaired Reaches on ARS Grazing Lands

Listed Reach Name	Category	Length (miles)	Use Class[a]	Beneficial Uses Not-Supported	Probable Cause(s)	Probable Source(s)[c]	Year Completed[b]
Beaver Ck (Beaver Ck-Dry Creek to canal)/(ID17040214SK014_05) (Humphrey Ranch)	4A	2.7	DWS; PCR; SS; CWAL	Coldwater Aquatic Life (Other Uses Not Assessed)	Water temperature	Streambank erosion reduced riparian vegetation due to grazing and low flow conditions. Ongoing drought exacerbating stream temperature elevation	2005
Beaver Ck (Source to Idaho Ck)/(Id17040214SK021_02) (Long Creek) (Modoc) (blank) (All Humphrey Ranch)	4A	5.8	DWS; PCR; SS; CWAL	Domestic Water Supply, Salmon Spawning, Primary Contact Recreation, Coldwater Aquatic Life	E. Coli and water temperature	Streambank erosion reduced riparian vegetation due to grazing and low flow conditions. Ongoing drought exacerbating stream temperature elevation	2005
Beaver Ck. (Source to Idaho Ck./ID17040214SK021_3)	4A	2.0	DWS; PCR; SS; CWAL	Coldwater Aquatic Life (Other Uses Not Assessed)	Water Temperature	Streambank erosion reduced riparian vegetation due to grazing and low flow conditions. Ongoing drought exacerbating stream temperature elevation	2005

a - DSW: Domestic Water Supply; PCR = Primary Contact Recreation; SS = Salmonid Spawning; CWAL = Coldwater Aquatic Life

b - Thompson, 2005

c - http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/beaver-camas-subbasin.aspx

Table 10. Summary of State of Montana Impaired Reaches on ARS Grazing Lands

Listed Reach Name	Category	Length (miles)	Use Class[a]	Items Partially (P) or Non-Supported (N)	Probable Cause(s)	Probable Source(s)[b]	TMDL Completed Yes/No
Corral Ck. (Headwaters to Mouth of Red Rock Ck.)	5	0.4	B1	Aquatic Life (P)	Alteration in stream-side or littoral vegetative covers, Total Phosphorus and Sediment	Grazing in riparian or shoreline zones; Unspecified unpaved road or trail	No
Hell Roaring Ck. (Headwaters to Mouth of Red Rock Ck.)	4C	0.6	B1	Aquatic Life (N)	Alteration in stream-side or littoral vegetative covers	Grazing in riparian or shoreline zones	No
Odell Ck. (Headwaters to Mouth of Red Rock River)	5	5.7	B1	Aquatic Life (N) Primary Contact Recreation (P)	Anthropogenic substrate alteration, physical substrate habitat alteration; High flow regime and Alteration in stream-side or littoral vegetative covers	Agriculture, Channelization, Habitat Modification, Hydrostructure Flow regulation, Irrigated Crop Production and Grazing in Riparian or Shoreline Zones;	No
Tom's Ck. (Headwaters to the mouth of Upper Red Rock Lake)	5	1.8	B1	Aquatic Life (P)	Alteration in stream-side or littoral vegetative covers; Low flow alterations; Sedimentation and siltation	Grazing in Riparian or Shoreline Zones; Irrigated crop production	No

a - Waters suitable for drinking, culinary and food processing purposes after conventional treatment; bathing, swimming and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; agricultural/industrial water supply.

b - State of Montana 2006b, 2006c, 2006d and 2006e

The 2014 State of Idaho Integrated 303(d)/305(b) report, and accompanying GIS data, document that 10.5 miles of stream flowing through ARS-administered lands are categorized as 4a and 5 (Table 9). A TMDL for temperature has been developed and approved by EPA for Beaver Creek but not implemented and Beaver Creek is still considered impaired. Table 9 summarizes the probable causes and sources of stream impairment and Figure 35 displays the location of these streams (State of Idaho, 2014).

Fieldwork in 2008 conducted three PFC surveys on Beaver Creek, where it flowed through ARS administered lands. Two of the surveys found the stream in proper functioning condition with abundant riparian vegetation and no signs of upland disturbance. At the third site, a rating of functional-at-risk was given due to the immediate adjacency of an old non-active gravel pit and a road crossing the stream.

On the Humphrey Ranch, surveyed sections of Beaver Creek, and Long Creek, did not show evidence of flow, physical substrate, and habitat alterations during the 2008 and 2009 field seasons. Fieldwork along Beaver and Long Creeks did not provide indications of past riparian harvest or removal. As a result, water temperature alterations may be due to flow alterations. It should be noted that Beaver Creek is listed by the State of Idaho as impaired although PFC surveys conducted on Humphrey Ranch rated the stream as in proper functioning condition. Analysis of the State of Montana's draft 2014 Water Quality Integrated Report (303(d)/305(b) list) documents three streams originating in the Centennial Mountains, are on the 303(d) list or listed impaired, but not requiring a TMDL. Corral Creek, O'Dell Creek, Tom Creek are listed as Category 5 streams (State of Montana, 2014). Hell Roaring Creek is listed as a category 4C. These streams, the causes for impairment and probable sources are listed in Table 10. The location of these streams is displayed in Figure 35 . Although Corral, Odell and Tom Creeks have been listed as requiring TMDLs, and a date has been assigned for TMDL completion, none of these TMDLs have been developed as of yet (State of Montana, 2014, Appendices B and F, http://cwaic.mt.gov/query.aspx).

Although these streams are listed from headwaters to steam mouths, the listings appear to be based on problem specific to certain reaches lower within the Red Rock Lakes basin, which are not located on ARS administered lands. Discussions with the State of Montana indicated that the listing of the entire reach appears to be more a matter of convenience than impairment (Fryxell, 2011a.).

The State of Montana's Clean Water Act Information Center, for the 2014 reporting cycle describes the upper reaches of Corral and Hell Roaring Creeks, whose headwaters are in the Tom Creek summer range, as in reference condition (http://cwaic.mt.gov/query.aspx). Field observations in July 2008 and August 2009 support these conclusions (Moser and Fryxell, 2008, Fryxell, 2009). Further communications with the State of Montana document conditions in these two drainages. The upper reach of Hell Roaring Creek is documented as in near pristine/reference condition and that the upper reach of Corral Creek is a mountain stream with good cool flow, stabile stream banks, good riparian vegetation and shading and clean substrate (Fryxell, 2011b).

In both areas, vegetation appeared consistent and well established, in the areas that were visited. There were no major areas of upland instability or erosion that were observed in these field trips that could be potential sources of sediment. No areas of excessive riparian impacts and browse were observed that could be construed as alteration of riparian vegetative cover (Moser and Fryxell, 2008, Fryxell, 2009).

The entire length of Odell Creek is listed, due to impairments which were the result of severe erosion from grazing in riparian areas and dewatering due to irrigation (State of Montana, 2006d, http://cwaic.mt.gov/query.aspx). The report is not specific to where these problems are located and neither of these issues was observed during field work conducted in 2008 on ARS grazing property in this area. However, the last time this reach was assessed was 1999. In addition, during field work vegetation appeared consistent and well established, in the areas that were visited. There were no major areas of upland instability or erosion that were observed in these field trips that could be potential sources of sediment. No areas of excessive riparian impacts and browse were observed that could be construed as alteration of riparian vegetative cover.

No areas of streambank degradation were noted except at two minor areas on Odell Creek (OD4 and 5, Moser and Fryxell, 2008).

A similar situation exists with Tom Creek. Probable causes of impairment are grazing in riparian or shoreline zones and irrigated crop production Probable causes of impairment are listed as grazing related sources and irrigated crop production (Montana, 2014, 2006e, http://cwaic.mt.gov/query.aspx). No grazing related sources of sediment and siltation, alterations to flow or to stream side vegetation were observed during the field seasons of 2008 or 2009 in the headwaters of Tom Creek (Moser and Fryxell, 2008 and Fryxell, 2009). However, the map for this reach indicates that the entire listed segment does not extend beyond the valley floor, in front of the north boundary of the Centennials (Figure 35 and Figure 38).

In Montana, there is only one impaired waterbody within the project area. Upper Red Rock Lakes is listed as impaired due to other flow regime alterations and sedimentation and siltation. These problems are due to agriculture, grazing in the riparian or shoreline zones, range land grazing and upland sources (State of Montana, 2014, Appendix A, Figure 35). Examination of maps associated with Red Rock Lake on the Montana Dept. of Quality Clean Water Information Center Mapper shows that both the Upper and Lower Red Rock Lake areas do not involve ARS lands (http://cwaic.mt.gov/query.aspx). In Idaho there are numerous waterbodies present but only one is assessed at fully supporting. The others have not been evaluated (Figure 36).

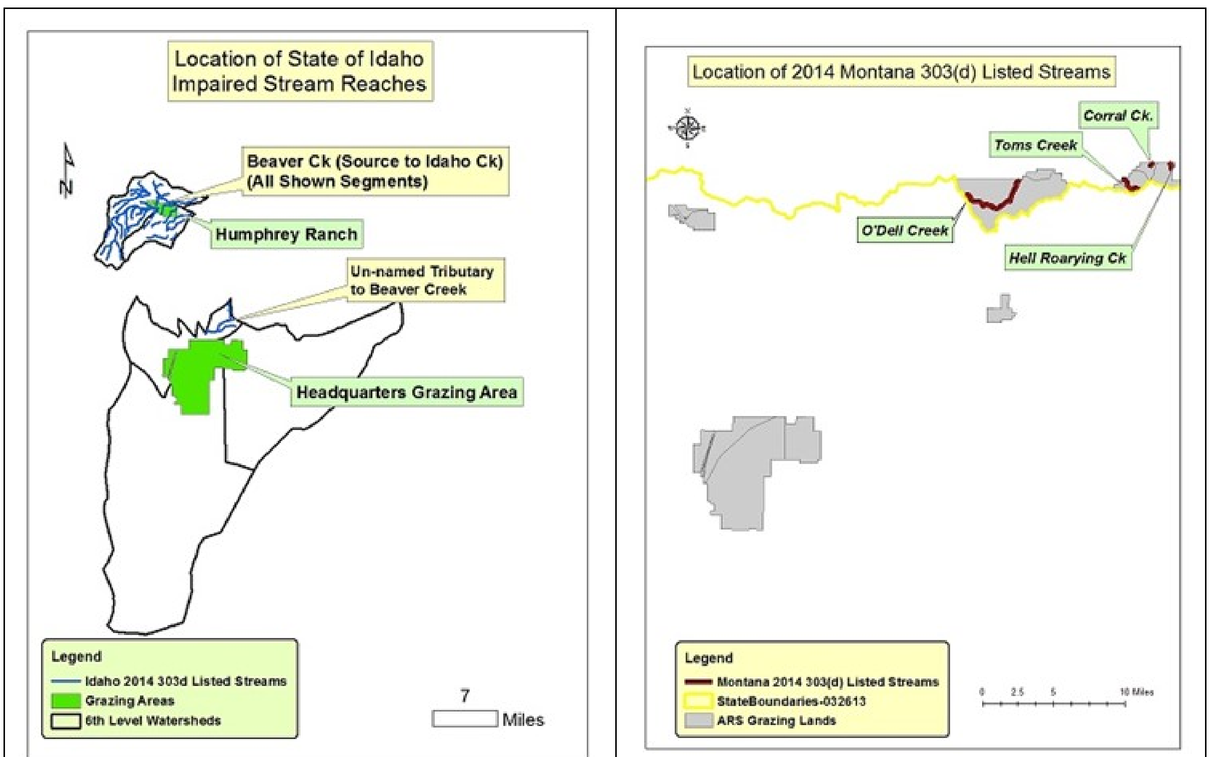

Figure 35. Location of Idaho and Montana 2008 303(d) Impaired Streams Found on ARS Grazing Lands

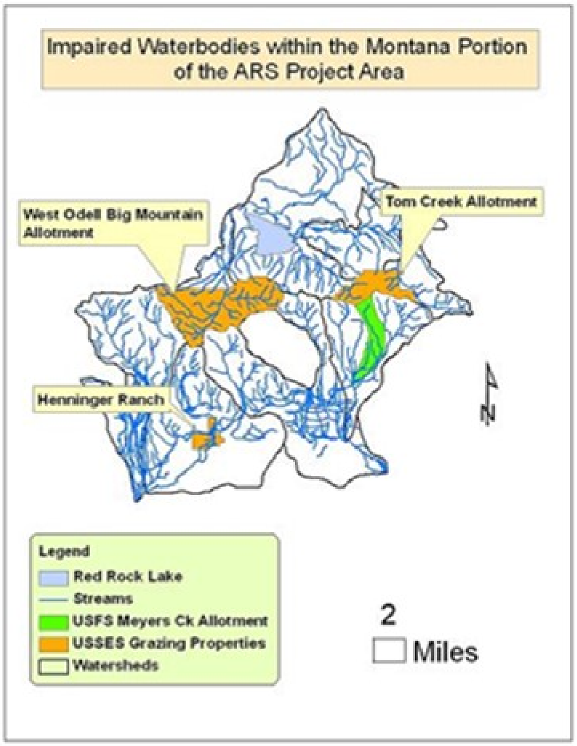

Figure 36. Locations of Impaired Waterbodies in the Montana Portion of the Proposed Project Area

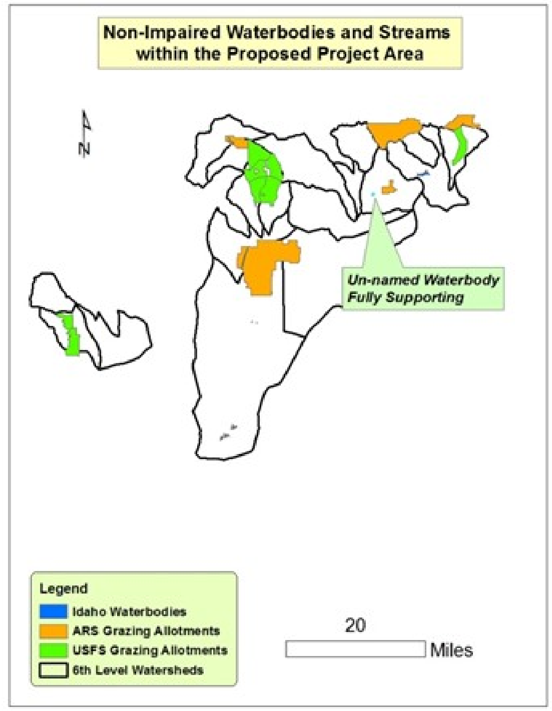

Figure 37. Locations of Non-impaired Waterbodies in the Idaho Portion of the Proposed Project Area

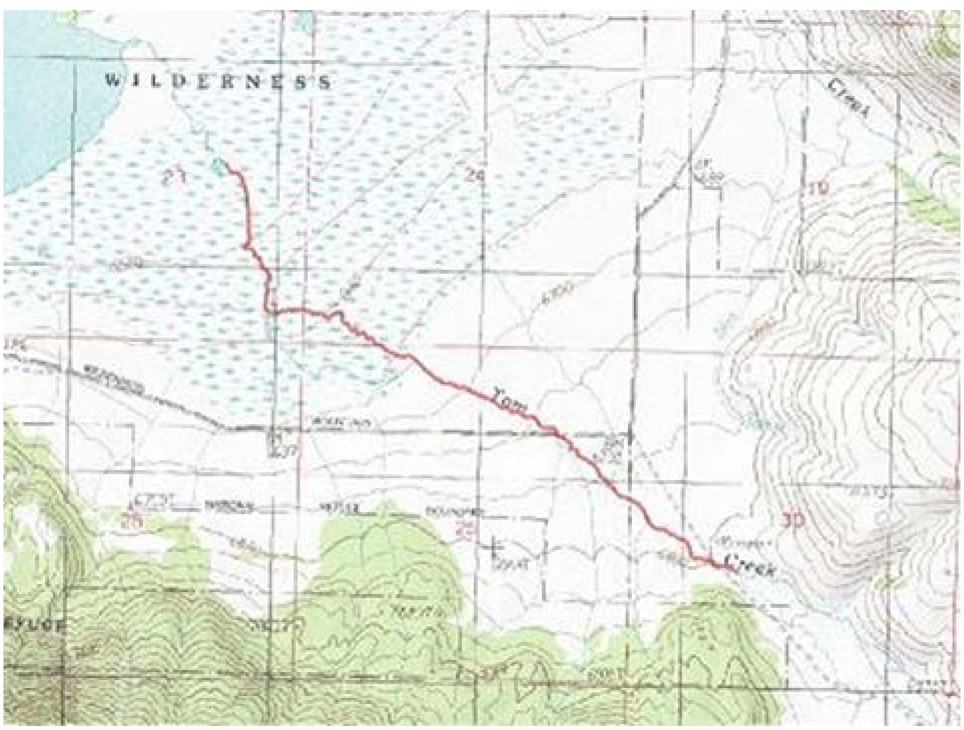

Figure 38 Location of Impaired Reach on Tom's Creek

All streams, and water bodies, which are not impaired in both Idaho and Montana, are displayed in Figure 39 Impaired streams are included as reference markers, as are the differing grazing allotments.

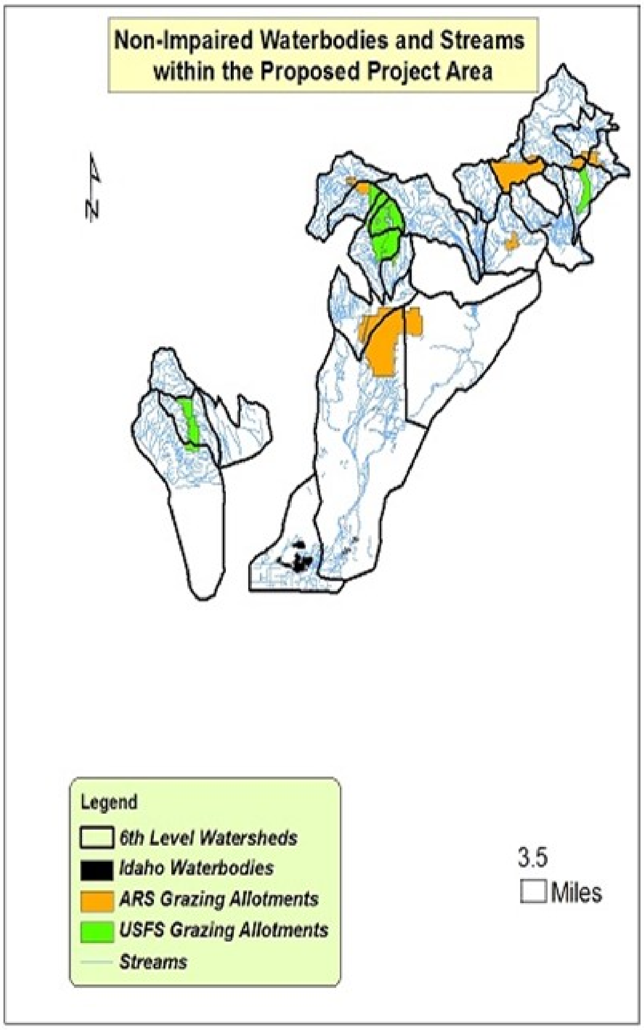

Figure 39. Locations of Non-Impaired Streams and Waterbodies in Montana and Idaho within the Project Area

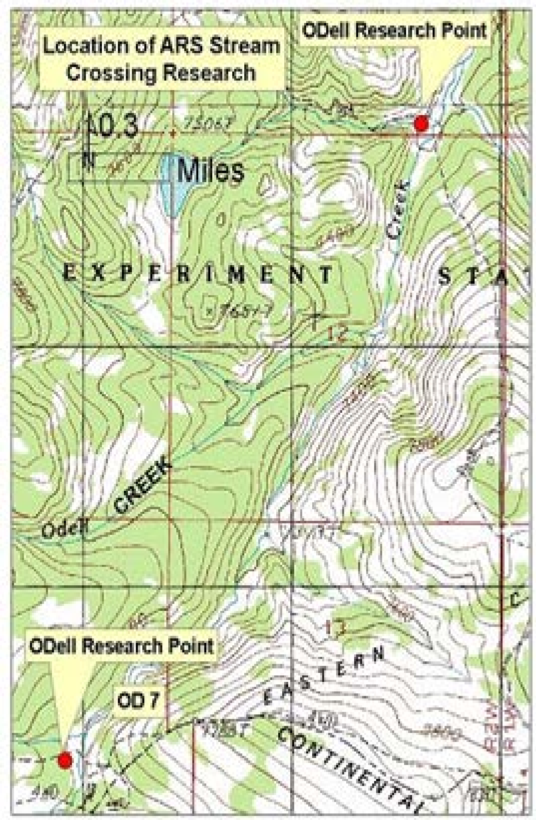

Figure 40. Location of Odell Creek ARS Stream Crossing Research Points

In 2005 and 2006, a study was conducted on two reaches located on Odell Creek by USDA ARS researchers (Lewis et al, 2009, Figure 40 and Figure 14). A total of 2,000 to 2,500 sheep were crossed each year. The objective of the study was to determine effects of sheep crossing Odell creek on suspended sediment and generic *Escherichia coli* (*E.coli*). Water samples were collected every two minutes at a point 25 meters above the crossing and at 25, 100, 500 and 1, 500 meters below of the crossing. Samples collected above the 25 meter upstream collection point represents background concentrations for both sediment and *E. coli* in Odell Creek.

The State of Montana surface water quality standards and procedures, for suspended sediment states "No increases are allowed above naturally occurring concentrations of sediment or suspended sediment (except as permitted in 75-5-318, MCA), settleable solids, oils, or floating solids, which will or are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish, or other wildlife(http://www.deq.state.mt.us/dir/Legal/Chapters/Ch30-10.pdf).

Data collection indicates that for Total Suspended Solids (TSS), it was 26 minutes from when the sediment plumes first appeared to when they disappeared. Roughly, 10-20 percent of TSS measured at 25 meters downstream from the crossing was transported to the 1,500 meter downstream station (Table 11). Although TSS values are obviously greater than those collected at the -25 meter site these values would not be considered as exceedances as the elevated levels do not create a nuisance or render the water detrimental to its beneficial uses at the 26 minute collection time

Table 11. Summary of Total Suspended Solids (TSS) Water Quality Data Collected 2005-2006, Odell Creek

Reach	Distance downstream (meters)	Peak Maximum Concentration (mg/L)	Post-peak Minimum Concentration (mg/L)	Peak Duration (minutes)	Cumulative Suspended Sediment (Kg)
Upper	-25	2[a]	n/a[b]	n/a	n/a
	25	1,566	5.0	6	82
	100	486	3.5	9	34
	500	85	1.9	15	17
	1,500	15	3.1	26	8
Lower	-25	3[c]	n/a	n/a	n/a
	25	483	6.5	10	373
	100	444	5.0	11	246
	500	178	4.1	13	120
	1,500	71	4.9	19	76

a - Mean concentrations for comparisons: No peaks were detected at 25 meters upstream.

b - n/a: not applicable

c - Mean concentrations for comparisons: No peaks were detected at 25 meters upstream.

Odell Creek is classified as B-1 drainage. The State of Montana water quality criteria for B-1 classified waters states: The water quality standard for *Escherichia coli* bacteria (*E. coli*) varies according to season, as follows: "from April 1 through October 31, the geometric mean number of *E. coli* may not exceed 126 colony forming units per 100 milliliters and 10% of the total samples may not exceed 252 colony forming units per 100 milliliters during any 30-day period; and from November 1 through March 31, the geometric mean number of *E. coli* may not exceed 630 colony forming units per 100 milliliters and 10% of the samples may not exceed 1,260 colony forming units per 100 milliliters during any 30-day period" (http://www.deq.state.mt.us/dir/Legal/Chapters/Ch30-10.pdf) .

E. coli measurement results displayed in Table 11 do not reflect geometric means. As a result, direct comparisons to water quality criteria for the State of Montana can't be made. Data displayed represent discrete points in time. *E. coli* concentrations were highest at 25 and 50 meters downstream after crossing. E. coli plumes appeared and disappeared within 15 minutes. At 1, 500 meters, concentrations were 1.3 percent and 4.8 percent of values documented at 25 meters downstream of the crossing, for upper and lower reaches respectively (Table 12).

Table 12. Summary of Escherichia coli (E. coli) Water Quality Data Collected, 2005-2006, Odell Creek

Reach	Distance downstream (meters)	Peak Maximum Concentration (MPN/100 mL)	Post-peak Minimum Concentration (MPN/100 mL)	Peak Duration (minutes)
Upper	-25	14[a]	n/a	n/a
	25	2, 808	119	7
	100	768	87	8
	500	484	16	15
	1,500	39	41	13
Lower	-25	24a	n/a	n/a
	25	1, 667	42	9
	100	1, 744	68	11
	500	1, 471	252	14
	1,500	795	101	14

a - Mean concentrations for comparisons: No peaks were detected at 25 meters upstream.

Data indicates that for both TSS and *E. coli* concentrations, effects diminish rapidly with distance downstream and duration of elevated water quality analytes is short-lived.

Table 13. Summary of Herbicides Applied on ARS Grazing Lands[a]

Herbicide	Comments
2, 4 D amine	Used for both aquatic and terrestrial vegetation control; Binds slightly to soil; Water soluble, Ester forms toxic to fish
Imazapyr	Used for both aquatic and terrestrial vegetation control; Binding to soils is pH dependent; Water soluble and degrades rapidly in sunlight; Low toxicity to fish and algae
Imazapic	Used to treat annual and perennial weeds; Not registered for use in aquatic systems, Average half-life in water is less than eight hours and 120 days in soils. Relatively non-toxic to aquatic mammals, birds and amphibians
Picloram	Used for terrestrial vegetation control; Known surface and groundwater contaminant; Does not bind tightly with soils
Bromacil	Used for terrestrial vegetation control; Mobile in soil; Known groundwater contaminant.
Clopyralid	Weakly adsorbed with moderate leaching potential in soils; Not known to be a common groundwater contaminant and is considered moderately toxic to fish
Triclopyramine	Weakly adsorbed to soil; Practically non-toxic to fish
Diuron	Used for terrestrial vegetation control; Known groundwater contaminant; Moderately toxic to fish and highly toxic to aquatic plants
Non-aquatic Glyphosate	Used for control of annual and perennial weeds; In water glyphosate is rapidly dissipated through adsorption to suspended and bottom sediments. Half life of 12 days to 10 weeks. Relatively low toxicity to birds, mammals, and fish.
Aminopyralid	Selective herbicide for control of broadleaf weeds, especially thistles and clovers. Given its high mobility, and moderate persistence in soil, aminopyralid is likely to leach to ground water, irrespective of soil type. Essentially non-toxic to slightly non-toxic (or a low potential for adverse effects) to fish and aquatic organisms [b]

a - References: Tu et al, 2001 and Thornton and Archer, 2009
b - Thornton, 2011

In general, up to 60 acres of herbicide application occurs for the treatment of invasive plants on ARS properties; approximately 90% of this is along roadsides. In 2014 and 2015 17 miles of Sheep Station and co-owned road (state, county, private) roadsides were spot treated for various noxious weeds. Herbicides used were non-aquatic glyphosate, 2,4-D amine and aminopyralid. Road surfaces were also treated. These treatments consisted of two miles per year of asphalt road surface with cracks. These areas were spot treated with Bromacil plus Diuron. Lot surfaces were also treated, which included animal holding lots surfaces at Headquarters and the Mud Lake Feedlot, as well as parking areas. Approximately two acres per year were treated using Bromacil and Diuron. Pastures were also treated at Humphrey, Headquarters or Mud Lake. Twelve acres per year were treated.

Review of available GIS layers, obtained from ARS, documenting weed locations, show that herbicides have been applied adjacent to Beaver Creek on the west side of the Headquarters Property and along several intermittent tributaries.

Municipal Watersheds

There are two wells located on the Headquarters property. One well, developed in 1918, is estimated to be at least 350 feet deep. The other well, developed in 1937, is 856 feet deep with the water level at 731 feet.

These wells are used for drinking water and are tested quarterly for the presence/absence of coliform and are tested annually for copper and lead. Volatile organic compounds and arsenic are monitored once every three years. Inorganic compounds and nitrite are required to be monitored every nine years. Nitrates are required to be monitored annually. Synthetic organics (herbicides) are required to be monitored every six years. Out of the three compounds known for groundwater contamination, only Picloram is monitored, apparently Bromacil and Diuron are not regulated in Idaho (Feisthamel, 2009). Exceedances above maximum contaminant levels are rare, with only one exceedance of MCLs in 2005 for coliform. There have been no detections of Picloram (Feisthamel, 2009).

There is also a domestic well on the Henninger Ranch, but that well is not used and is not monitored (Jacobson, 2009b, Yurczyk, 2009b).

Desired Condition

The USDA Agricultural Research Service (ARS) U.S. Sheep Experiment Station (USSES) is an agricultural research facility whose primary mission is to “develop integrated methods for increasing production efficiency of sheep and to simultaneously improve the sustainability of rangeland ecosystems” (USDA Forest Service 2015).

As a research station they are not required to have a land management plan. As a result, there are no defined Desired Conditions, Standards and Guidelines, or Objectives, as typically found in a land management plan that is developed by an agency such as the Forest Service or Bureau of Land Management. However, research activities must adhere to federal laws and regulations such as Executive Orders and Acts. Applicable federal laws and regulations are:

- *Clean Water Act of 1977*: The objective of the Act is to restore and maintain the chemical, physical and biological integrity of the Nation’s waters. (Section 101(a)). It also regulates discharge of dredged or fill material into navigable waters (waters of the U.S.) (Section 404). Section 305(b) of the CWA also requires the establishment and implementation of water quality standards and criteria. It also requires each state to conduct water quality surveys to determine a water body's overall health, including whether or not basic uses are being met. Findings are summarized in the biennial 305(b) report which lists impaired water bodies within that State. States, tribes, and other jurisdictions define appropriate uses for a waterbody and incorporate these uses into water quality standards that are approved by the Environmental Protection Agency (EPA).

- *Executive Order 11990, 1977: Wetlands Management:* E.O. 11990 requires federal agencies to follow avoidance, mitigation, and preservation procedures with public input before proposing new construction in wetlands. To comply with Executive Order 11990, the federal agency would coordinate with the ACOE, under Section 404 of the Clean Water Act, and mitigate for impacts to wetland habitats. No known wetlands exist within the project area.
- *Executive Order 11998, 1977: Floodplain Management:* E.O. 11998 requires all federal agencies to take actions to reduce the risk of flood loss, restore and preserve the natural and beneficial values in floodplains, and minimize the impacts of floods on human safety, health, and welfare. There are no stream channels with floodplain characteristics that would be affected by this project. All channels that cross or are immediately adjacent to project activities are intermittent streams and do not have floodplain features.

Environmental Consequences

Incomplete and Unavailable Information

All available information was used.

Spatial and Temporal Context for Effects Analysis

Spatial context for this project is defined by those 6th level watersheds containing any ARS properties, grazing allotments and sheep trailss used in ARS activities.–direct/indirect and cumulative effects (. Sixth-level watersheds in the project area typically range from approximately 8, 504 to 203, 938 acres. This level of analysis was selected as it provides a good scale for determining effects. If a larger scale were used, the amount of area tends to be overwhelming, and when smaller scales are used, the amount of area is too limited in scope.

Watersheds containing only roads used for trucking sheep to various grazing areas where not included in the cumulative effects area, as there are only twelve trips a year, which is the maximum under the proposed action. Maintaining or reducing this number would be inconsequential when comparing to traffic levels on State Highways, county roads, and Forest Service Roads, which are used for trucking sheep.

Two levels of temporal context are used in the effects analysis. The time frame for short-term effects is defined as less than 10 years and long-term is defined as greater than 10 years. These time frames are based on professional judgment and discussions with other TEAMS hydrologists.

Sources of information used in this analysis are discussed under “Methodology.”

Environmental Analysis

Measures used for analysis are summarized below in Table 14. The types of direct and indirect effects are the same for all alternatives.

Analysis Assumptions

The USSES has water rights on Modoc and Dry Creeks. For analysis purposes, it is assumed that rates of water use would remain the same for alternatives 1, 3, 4 and 5 where the Humphrey and Henninger Ranch properties would be used for grazing. It is assumed that where one or both of these properties are not grazed then the water rights would not be used (alternatives 2, 3, 4 and 5).

All proposed design features and mitigations measures would be implemented for alternatives 1, 3, 4 and 5. However, if an activity, design feature or mitigation measure is located in a property where grazing would not occur then they would not be implemented.

The percent forage utilized reflects the potential for ground disturbance, erosion and sediment generation.

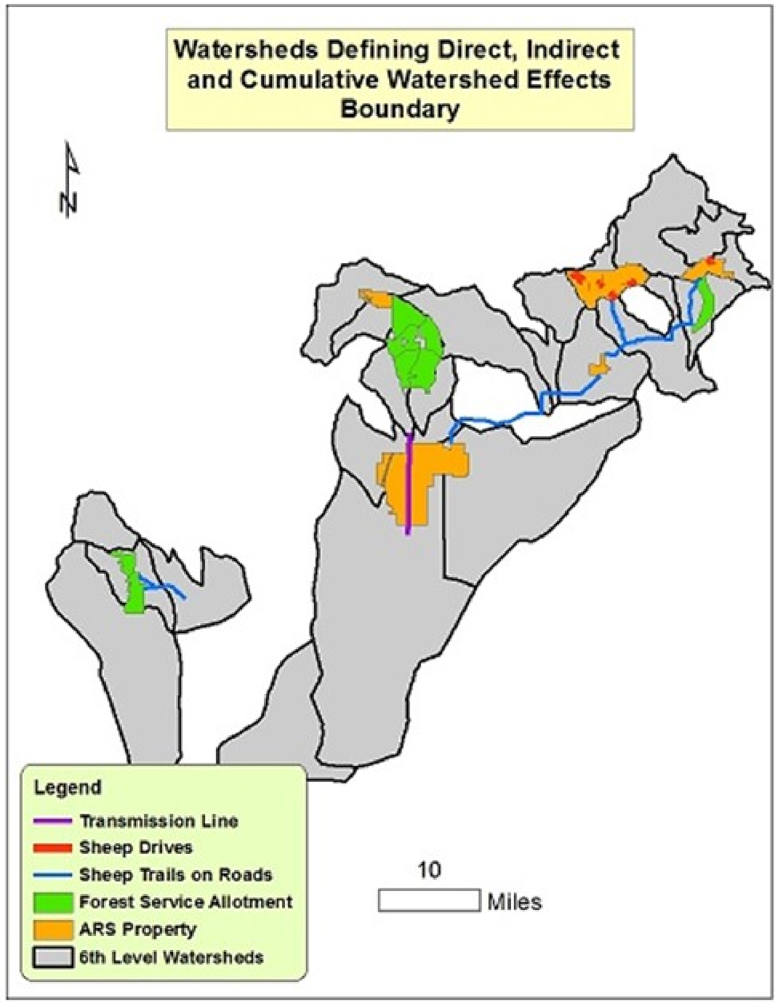

Figure 41. Watersheds Defining the Area of Analysis for Direct, Indirect and Cumulative Effects

Measures Used for Analysis

Table 14 and Table 15 displays a summary of the measures used for analyzing potential effects by alternative. Table 15 summarizes how the percent utilization would vary by alternative. In total, alternatives 2, 3, and 4 have reduced numbers of sheep that would be grazed, and Alternative 4 would graze the same number of sheep.

Table 14. Summary of Analysis Measures by Alternative

Unit of Measure	Modified Alternative 1- Proposed Action	Alternative 2	Modified Alternative 3	Modified Alternative 4	Modified Alternative 5
Total Miles of Sheep Trails (Trails off of Roadways)	3.1	0	0	2.3	3.1
Total Miles of Sheep Trails (Trails off of Roadways) within 300 ft. of Streams	1.4	0	0	1.2	1.4
Percent change in Number of ARS Property Acres Grazed Compared to Alternative 1 [a]	0% (47, 606 acres total)	*NA*	*-36%*	*-8%*	*0%*

Unit of Measure	Modified Alternative 1-Proposed Action	Alternative 2	Modified Alternative 3	Modified Alternative 4	Modified Alternative 5
Additional Measures for Cumulative Effects					
Total Miles of Trail (Total Sheep Trails off Roads Plus Total Trails on Roadways)	50.9	0	6.7	33.6	40.1
Total Miles of Trail within 300 ft of Streams (Trails Both on and off Road)	20.2	0	3.1	16.2	17.1

Table 15. Summary of Percent Utilization by Alternative

Property		Utilization Percent				
		ALT1	ALT2	ALT3	ALT4	ALT 5
Agricultural Research Service Lands		**8%**	**NA**	**8%**	**8.0%**	**5%**
Headquarters		6 %	**NA**	6%	7%	4%
Humphrey		18 %	**NA**	27%	20%	11%
Henninger Ranch		18 %	**NA**	16%	21%	11%
East Summer Range (Tom's Creek)		6 %	**NA**	NA	NA	3%
West Summer Range (Odell Creek/ Big Mountain)		5 %	0.0%	NA%	5%	3%
Allotments on Forest Service-administered Lands		**3 %**	**NA**	**13%**	**4%**	**< 1%**
Snakey-Kelly		25.0 %	**NA**	13%	25.0%	NA
East Beaver		1.0 %	**NA**	NA	2%	< 1%
Meyers Creek		1.0 %	**NA**	NA	NA	< 1%

a - Animal Unit Month. By definition, one (1) AUM represents 790 lbs of dry forage consumed over 30.44 days by a 1,000-lb cow that is nursing a calf. For the purposes of this table, five (5) sheep[c] are equivalent to one (1) AUM

Best Management Practices, Project Design Features and Mitigation Measures

Best Management Practices

Best Management Practices would apply to all alternatives.

Best Management Practices (BMPs) are be implemented for herbicide application. A complete list is included in Appendix C of the Revised DEIS (USDA Forest Service 2015); those applicable to protecting water quality are included below.

Herbicides

- A contingency plan, or emergency spill plan, will document notification requirements, time requirements for notification, spill management, and parties responsible for cleanup. Factors to be considered during spill cleanup are the substance spilled, the quantity, and toxicity, proximity to waters and hazard to life, property and environment, including aquatic organisms.

- Tebuthiuron would not be used when the ground is frozen or saturated with water (http://www.keystonepestsolutions.com/tebuthiuron-80wg-herbicide-4-pounds-brush-killer-replaces-spike-80wg-spike-80df-281.html).
  - An intermittent stream is located in the western-most treatment polygon (Figure 42). Tebuthiuron would not be applied when the stream is flowing, the ground is saturated with water or the stream bed is frozen
- The granular form of Tebuthiuron would not be applied when wind speeds exceed 10 mph. Herbicides will not be applied when conditions stated on the herbicide label cannot be met and when air turbulence significantly affects the desired spray pattern (Bureau of Land Management 2010).

Table 16. List of Herbicides and Recommended Buffer Widths to Reduce Potential for Groundwater Contamination

Herbicide	Recommended Buffer Width	Comment
2, 4 D amine	25 ft [a]	If using ester form, toxic to fish
Imazapyr	Up to Edge [b]	Low toxicity to fish and algae; Mobility pH dependent
Picloram	25 ft [a] 164 ft	Known surface and groundwater contaminant; 25 ft buffer applies to surface water drainages; 164 ft buffer applies if herbicide applied near Station groundwater wells
Bromacil	25 ft [a] 164 ft	Known groundwater contaminant; 25 ft buffer applies to surface water drainages; 164 ft buffer applies if herbicide applied near Station groundwater wells
Clopyralid	25 ft [a] 164 ft	Considered moderately toxic to fish; 25 ft buffer applies to surface water drainages; 164 ft buffer applies if herbicide applied near Station groundwater wells
Triclopyr amine	Up to Edge [b]	If ester form used, can be persistent in aquatic environment
Diuron	25 ft [a] 164 ft	Known groundwater contaminant; Moderately toxic to fish and highly toxic to aquatic plants; 25 ft buffer applies to surface water drainages; 164 ft buffer applies if herbicide applied near Station groundwater wells
Non-aquatic Glyphosate	100 ft [b]	Relatively low toxicity to birds, mammals, and fish.
Aminopyralid	0 ft. [c]	Given its high mobility, and moderate persistence in soil, aminopyralid is likely to leach to ground water irrespective of soil type; slightly non-toxic (or a low potential for adverse effects) to fish and aquatic organisms [d]
Tebuthiuron	100 ft.[e]	A minimum buffer zone of 100 feet wide will be provided for aerial application.

a - Bonneville Power Administration, Date Unknown, Transmission System Management Program (DOE/EIS-0285)-Final EIS, Chapter

b - Tu et al, Nature Conservancy Handbook

c - Durkin, 2007 Risk Assessment for U.S. Forest Service

d - Thornton, 2011 Bureau of Land Management 2010

Buffers would be used adjacent to streams, ponds or wetlands. Buffer width would be a function of the herbicide used. Recommended buffer widths are in Table 16. However, during pesticide application the following factors would be taken into consideration in case buffer widths would need to be increased: beneficial water uses, adjacent land use, rainfall, temperature, wind speed and direction, terrain, soils, vegetative type and aquatic life. Other consideration would be type of application, persistence on-site foliage, spray pattern and droplets and carrier. Buffers have been proven effective across the country in managing non-point sources of pollution, and their implementation is required in both Idaho and Montana as part of the Clean Water Act (Seyedbagheri, 1996, Schuler and Briggs, USDA Forest Service, 2002, State of Idaho, 1999, State of Montana, 2007, Thornton 2001). Buffers have proven effective in are effective at reducing the movement of herbicide to streams (Bureau of Land Management 2010).

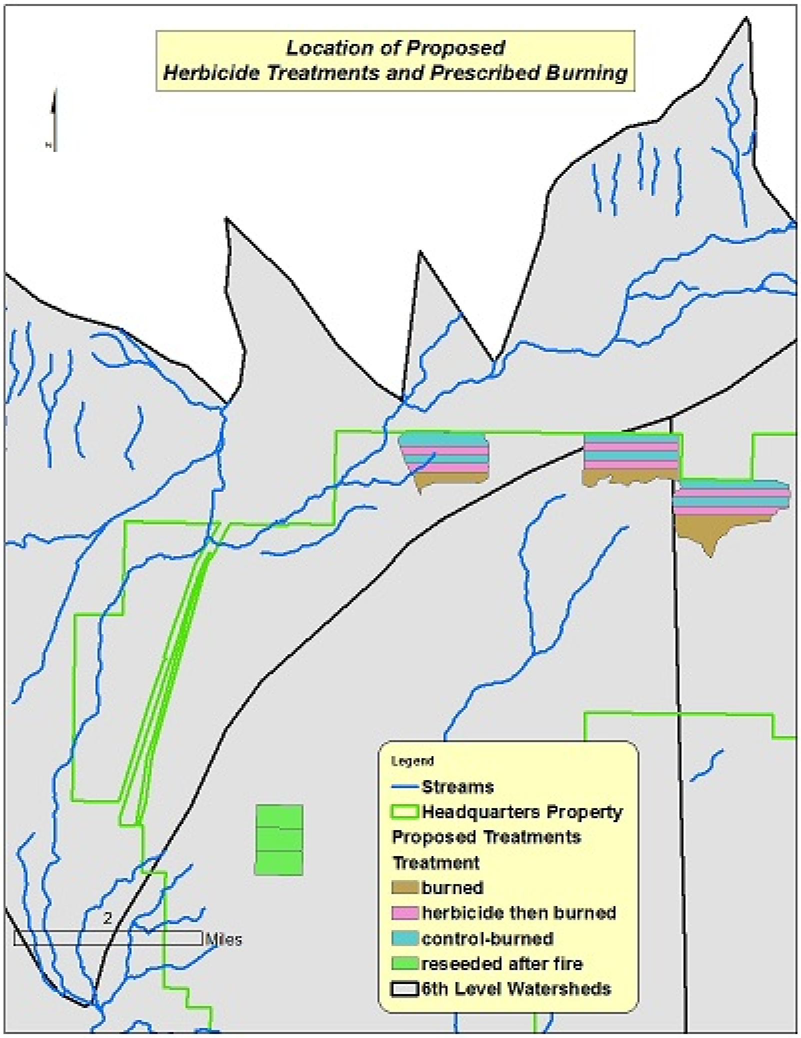

Figure 42. Location of Five Year Proposed Herbicide and Prescribed Burning Experiment

Project Design Features

The single project design feature would apply to alternatives 1, 3, 4 and 5.

Continued resting of the North Fork Tom's Creek from consistent grazing, but allowing grazing for incidental use. Incidental use would allow sheep to be moved up and out of this drainage to the rest of the Big Mountain grazing area.

Mitigation Measures

Implementation depends on alternative. Blair Lake is associated with East Summer Range. Alternatives 1 and 5 would implement grazing on the East Summer Range and mitigations would be implemented.

The O'Dell sheep crossings are associated with alternatives 1, 4 and 5 where the West Summer Range (or O'Dell) would implement grazing and mitigations would be implemented.

Road to Blair Lake

Mitigations to reduce and prevent erosion are needed on this road from where it crosses on to ARS land to where the road ends, near Blair Lake. Mitigation measures are as follows:

- Close road to all motorized use on ARS Lands. Close road effectively where slope begins to increase, shortly after road crosses on to ARS property. Selectively drop trees such that off-road vehicle traffic cannot detour around closure.
- From crest of hill down to first meadows: Rills and gullies are starting to develop on the compacted road surface. Install water bars at the first gradient breaks to get the water off the road. Install subsequent water bars at gradient breaks till the open meadows are reached. Extend water bar at least 6 ft into adjacent hillside along contour or at a slight angle to the slopes gradient. Knock rut edges down and fill in ruts. Place small diameter (4 inches or less) logs/poles consistently over the length of the ruts to slow any surface runoff and encourage deposition of fine grained sediment. Deposition of fine grained sediment would provide the opportunity for re-vegetation from adjacent sources. If vegetation is not established within three years consider re-seeding.
- From major slope break to where road ends: Install water bars at noticeable gradient breaks on ruts and road to eliminate surface runoff from road. Extend water bars at least 6 ft into adjacent hillside along contour or at a slight angle to the slope gradient. Place small diameter (4 inches or less) woody material consistently over the length of the ruts to slow any surface runoff and encourage deposition of fine grained sediment. Deposition of fine grained sediment would provide the opportunity for re-vegetation from adjacent sources. If vegetation is not established within three years consider re-seeding.
- At road end: Harden the sheep drive way across the stream to minimize sediment input into stream with gravel and small cobbles from surrounding area. In addition, harden the last 30-50 ft of the road and place a water bar at the roads end to divert surface run-off. This would minimize or eliminate surface runoff and sediment from entering the creek at the roads end

Monitor the mitigated areas after large storms and annually. Conduct maintenance at least seasonally to ensure water bars are kept clean and functioning. Establish key photo points for annual monitoring and document recovery conditions. If monitoring indicates further work is needed, address issues through additional restoration efforts

Odell Creek Sheep Crossings

The following mitigation measures are for sheep crossings at OD 4 and OD5, found on the North and South Forks of Odell Creek. The secondary crossings are located to the west of the main Odell crossing. These secondary crossings consist of narrow trails which are eroding into a washed out trench.

North Fork Odell Creek (OD 4/T15S, R2W, Section 11, SW ¼)

These mitigations apply to the main and secondary crossings.

- At both crossings place water bars at key gradient breaks or embed 10-12” logs at these gradient breaks about 3-5 inches deep, depending on log size. Place logs or water bars at an angle of 20-45 degrees across the driveway to ensure water is diverted off these areas, into undisturbed vegetated forest floor, which will function as sediment filter strip.
- At the secondary and smaller crossing harden the stream banks with rock, small logs, pole sized timber, or other locally obtained native material (that can harden streambanks) to prevent further degradation due to sheep crossing the stream.

South Fork Odell Creek (OD 5/T15S, R2W, Section 14, SW ¼)

The far-side of the crossing (on bank opposite from where the sheep enter the stream) comes out on to a steep slope which is largely bare of vegetation. Currently, there are no signs of rilling or gullying. However, mitigation is recommended to prevent the development of an adverse situation.

- Harden the far bank with rock, small logs, pole sized timber, or other locally obtained native material (that can harden streambanks) to prevent further degradation due to sheep crossing the stream.

Recommended Monitoring

- For Mitigations prescribed at the Odell sheep crossings, road to Blair Lake and for the drainage at the mine pond exit, inspections would be conducted after high precipitation events and at the beginning of each season of use. Maintenance would be conducted as needed, based on inspections. Established key photo points would be used for annual monitoring and writing a short description of recovery conditions. If monitoring indicates further work is needed, address issues through additional restoration efforts.
- Continue existing water quality monitoring on groundwater wells used for drinking:
  - Test quarterly y for the presence/absence of coliform
  - Test annually for copper and lead.
  - Test every three years for volatile organic compounds and arsenic.
  - Test every nine years for inorganic compounds and nitrite as required.
  - Test every six years for organics (herbicides) as required. Out of the three compounds known for groundwater contamination, only Picloram is monitored, apparently Bromacil and Diuron are not regulated in Idaho (Feisthamel, 2009). Include monitoring for Tebuthiuron if required by the State of Idaho.
- Conduct water quality monitoring, using the methods of collection and analysis outlined for Idaho and Montana. Conduct monitoring during the summer of 2016 to screen existing water quality conditions for turbidity, stream temperature, and fecal coliform (*E.Coli*) at Beaver Creek, Tom's, Odell, Hell Roaring and Corral Creeks and the sheep crossing at Odell Creek. A long term monitoring plan would be developed only if water quality concerns are defined during the screening phase of monitoring.

Description of Alternatives

- Modified Alternative 1: This is the Proposed Action, or no new federal action alternative. Grazing would continue to occur on Headquarters Range, Henninger Ranch, Humphrey Ranch, East Summer Range, West Summer Range, and the following FS allotments: Snakey-Kelly, East Beaver, and Meyers Creek.
- Alternative 2: No grazing would occur on the Headquarters Range, East Summer Range, West Summer Range, Henninger Ranch, and Humphrey Ranch as well as on the following FS allotments: Snakey-Kelly, East Beaver, and Meyers Creek.
- Modified Alternative 3: No grazing would occur on the East Summer Range, West Summer Range, and Humphrey Ranch east of Beaver Creek as well as on the following FS allotments: East Beaver and Meyers Creek.
- Modified Alternative 4: No grazing would occur on the East Summer Range as well as on the FS-Meyers Creek allotment.

- Modified Alternative 5: No grazing would occur on FS-Snakey-Kelly allotment.

Direct and Indirect Effects Common to All Alternatives

Climate Change

Temperatures are predicted to rise by 5ºF by the 2050s. Increased precipitation is expected to result in conditions being wetter on average with increased precipitation in winter and the same or decreased precipitation in the summer (Furniss, 2010). Climate changes at large scales such as national or regional will influence changes at smaller scales, such as a 6th level watershed. However, influences will be greatly modified by topography, elevation, aspect, local airflow patterns, vertical mixing and transport, lapse rates and the tendency for inversions to form (Furniss, 2010). Most modeling is done at these larger scales (global, national or regional). However, land management activities are typically conducted at a much smaller scale, somewhere between 0.4 and 193 square miles.

As a result there are problems with application of model results due to numerous factors not being accounted for or adequately considered at the proper scale (Furniss, 2010, Salathe' et al, 2008).

As a result, most models are not precise enough at this time to apply them to land management activities at the project level. This limits the analysis of potential effects from climate change and the inter-relationship with proposed land management activities.

As a result, it is not possible to determine specific climate changes and how they would affect implementation of any of the proposed alternatives.

Ground Disturbance

Total miles of off-road trailing and total miles of off-road trailing within 300 ft. of streams do no vary substantially between 1, 4 and 5 and there would essentially be no differences between direct and indirect effects for these three alternatives. Alternatives 2 and 3 contain zero miles of trailing and zero miles of trail within 300 feet of streams. Although there would be a decrease in direct and indirect effects the decrease in erosion and sediment generation would not be measurable (Table 14).

As there are no discernable direct and indirect effect for total miles of driveway and total miles of driveway within 300 feet of streams there are no cumulative effects.

Range Improvements (Shrub Management)

Herbicides

Invasive weeds are present and have been addressed through targeted select grazing and localized herbicide use. Herbicides are used to kill or inhibit the growth of invasive undesirable or exotic broadleaf weeds and/or woody plants.

Herbicides have been used along roads, buildings, feedlots and corrals for the past thirty years following manufacturer's directions. Spraying occurs semiannually. Herbicides that are used include, but are not limited to: clopyralid, triclopyr amine, Imazapyr, Diuron, Picloram, Bromacil, non-aquatic Glyphosate, 2, 4-D amine and imazapic. Application methods are spot application, hand wand application to control weeds along roadsides, in dry-lots and corrals and near building structures. Four-wheeler-mounted and tractor-mounted boom-sprayer applications are done in small pastures and large dry lots (USDA ARS, Appendix C, 2015). A summary of the herbicides utilized for various purposes within the ARS properties and their relationships to soil and water are summarized in Table 13. Applications are according to product directions and adhere to directions in the MSDS sheets. Herbicide application requirements are defined in Appendix C of the Revised DEIS.

The Sheep Station is proposing to study the use of herbicides in helping to control wildfire in sagebrush ecosystems. This is part of the issued directives to help suppress rangeland wildfire in order to protect shrub-dense areas that provide critical sage grouse habitat (USDA Forest Service 2015). Consequently, this is resulting in large, contiguous area of non-sagebrush species, such as bitterbrush. To treat these areas the Station is proposing to conduct experimental strip and spot treatments of herbicides on the Headquarter property. Strips would be less than 150 ft. wide. The purpose of these narrow strips would be to reduce shrub density and reduce the likelihood of wildfire advancing at an uncontrolled and destructive rate through contiguous shrub-dense sage grouse habitat. Aerial application would be used to apply the herbicide, tebuthiuron. Spot treatment with tebuthiuron would occur as needed following strip treatments. Proposed areas of application are shown in Figure 42.

Tebuthiuron persists in the environment and has been found as a groundwater contaminant. It has a low adsorption to soil and is highly persistent in soils. It degrades slowly in aquatic systems (Bureau of Land Management 2010, http://pmep.cce.cornell.edu/profiles/extoxnet/pyrethrins-ziram/tebuthiuron-ext.html). The EPA considers tebuthiuron to be one of a group of pesticide compounds that have the greatest potential for leaching into, and contaminating, groundwater. It was not found in groundwater in a U.S. groundwater survey conducted by the EPA (http://pmep.cce.cornell.edu/profiles/extoxnet/pyrethrins-ziram/tebuthiuron-ext.html). Fish and aquatic insect exposure to tebuthiuron occurs primarily through direct contact with contaminated surface waters and sediment (State of Washington 2006).

Spot applications may also occur were seeding of test plant products occur for experimental evaluation. All herbicide applications would occur according to label specifications and would follow protocols in Appendix C.

These treatments would occur under alternatives 1-5. Two groundwater wells occur on the Headquarters property and are used for drinking water. Table 16 requires a 100 ft. minimum buffer for aerial application of tebuthiuron. Tebuthiuron would not be used when the ground is frozen or saturated with water (http://www.keystonepestsolutions.com/tebuthiuron-80wg-herbicide-4-pounds-brush-killer-replaces-spike-80wg-spike-80df-281.html). This includes when the intermittent stream, located in the western-most treatment polygon (Figure 42), is flowing or the streambed is water saturated or frozen.

The granular form of Tebuthiuron would not be applied when wind speeds exceed 10 mph. Herbicides will not be applied when conditions stated on the herbicide label cannot be met and when air turbulence significantly affects the desired spray pattern (Bureau of Land Management 2010).

Buffers are effective at reducing the movement of herbicide to streams (Bureau of Land Management 2010). The project design features limiting application to dry conditions are to prevent mobilization of Tebuthiuron into the water column. The design feature involving wind speed and turbulence are to limit the potential for drift. Based upon BMP effectiveness it would be expected that Tebuthiuron entrainment into the water column would be prevented or mitigated to the maximum extent possible. Effects may not be discernable at the 6^{th} watershed level. Water quality monitoring is recommended for this herbicide. Bahr 2015 does note that there are no requirements for its monitoring under the Safe Drinking Water Act.

Prescribed Burning

As part of ongoing research activities the station conducts burning in areas on the Headquarters Range to test research hypotheses. Over the next five years several small burns are planned totally 480 acres over the next five years. The largest of the prescribed fires would be 160 acres. Fires would provide opportunity to validate post-fire recovery models and help reduce fuels on small strips of land to mitigate wildfires threatening large areas of sage grouse habitat. Prior to each burn a fire plan would be prepared. Temporary graded fireline would be constructed around proposed burn areas. Construction would be with a dozer and motor grader and lines would be approximately 15 ft. wide.

The soil specialist report states that a prescribed burn, a burning plan will be prepared by trained professional range scientists and technicians, that reflect range conditions (soil and vegetation) and weather to achieve burn objectives, while protecting future soil productivity. Short-term adverse impacts to soils from severe burning are not expected from either fall or spring burning as fuel loads are light, resulting in fires of shorter duration and intensity (less soil heating). Nor is erosion predicted to increase given the low seasonal rainfall. In addition, the natural burning cycle yields a return cycle of once every 30 years, these acres should fully recover their vegetation cover within two to three growing seasons. Erosion and sedimentation therefore, is of low risk to soil productivity and water quality (Chalfant 2015). In addition it should be noted that mapped drainages are largely absent within the proposed treatment polygons (Figure 42).

For hydrology the primary direct effect is ground disturbance with erosion and sedimentation the main indirect effects. Based on the information above it would be expected that direct and indirect effects would be short term. No impacts to streams due to erosion would be expected due to the lack of flowing streams at the Headquarters property.

Cumulative Effects Common to All Alternatives

No other activities on private land or other government administered lands are presently known.

The Idaho Power Transmission Line currently crosses the Headquarters property and is located in two 6th level watersheds (170402140401 and 170402140101; Figure 41 and Figure 43). At present there is ongoing work to upgrade this line. No new roads have been constructed for the upgrade. Existing roads are being used to access the line and no new towers are being constructed. As a result the use of the existing roads is similar to the use of the roads for power line maintenance. The difference in the amount of use is not discernable at the 6th watershed level. As no new towers are being constructed there is no additional ground disturbance. Minor short term disturbance may occur at material staging sites, pulling, tensioning and splicing sites. However this disturbance would be expected to be well below one percent of watersheds 170402140401 and 170402140101. As a result measurable increases for short term cumulative effects would not be expected. Existing long term effects would continue at the same level.

Application of Tebuthiuron on 50 additional acres would probably not be discernable at the 6th watershed level due to the application of best management practices and project design features. Water quality monitoring has been recommended.

There would be no discernable changes in cumulative effects related to sheep trailing, on or off roadways (Table 14).

Irretrievable and Irreversible Commitment of Resources

Streamflow diverted for irrigation purposes is irretrievably lost from the bypass reach. This commitment is not irreversible since the diversion could be removed or the water right not used.

Alternative 1 – Modified Proposed Action/No New Federal Action

Under alternative one there would be no change in the amount of acreage grazed compared to existing operations (Table 14).

Alternative 1, the proposed action, also represents current operations at USSES. 1 would continue grazing at Headquarters, Humphrey Ranch, Henninger Ranch, and the East and West Summer ranges. Under this alternative, 3,000 sheep would continue to be grazed, and the grazing schedule would be the same as what is currently implemented. All ARS properties currently in use would still be used (Headquarters, Humphrey, Henninger Ranch, West and East Summer Ranges). Total acres grazed would be approximately 40,000 acres, for approximately 3,625 AUMs or eight percent utilization (Table 15).

Planned activities that would be conducted in addition to grazing include road and fire break maintenance at Headquarters and Henninger Ranch; fence maintenance at Headquarters, Humphrey and Henninger Ranch Ranches, and in the Summer Range; and maintenance of water developments in Humphrey and Henninger Ranches as well as in the summer Range.

Figure 41 shows ARS properties relative to the watershed boundaries which define the spatial limits for direct, indirect and cumulative effects. Also shown is the Idaho Powerline which crosses the Headquarters property. Figure 43 shows the sixth level watersheds involved along with their assigned watershed numbers.

Annually there would be 20 miles of road maintenance and two miles of firebreak maintenance. Prescribed burning would continue, with an average of 480 acres per year proposed for burning in the next five years.

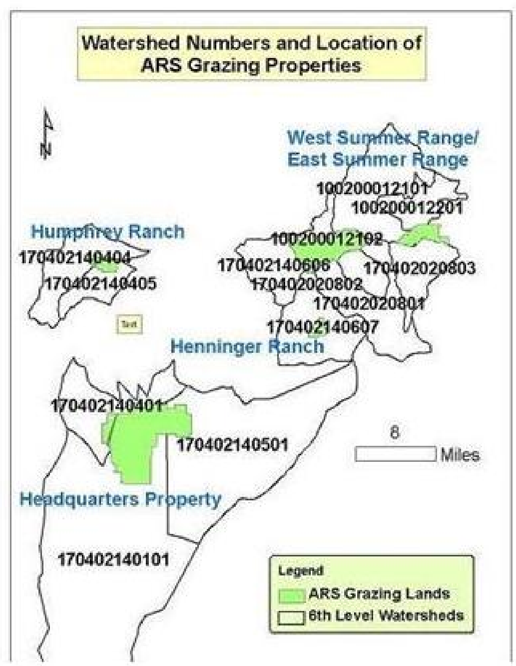

Figure 43. Location of Watersheds by Number

Alternative 1 - Direct/Indirect Effects: ARS Lands

The primary direct effect is ground disturbance and water withdrawal.

Ground disturbance, loss of vegetative ground cover, and compaction would be associated with watering troughs, along sheep trails, bedding areas and corrals. Other areas of compaction include trailing along fence lines. In-stream disturbances would occur as the sheep actually cross a stream. Potential in- stream disturbances would include substrate trampling and incorporation of manure into stream flow.

Ground disturbance would also occur during road and firebreak maintenance activities, as well as when temporary firelines, associated with the prescribed burning/herbicide application experiment are constructed. Maintenance activities have the potential for generating localized areas of disturbance during road grading, maintaining the firebreak, fence and water development replacements and ditching. Potential direct effects include erosion and the introduction of sediment into streams. Burroughs and King (1989) and Burroughs (1990) document that little sediment beyond 300 feet is transported to streams. 8.5 of the 142.3 miles of road on the Headquarters property occur within 300 feet of streams (Table 3).

All stream drainages located on the Headquarters property are intermittent and are underlain by flood-basalts characterized by lava tubes, blisters and jointing. As a result, this material is highly porous and permeable with little evidence of sustained surface flow. As a result, minimal erosion and sediment transportation are expected. Indirect effects would be expected to be short term and associated with initial disturbance. Long term effects associated with roads would be expected to remain the same as no road construction was proposed.

The total acreage grazed under alternative 1 is the same as current operations. There would be no discernable difference in ground disturbance from existing conditions (Table 14).

Under alternative 1 a total 3.1 miles of sheep trail, for trails (off road), are proposed. 1. 4 of these miles are within 300 ft. of streams. This would be the same as existing conditions. Hence there are no changes in direct or indirect effects when compared to existing conditions.

Principal indirect effects for any type of ground disturbance would be erosion and sediment introduction into streams and alterations of stream flow and channel morphology. The type and magnitude of direct/indirect effects, both of a short term and long term nature, for all 6th level watersheds except 100200012102 are generally not expected to change with the implementation of the proposed action. This includes the proposed prescribed burning and associated fireline as proposed activities are less than one percent of the 6th level watershed (Figure 41 and Figure 43). The two exceptions to this generalization in alternative 1, is in watershed 100200012102 where there would be a reduction of localized sediment sources at OD4 and OD 5 (Figure 14). The second exception is in watershed 100200012202, on the road to Blair Lake (. As current management and alternative 1 are one in the same, there would be no quantifiable changes to the measures used for analysis, shown in Table 14.

There would be no modification to current floodplain function, water-influenced soils and riparian areas as sheep numbers do not change.

Recovery from past prescribed burns would continue and as these areas recover their ground cover the risk for transportation of surface sediment would decline. Monitoring has shown that within two years forbs and grass cover returns, minimizing the potential for erosion.

Historically less than 60 acres per year are treated with pesticides. This is assumed for alternative 1, which is the same as current management. Herbicides listed in Table 16 are used at the ARS. Picloram, Tebuthiuron, Diuron and Bromacil are all proven ground water contaminants (Gilliom, 2007 SERA, 2003). As part of the proposed prescribed burn/herbicide treatment experiment an estimated 50 additional acres would be treated thru aerial applications of Tebuthiuron.

Ground water contamination, due to herbicide incorporation, is of concern in the Headquarters area due to the under lying geology. The underlying geology consists of Pleistocene flood basalts and well-drained soils.

Basalts were observed to have polygonal jointing, vesicular characteristics and flow features, such as pressure ridges, blisters etc. that would form conduits for ground water movement. In addition, the flows are faulted to some extent as the area is in a horst and graben setting. Soils on the volcanic plain have moderate to moderately rapid permeability from coarse rock and sandy loam to loam textures.

All of these characteristics suggest high permeability's and porosities, facilitating the incorporation of herbicide into groundwater. Picloram, Diuron and Bromacil all have high solubility's and low soil adsorption thereby transporting readily in storm wash or percolating readily. Tebuthiuron is known as a groundwater contaminant, has low soil adsorption and is readily entrained into water. Bromacil in particular has a high concern for surface water transport. These risks are most pertinent in agricultural situations with irrigation and where rainfall is abundant. Climatic conditions at the ARS border on arid and lack rainfall that would transport herbicides, except from thunderstorms. However, the risks at the feedlots are related to continued use proximate to the domestic well locations. It should be noted though that these areas are not irrigated. In the case of Tebuthiuron applications are generally in areas lacking mapped surface drainage, with the exception of the western-most proposed treatment polygon (Figure 42). In this polygon there is a mapped intermittent stream.

Alternative 1 would implement herbicide BMPs, project design features and recommended buffer widths, which reduce the opportunities for ground water contamination. This is the same as existing conditions for Picloram, Diuron and Bromacil. Implementation of project design features and best management practices (including buffers), for Tebuthiuron, would be expected to have prevented or reduced short and long term impacts to the maximum extent possible. The short and long term indirect effects of 50 additional acres may not be discernable at the 6th watershed level. For a discussion of BMP effectiveness, the reader is referred to the “Best Management Practices, Project Design Features and Mitigation Measures” section found earlier in this document. Additional direction regarding herbicide applications at the ARS is found in Appendix C of the EIS.

There would be no change in effects to water-influenced soils and riparian areas as the number of sheep and grazing locations would not change between alternative one and existing conditions.

Flows in Beaver Creek from June through October are less than 50 cfs (cubic feet per second), with flows in mid-July less than 20 cfs (Figure 31). The allocated amount of 7.2 cfs per day represents a substantial portion of flow in the later summer months on Modoc Creek compared to the average irrigation season flow of 3.09 cfs and an average flow range of 1.21-7.45 cfs, as estimated by StreamStat (Moser, 2011, Table 6 , Figure 31). As a result, there is the potential for stream dewatering. However, when considering the proportion of withdrawals to estimated flows at the un-gaged Modoc it should be kept in mind that, as a guide, that flow values given could be from about +150 to -50% different than actual flow (Moser, 2011). The large margin in error is likely due to StreamStat as it is a regional model and may not take into account all location conditions, thus affecting low flow and seasonal averages (Moser, 2011).

At Dry Creek average irrigation season flow was estimated at 7.89 cfs and range of average flow from May 1 to October 31 is 1.77-25.5 cfs with the allocated amount to USSES being 14.2 cfs (Table 6, Figure 31). As a result, there is the potential for dewatering in Dry Creek. However, estimates of average irrigation season flow and range of average flow for Dry Creek have the same margin of error as discussed for Modoc Creek. The large margin of error for both streams are likely tied to the fact that StreamStat data are calculated from regression models developed region wide and may not take into account all local conditions (Moser, 2011).

At Dry Creek the area is dominated by Quaternary age flood basalts. These basalts consist of lava tubes, compression ridges as well as large areas bisected by cooling joints. All these features combine to allow water to percolate to depth and provide an unusual amount of storage (Moser, 2011).

With large amounts of storage it would be harder to maintain surface flow. Dry Creek was observed to lack surface flow in the summer of 2009 but it was not possible to determine if this was due to dewatering or due to the influence of the local geology.

The short term effect of withdrawing water would continue. Indirect effects related to water withdrawal, such as potential impacts to channel function would continue in the long term as long as water is withdrawn in Modoc Creek (6th field watershed 170402140404) and Dry Creek (6th field watershed 170402140607).

Modified Alternative 1 - Cumulative Effects

Grazing would continue on Snakey-Kelly, Meyers Creek and the East Beaver allotment. Winter feeding of sheep would continue at the Mud Lake Feedlot. The number of sheep would not change from the number of sheep currently being grazed. The effects of the USSES grazing operations on these properties would not vary from those analyzed in the NEPA done for the allotments by their respective agencies.

As there were no predicted changes in direct and indirect effects to watershed condition, hydrology, riparian, channel and floodplain conditions, springs and wetlands, and water quality in all watersheds except 100200012102 and 100200012202, there would be no changes to existing levels of cumulative effects watershed effects. Sediment contributions from the old phosphate mine would continue in 6th level watershed 100200012102. In watersheds 100200012102 and 100200012202 existing levels of sediment would be reduced locally at pts OD 4 and 5 and on the road to Blair Lake, respectively. Decreases would be related to implemented design features and mitigation measures. This would result in a decrease to existing cumulative watershed effects. However, the decrease would likely not be measurable in either 6th level watershed due to scale.

Modified Alternative 1 - Compliance with Relevant Laws, Regulations, Policies and Plans

This alternative would meet the intent of the Clean Water Act and the Executive Orders for wetlands and floodplains.

Modified Alternative 1 - Other Relevant Mandatory Disclosures

There are no other relevant mandatory disclosures for alternative 1.

Modified Alternative 1 – Proposed Action (No New Federal Action) Summary of Effects

The type and magnitude of direct/indirect or cumulative effects is expected to remain the same as current conditions except for reductions in localized sediment transportation that would be reduced at two sheep trails (OD 4 and OD 5) located in the watershed 100200012102 and on the road to Blair Lake (watershed 100200012202), where mitigation measures would be implemented.

Modified Alternatives 2 - 5

The only differences for alternatives 2-5 is that they reconfigure grazing areas used (Table 15). The number of AUMs utilized varies by alternative. In addition the number of sheep grazed varies by alterative, with those alternatives using less properties affording sufficient grazing area for fewer sheep.

- Under alternative 3 on the headquarters property total utilization would go from 8% under Alternative 1 to 5.0% under alternative 3. A decrease in utilization of 3%.
- Under lternative 4 on Henninger Ranch total utilization would go from 18.0 % under alternative 1 to 16.0%, decrease of two percent in utilization. On the West Summer Range, total utilization would be5.0% under both alternative’s 1 and alternative 4. There would be no increase in percent utilization.

Modified Alternative 2

Under alternative 2 ARS and Forest Service lands would not be used for grazing, hence there would be no utilization of these acreages. Sheep would be feed harvested feeds daily to meet the nutrient needs of the sheep. Associated activities of sheep trailing, stock water operations, camp tending, fence maintenance, and range improvement would also not occur. Herbicide treatments and prescribed burning would occur. No trailing of sheep would occur on roadways or on trails (Table 14).

Modified Alternative 2 - Direct Indirect Effects: ARS Lands

No direct or indirect effects related to grazing, and prescribed burning, such as ground disturbance and introduction of sediment, would occur under this alternative a (Table 15). Consequently, any sediment generated with use would not be present. As a result direct and indirect effects would decrease but would not be expected to be discernable at the 6th watershed level, due to the amount of trailing involved compared to watershed size.

Water rights would not be utilized and there may be potential local improvements to flow. Indirect effects to channel morphology related to water withdrawal would decrease. However, these localized improvements would not be expected to be discernable at the 6th field watershed level, due to the size of the watershed. Indirect effects related to road and firebreak maintenance, and temporary firelines associated with prescribed burning, would occur as described under alternative 1, but indirect effects related to fence and water development maintenance would not. Indirect effects related to current herbicide use would continue along with applicable best management practices and buffers. Application of Tebuthiuron would be mitigated with the implementation of project design features and best management practices, including stream buffers. Indirect effects may occur but may not be discernable at the 6th watershed level.

These changes to direct and indirect effects, both those that are short and long term, would occur in all 28 6th level watersheds involved in this project (Figure 43). Existing sources of sediment from the road to Blair Lake, at sheep crossing points OD 4 and 5, and at the Mine Waste Water pond would continue, as mitigation measures would not be implemented (Figure 14). Although decreases would occur for both direct and indirect effects these changes may not be detectable due to the size of these 6th level watersheds.

Alternative 2 - Cumulative Effects

No grazing would occur on the Snakey-Kelly, East Beaver, and Meyers Creek allotments under this alternative. Under alternative 1 the East Beaver and Meyers Creek allotments currently utilize only one percent of the allotted AUMs, respectively (Table 15). Under alternative 2 the East Beaver and Meyers Creek allotments would not be available for utilization (Not Available-NA) (Table 15). As utilization under alternative 1 is so low the difference between alternatives 1 and 2 would not be discernable at the 6th level watershed.

Grazing in the Snakey-Kelly allotment utilization would decrease by 25 percent under alternative 2 as these lands would no longer be utilized when compared to alternative 1 (Table 15). The Snakey-Kelly allotment is comprises 22 and 1 percent of watersheds 170402150401 and 170402160601 respectively. In watershed 170402150401 the allotment is in good condition. Direct and indirect effects would decrease due to the lack of grazing; however any improvements due to the lack of grazing would likely not be discernable due to the allotments good existing condition (McCoy, date unknown). 170402160601 there would be no discernable difference as only one percent of the watershed is involved with the allotment.

Because there are no discernable direct/indirect hydrological effects to under alternative 2 compared to alternative 1, there are no cumulative effects. Sediment contributions from the old phosphate mine would continue in 6th level watershed 100200012102. Levels would not be expected to change. Application of Tebuthiuron on 50 additional acres would probably not be discernable at the 6th watershed level due to the application of best management practices and project design features. Water quality monitoring has been recommended.

Compared to alternative 1 alternative 2 does not propose trailing on roads or trails. Hence the total miles of trail, both on and off road, would decrease from 50.9 to 0. Sheep trails (both on and off road) within 300 ft. of streams would remain but not be used. Sediment generated from these trails would be expected to decline over time as they re-vegetate due to lack of use. Both would result in a decrease of sediment and a decrease in existing cumulative effects. However the change would not be expected to be discernable at the 6th watershed level.

Modified Alternatives 2: Compliance with Relevant Laws, Regulations, Policies and Plans

This alternative would meet the intent of the Clean Water Act and the Executive Orders for wetlands and floodplains.

Modified Alternatives 2: Other Relevant Mandatory Disclosures

There are no other relevant mandatory disclosures for Alternative 2.

Modified Alternative 2: Summary of Effects

The type and magnitude of direct/indirect or cumulative effects would be expected to be less than those discussed in Alternative 1 as there would be no AUM utilization on ARS lands or on Forest Service allotments used by the Sheep Station. However, changes may not be measurable at the 6th watershed level. Application of Tebuthiuron on 50 additional acres would probably not be discernable at the 6th watershed level due to the application of best management practices and project design features. Water quality monitoring has been recommended. No discernable changes related to sediment generation associated with trailing would be expected at the 6th watershed level.

Modified Alternative 3

There is a 39 percent decrease in the total number of acres grazed when compared to alternative 1. When compared to alternative 1 alternative 3 proposes zero miles of sheep trail off roadways compared to 3.1 miles for alternative one. The Total miles of sheep trails (off of road ways) within 300ft. would decrease by 1.4 miles under alternative 3 to zero. Any changes in direct and indirect effects would not be discernable at the 6th watershed level.

Modified Alternative 3 - Direct and Indirect Effects: ARS Lands

Under modified alternative 3 direct and indirect effects, both short and long term, as described in alternative 1 would be reduced on Henninger Ranch as the percent utilization is two percent less. Direct and indirect effects, both short and long term, as described in alternative 1 would be decreased on Humphrey Ranch east of Beaver Creek, the East Summer Range, and West Summer Range, as these areas would not be grazed.

Compared to alternative 1 alternative 3 does not propose trailing on roads or trails. Consequently, any sediment generated with use would not be present. As a result direct and indirect effects would decrease but would not be expected to be discernable at the 6th watershed level, due to the amount of trailing involved compared to watershed size.

For the portion of Humphrey Ranch, west of Beaver Creek, the percent utilization would increase by nine percent, from 18 to 27 percent (Table 15). This would translate to an increase of direct and indirect effects. Approximately 340 acres of the increased utilization would occur in watershed 170402140404 with roughly 20 acres total occurring in watershed 170402140405. Consequently, direct and indirect effects would not be expected to be discernable in each watershed. In each watershed the acreage experiencing increased utilization would be well below one percent of the watersheds area.

Water would not be withdrawn from Modoc Creek. Current levels of direct and indirect effects related to water withdrawal would decrease and would be the same as described in alternative 2. The stream at the south end of the Humphrey allotment would not be used for watering reducing direct and indirect effects on bank trampling and sediment generation. However, these changes would not be discernable in watersheds 170402140404 and 405 due to scale.

However, the mitigation measures recommended for implementation under alternative 1, for the road to Blair Lake, the sheep crossings at OD 4 and OD 5 and for the drainage exit at the mine wastewater pond would not be implemented (Figure 14). As a result, sediment generation at these areas would continue at their present levels.

Under alternative 3, forage utilization on the Headquarters allotment would remain the same as under alternative 1 as the number of grazed sheep remains the same (Table 15 . When compared to alternative 1, no discernable difference would be expected for direct and indirect effects. The Headquarters property is located in watersheds 170402140101, 170402140401 and 170402140501.

Indirect and direct effects would be expected to be the same for proposed prescribed burning, temporary fireline and herbicide application of Tebuthiuron in alternative 3 as in Alternatives 1, 2, 4 and 5.

Modified Alternative 3 - Cumulative Effects

For the Snakey-Kelly allotment, the effects, in both the short and long term, would be expected to decrease when compared to alternative 1, as AUMs utilized would go from 25 to 13 percent (Table 15). As a result, existing levels of cumulative effects within watersheds 170402160601 and 170402150401 would decrease with a decreased AUM utilization percent. However, the decreases in cumulative watershed effects are unlikely to be detectable at the 6th watershed level.

For the East Beaver and Meyers Creek allotments utilization would change as these allotments would not be grazed. Existing levels of cumulative watershed effects related to ground disturbance, erosion and sediment generation would decrease in watersheds 170402140404, 405, 406,407, 408 and 60, 1002000012101 and 170402020803(Table 15).

No changes in existing effects would be expected in 6th level watersheds 170402150102 and 17040215014 where the Mud Lake allotment exists as there would be no changes to existing levels of effects.

Sediment contributions from the old phosphate mine would continue in 6th level watershed 100200012102. Levels of sediment generation would not be expected to change. The design feature for rest and incidental use of the North Fork Tom Creek would not be implemented as this area would not be grazed. This change would not make a discernable difference in existing cumulative effects. Mitigation measures for sheep driveways at OD 4 and OD 5 (Figure 14) and the road to Blair Lake would not be implemented. Existing levels of erosion would be expected to continue.

Alternative 3 proposes 6.7 miles of total sheep trail (both on and off road) compared to 50.9 miles for alternative 1, a decrease of 44.2 miles. Alternative 3 would have 3.1 miles of trail (both on and off road) within 300 ft. of streams compared to 20.2 for alternative 1, a decrease of 17.1 miles (Table 14). Although these decreases would result in a decrease of generated sediment, these decreases would not be expected to be discernable at the 6th watershed level due to the amount of trailing involved compared to watershed size. As a result no discernable changes in cumulative effects would be expected.

Application of Tebuthiuron on 50 additional acres would probably not be discernable at the 6th watershed level due to the application of best management practices and project design features. Water quality monitoring has been recommended.

Cumulative effects for not withdrawing water from Modoc Creek would be the same as described under alternative 2 (Table 15).

Modified Alternative 3: Compliance with Relevant Laws, Regulations, Policies and Plans

These alternatives would meet the intent of the Clean Water Act and the Executive Orders for wetlands and floodplains.

Modified Alternative 3: Other Relevant Mandatory Disclosures

There are no other relevant mandatory disclosures for Alternative 3.

Modified Alternative 3: Summary of Effects

The type and magnitude of direct/indirect or cumulative effects would be expected to be less than those discussed in alternative 1 as the East and West Summer Ranges, East Beaver and Meyers Creek allotments would not be used. However, changes may not be measurable at the 6^{th} watershed level. No discernable changes related to sediment generation associated with trailing would be expected at the 6^{th} watershed level.

Modified Alternative 4

There is an eight percent decrease in the total number of acres grazed when compared to alternative 1. When compared to alternative 1 alternative 4 proposes 0.8 miles less of total trails than alternative 4. Within 300 ft. of streams the difference is even less at 0.2 miles (Table 14). No discernable changes in direct and indirect effects would be expected.

Modified Alternative 4 Direct and Indirect Effects: ARS Lands

For alternative 4 the direct and indirect effects, both short term and long term are essentially the same as described in alternative 1on the Headquarters and Humphrey allotments (Table 15). The differences in AUM percent utilization are an increase of one percent for Humphrey Ranch when compared to alternative 1, and increase of three percent for Henninger Ranch and a one percent increase for East Beaver allotment. The differences in indirect effects would not be discernable at the 6^{th} watershed level, as they are relatively minor. On the East Summer Range allotment, grazing would be discontinued. As a result there would be a decrease in existing levels of direct and indirect effects when compared to alternative 1 (Table 15). The design feature for rest and incidental use of the North Fork Tom Creek would not be implemented as the East Summer Range would not be grazed. There would no discernable change in direct and indirect effects related to this.

Mitigation measures for sheep driveways at OD 4 and 5 (Figure 14) in the West Summer Range would be implemented. As a result, existing levels of direct and indirect effects would decrease. Mitigation measures would not be implemented on the road to Blair Lake and existing levels of erosion and sediment introduction would continue as the East Summer Range would not be grazed

Utilization would only increase by 0.8 percent on the Henninger Ranch allotment and by 2.1 percent on the West Summer Range (Table 15). As utilization increases are so low, no discernable changes, when compared to alternative 1, would be expected for both short- and long-term direct and indirect effects as described in alternative 1.

As a result, not discernable difference between short- and long-term direct and indirect effects as described in alternative 1 would be expected. Mitigation measures recommended for sheep crossings at OD 4 and OD 5 would be implemented and effects would be expected to be the same as described in alternative 1.

Modified Alternative 4 - Cumulative Effects

Under this alternative, there would be no change in the number of AUMs used for the Snakey-Kelly allotment. The East Beaver allotment would increase from one percent under alternative 1 to two percent for alternative 4. There would be no discernable increase in cumulative effects due to this change. Mud Lake Feedlot would continue to be utilized. As a result there would be no discernable changes to existing levels of direct and indirect effects at the 6th field watershed level.

The elimination of grazing on the Meyers Creek allotment would reduce utilization from 1.0 percent to 0.0 percent, and the change would not be discernable at the 6th field watershed level. On the East Summer Range grazing would be eliminated. Utilization would be reduced from 6.0 percent to zero. Changes would not be expected to be discernable at the 6th field watershed level.

Because there are no discernable direct/indirect hydrological effects under alternative 4 compared to alternative 1, related to AUM utilization there are no cumulative effects.

Alternative 4 would have 33.6 miles of total trail (both on and off road) and alternative 1 would have 50.9 a decrease of 17.3 miles. Total miles of trail (both on and off road), within 300ft. of streams, would be 16.2 under alternative 4 compared to 20.2, a difference of four miles. These decreases in cumulative effects, while positive, would not be expected due to the relative small amount of trail compared to watershed size.

Modified Alternative 4: Compliance with Relevant Laws, Regulations, Policies and Plans

This alternative would meet the intent of the Clean Water Act and the Executive Orders for wetlands and floodplains.

Modified Alternative 4: Other Relevant Mandatory Disclosures

There are no other relevant mandatory disclosures for alternatives 2-5.

Modified Alternative 4: Summary of Effects

The type and magnitude of direct/indirect or cumulative effects would be expected to be less than those discussed in alternative 1. There is only a one percent increase in utilization on the East Beaver allotment and the Meyers Creek allotment is not grazed. t However, changes may not be measurable at the 6th watershed level. No discernable changes in cumulative effects related to trailing would be expected.

Modified Alternative 5

Alternative 5 proposes to graze 30 percent fewer acres total than alternative 1. Alternative 5 proposes the same amount of total trail (off road) at 3.1 miles and the same for total miles of trail (off of roads) within 300 ft. of streams. No difference in direct and indirect effects would be expected.

Modified Alternative 5 Direct and Indirect Effects: ARS Lands

Alternative 5 would have the same type of direct effects (water diversion, ground disturbance) and indirect effects (alteration of channel morphology and function due to water withdrawal, sediment introduction) as described in alternative 1, although the magnitude of effects would decrease in all of the ARS properties grazed (Table 15, Figure 3). This would apply to both short- term and long-term effects as described in Alternative 1. Mitigation measures would be implemented on the road to Blair Lake, at sheep crossing at OD 4 and 5 and at the drainage exit to the mine waste water pond (Figure 14). Effects would be expected to be the same as under alternative 1.

Modified Alternative 5 - Cumulative Effects

Utilization on both the East Beaver and Meyers Creek allotments would be less than one percent. These changes would not be discernable at the 6th level watershed due to scale.

No grazing would occur on the Snakey-Kelly allotment under alternative 5. The Snakey-Kelly allotment is located in watersheds 170402150401 and 170402160601. Twenty-two percent of the allotment is found within watershed 170402150401. One percent of the allotment is in 170402160601. Currently 25 percent of available AUMs are utilized with zero percent being utilized under alternative 5. A decrease of 25 percent of AUMs utilized would decrease direct and indirect effects. However, it is likely that these effects would not be discernable as the allotment is in good condition (McCoy, date unknown).

Under alternative 5 the Snakey Kelly allotment would not be grazed. Without this grazing (1, 756 acres) there would be a decrease in existing cumulative effects primarily in 6th level watershed 170402150401, and to a lesser extent in 170402160601.

The allotment represents eight percent of the total watershed size, so decreases in existing cumulative effects would probably not be discernable at the 6th watershed level.

Under alternative 5 there would be 40.1 miles of trail (off road) compared to 50.9 for alternative 1, a decrease of 10.8 percent. For total miles of trail (both off and on road), within 300 ft. of streams, alternative 5 would propose 17.1 miles of trail compared to 20.2 for alternative 1-a minimal decrease. Although these decreases in cumulative effects would result discernable changes at the 6th watershed level would not be expected.

Modified Alternative 5: Compliance with Relevant Laws, Regulations, Policies and Plans

These alternatives would meet the intent of the Clean Water Act and the Executive Orders for wetlands and floodplains.

Modified Alternative 5: - Other Relevant Mandatory Disclosures

There are no other relevant mandatory disclosures for alternatives 2-5.

Modified Alternative 5: Summary of Effects

The type and magnitude of direct/indirect or cumulative effects would be expected to be less than those discussed in alternative 1 as there is a three percent reduction in AUM utilization on ARS lands under alternative 5.

The percent utilization is relative unchanged between alternatives 1 and 5 for non-ARS lands. No discernable changes in effects related to trailing would be expected.

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