Bureau of Land Management

WIND RIVER/BIGHORN BASIN DISTRICT
Worland Field Office

Badlands Allotment
#00016

Standards for Healthy Rangelands
and
Guidelines for Livestock Grazing Management

for

Public Lands Administered by the Bureau of Land Management in the State of Wyoming

DRAFT

BLM

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

FY 2013/2014

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1.0 INTRODUCTION

The Bureau of Land Management (BLM) grazing regulations at 43 CFR 4130.3-1(c) require that grazing permits issued by the BLM contain terms and conditions that ensure conformance with BLM regulations at 43 CFR 4180, which are the regulations under which the Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management for Public Land Administered by the Bureau of Land Management in the State of Wyoming were developed. Recently, the Worland Field Office completed an assessment of the achievement of these standards on the Badlands Allotment No. 00016. The results of this assessment are presented in this report. This assessment will serve to inform the BLM's determination as to whether these standards are being met, and, if they are not met, whether existing grazing management practices contribute to their lack of attainment.

1.1 Standards

The approved standards for rangeland health are as follows:

Standard #1: Within the potential of the ecological site (soil type, landform, climate, and geology), soils are stable and allow for water infiltration to provide for optimal plant growth and minimal surface runoff.

Standard #2: Riparian and wetland vegetation has structural, age and species diversity characteristic of the state of channel succession and is resilient and capable of recovering from natural and human disturbance in order to provide forage and cover, capture sediment, dissipate energy, and provide ground water recharge.

Standard #3: Upland vegetation on ecological site consists of plant communities appropriate to the site which are resilient, diverse, and able to recover from natural and human disturbance.

Standard #4: Rangelands are capable of sustaining viable populations and a diversity of native plant and animal species appropriate to the habitat. Habitats that support or could support threatened species, endangered species, species of special concern, or sensitive species will be maintained or enhanced.

Standard #5: Water quality meets State standards

Standard #6: Air quality meets State standards

2.0 Affected Environment – Allotment Description, Resource Values, and Uses

2.1 Location and Land Ownership

Badlands Allotment is located approximately 10 miles southeast of Worland, Wyoming. The average elevation ranges from 4,500 feet to 5,000 feet above sea level. Administratively the allotment encompasses 8462 public acres and 954 state/private land acres (Washakie Resource Area RMP); As determined through Geographic Information System (GIS), the allotment consists of 8481 public acres and 942 state/private land acres. The allotment is classified in the "I" (Improve) category.

2.2 Climate/Air Quality

Annual precipitation for the allotment ranges from 5-9 inches per year. The normal precipitation pattern shows peaks in May and June and a secondary peak in September. This amounts to about 50% of the mean annual precipitation. Much of the moisture that falls in the latter part of the summer is lost by evaporation and much of the moisture that falls during the winter is lost by sublimation. Average snowfall is about 20 inches annually. Wide fluctuations may occur in yearly precipitation and result in more dry years than those with more than normal precipitation.

Temperatures show a wide range between summer and winter and between daily maximums and minimums, due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring.

High winds are generally blocked from the basin by high mountains, but can occur in conjunction with an occasional thunderstorm.

Growth of native cool-season plants begins about April 1 and continues to about July 1. Cool weather and moisture in September may produce some green up of cool season plants that will continue to late October.

The following information is from the "Emblem" climate station:
Minimum Maximum 5 yrs. out of 10 between
Frost-free period (days): 98 171 May 13 – September 19
Freeze-free period (days): 120 184 May 1 – October 5
Mean Annual Precipitation (inches): 3.22 10.97

Mean annual precipitation: 7.42 inches
Mean annual air temperature: 45.01 F (31.2 F Avg. Min. to 58.7 F Avg. Max.)
For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/ website. Other climate station(s) representative of this precipitation zone include" Basin", "Deaver", "Lovell", and "Worland".
Annual precipitation for the Badlands Allotment ranges from 5-9" inches per year. The normal precipitation pattern shows peaks in May and June and a secondary peak in September. This amounts to about 50 percent of the mean annual precipitation. Much of the moisture that falls in the latter part of the summer is lost by evaporation and much of the moisture that falls during the winter is lost by sublimation. Average snowfall exceeds about 20 inches annually. Wide fluctuations may occur in yearly precipitation and result in more dry years than those with more than normal precipitation.
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The following information is from the "Emblem" climate station:

Minimum Maximum 5 yrs. out of 10 between

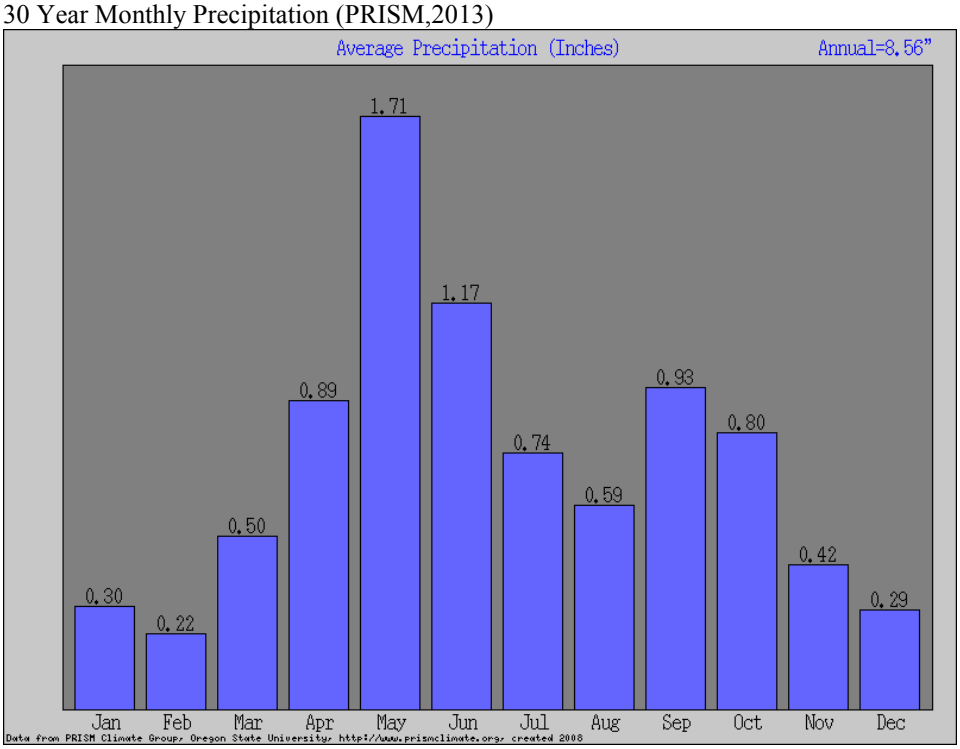
Frost-free period (days):	98	171	May 13 – September 19
Freeze-free period (days):	120	184	May 1 – October 5
Mean Annual Precipitation (inches):	3. 22	10.97	

Mean annual precipitation: 7.42 inches
Mean annual air temperature: 45.01°F (31.2°F Avg. Min. to 58.7°F Avg. Max.)

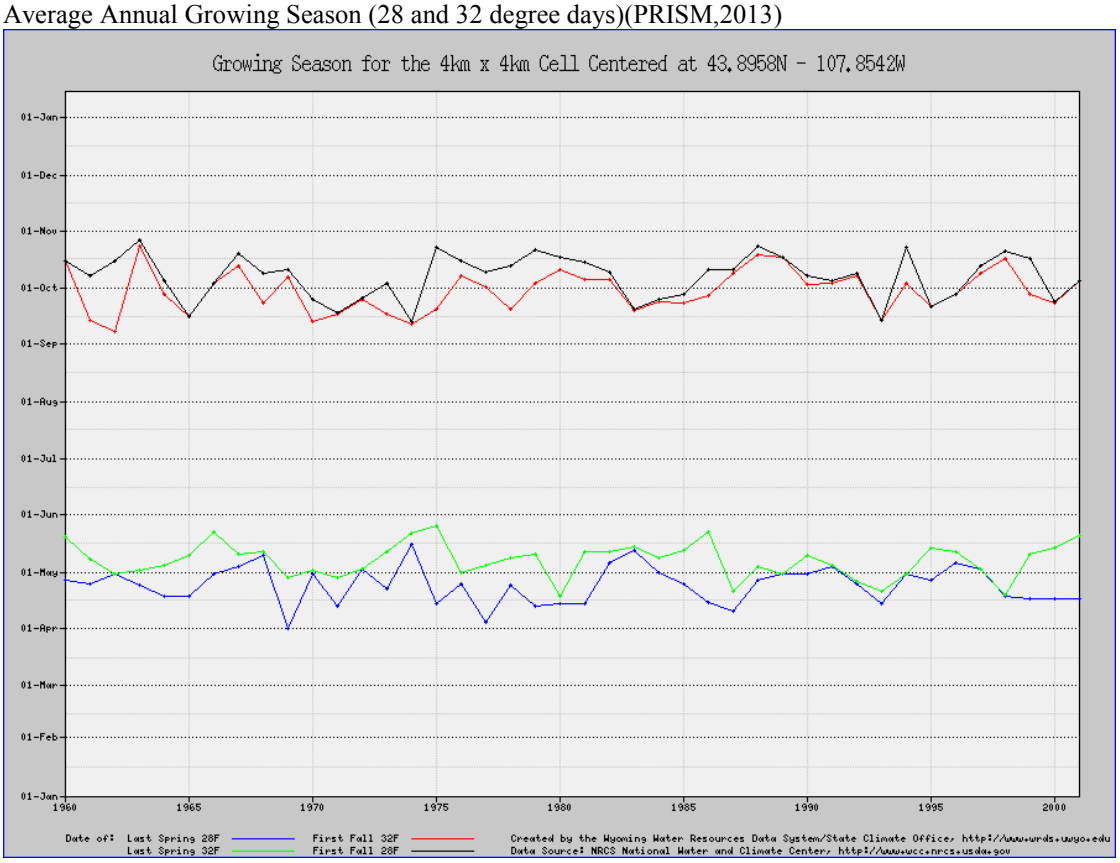
For detailed information visit the Natural Resources Conservation Service (NRCS) National Water and Climate Center at http://www.wcc.nrcs.usda.gov/ website. Other climate station(s) representative of this precipitation zone include "Basin", "Deaver", "Lovell" and "Worland", (Information taken from the United States Department of Agriculture (USDA) NRCS Technical Guide Section IIE Rev. 08/12/05).

Precipitation
Additional precipitation references available are from the Demer Rain Gauge located near the allotment. Precipitation from this BLM rain gauge has average 7.67 inches over the last 30 years (1984 – 2013). Additionally the PRISM (Parameter-elevation Regressions on Independent Slopes Model), overall averages for monthly precipitation, mean annual precipitation, mean annual air temperature, have been sampled from 4 kilometer x 4 kilometer grid cell selected is centered at 43.8958 N, 107.8542 W, that was approximated to be to average for the watershed (Figure 1-3). In total 40 percent of the total precipitation is during the months of April-June.

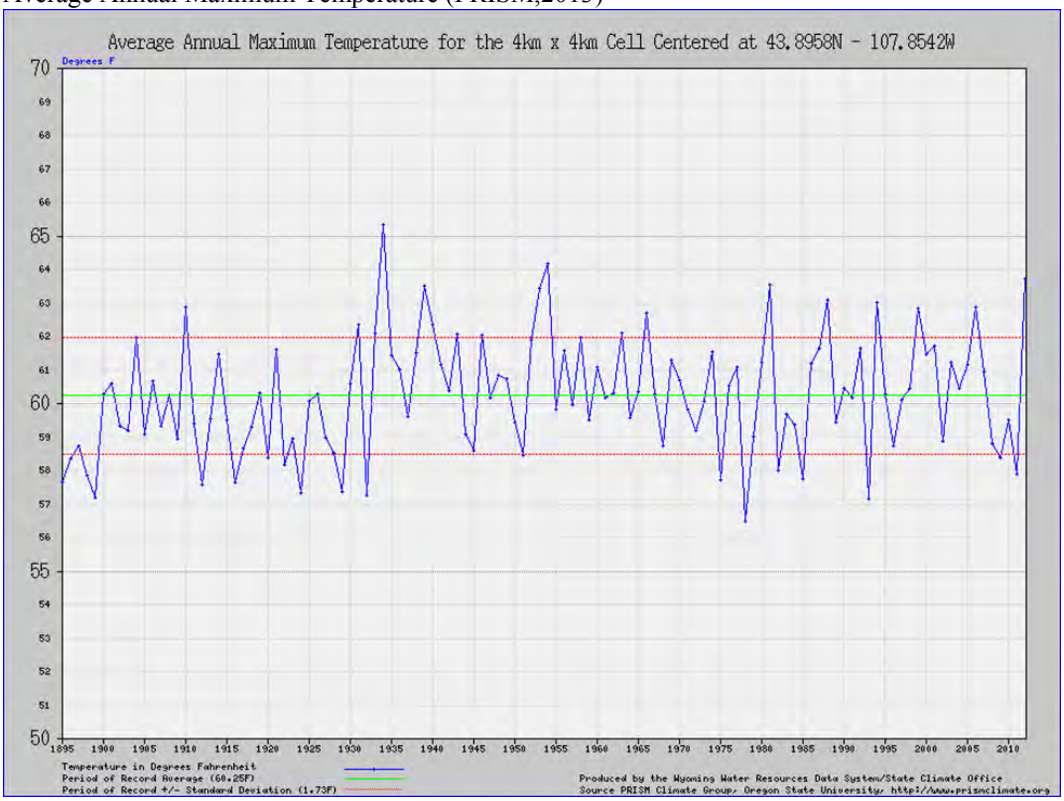
30 Year Monthly Precipitation (PRISM,2013)



Average Annual Growing Season (28 and 32 degree days)(PRISM,2013)



Average Annual Maximum Temperature (PRISM,2013)



The maximum and minimum elevations for each allotment within the East Fork Nowater Creek watershed were calculated along with the average slope given in percent rise for each 10 meter digital elevation grid. The Badlands allotment positioned in the upper northern region of the watershed and has a maximum elevation of 5013 feet above sea level. The Badlands allotment has the highest average percent rise of slope of 18% which reflects the high amounts of rock-outcrop and steep areas that are present in the area.

Elevation\Average Slope East Fork Nowater Allotments

Allotment	**Max Elev (ft)**	**Min Elev (ft)**	**Average Elev (ft)**	**Average Slope (% Rise) 10m**
HoneyCombs	5341	4373	4669	17.0
Worland Cattle Group	4577	4134	4327	8.2
Denver Jake	4550	4216	4367	9.0
Demer Nowater	4705	4311	4491	10.0
East Fork	4751	4321	4488	13.0
Antelope Draw	5335	4331	4692	16.4
Mileski	5508	4452	4803	13.0
Healy	4810	4301	4521	14.0
Slickwater	4665	4176	4403	12.7
Nowater	4849	4298	4570	15.2
Badlands	**5013**	**4465**	**4715**	**18.0**

2.3 Soils

The soils reflect the high desert environment in which they formed. They are highly variable, reflecting differences in parent material (shale, sandstone and/or mixed alluvium), position on the landscape, elevation, slope and aspect. The Badlands allotment is in the watersheds which are characterized by rolling hills, ridges and escarpments that are dissected by ephemeral drainages. Soil depth ranges from less than 10 to over 60 inches. Sandstone and soft shale bedrock are common below the substratum. The soils typically have a light brown surface layer. Reddish hues, visible on satellite imagery, are exposed portions of the Persayo formation which makes up much of the 'badland' landform typical of the allotment.

Soil textures are varied ranging from coarse sandy loams to fine sandy loams, and clay loams to sandy clay loams and silty clay loams. In many locations, clay content, calcium carbonate and sodium increases increase with depth being expressed as argillic, calcic, natrid and natriargid diagnostic features of the soil layers. Slopes range from 0 to 60 percent.

The Badlands Allotment is situated within the 5-9 inch Big Horn Basin (BH) Precip Zone as depicted by NRSC spatial data. Based on the soil survey data for Washakie County, the dominant soil units found in the allotment are listed below:

Soil Map Unit	**Name**	**Acreage in Allotment**	**Characteristics**	**Ecological Site**
23	Fruita-Neiber association, 1-30% Slopes	841	Moderately deep, well drained soils. Fruita found on fans, Neiber on uplands. Formed in alluvium often derived from sand stone. Fine sandy loam.	Loamy, 5-9bh, R032XY122WY Shallow Loamy, 5-9bh R032XY162WY
42	Lostwells-Youngston complex, 1-10% Slopes	718	Deep to very deep, well drained soil. Lost wells and Youngston are formed from alluvium. Mildly to moderately alkaline. Sandy to Silty Clay loam.	Loamy, 5-9bh, R032XY122WY

46	Muff-Neiber fine sandy loans, 3-30% Slopes	51	Moderately deep, well drained soils on hillsides and ridges of uplands. Muff formed in material derived from shale, Neiber from sandstone. Mildly to moderately alkaline. Slow permeability and moderate water capacity. Fine sandy loam.	Loamy, 5-9bh, R032XY122WY
57	Persayo-Rock outcrop association, 15-40% Slopes	5,108	Shallow, well drained soils on ridges, hills that are dissected by numerous dendritic drainage ways, and escarpments. These soils formed in material derived from shale. Moderate to strongly alkaline. Loam.	Shale/Rock Outcrop 5-9bh, R032XY154WY
61	Rock outcrop-Persayo complex, 15-70% Slopes	1,421	Shallow, well drained soils on hilly to steep uplands. These soils formed in material derived from predominately shale. Moderate to strongly alkaline. Loam.	Shale/Rock Outcrop 5-9bh, R032XY154WY
84	Youngston-Uffens-Lostwells complex, 1-10% Slopes	1,324	Deep, well drained soils on terraces, fans, and flood plains and in valley floors. Formed in material derived from alluvium. Moderate to strongly alkaline. Sandy clay loam.	Saline Upland 5-9bh, R032XY144WY Saline Lowland 5-9 bh, R032XY138WY

Assessment sites occurred on the following Ecological Site Descriptions (ESD):
Loamy 5-9 inch pz. R032XY122WY
Saline Upland 5-9 in. pz. R032XY144WY

There is also a significant amount of Rockoutcrop (badlands) found within the allotment.

In 2013 an interdisciplinary team of BLM resource specialists evaluated the Allotment through 4 assessments using the "Interpreting Indicators of Rangeland Health", Technical Reference 1734-6 and other monitoring data.

Soil Features	**LI 1**	**LI 3**	**Step Point 5**	**Step Point 7**
Soil Name	Lostwells-Youngston-Uffens Complex	Youngston-Uffens-Lostwells Complex	Persayo-Rock Outcrop Association	Fruita-Neiber-Muff Assocation
Parent Material Kind	alluvium	alluvium	shale	Sandstone
Parent Material Origin	sandstone, shale	shale	shale	Sandstone
Surface Texture	loam	silty clay loam	clay loam	clay loam
Electrical Conductivity (mmhos/cm)	Not Noted	2.2	3.4	Not Noted
Ph	Not Noted	8.5	8.5	9.1

The first assessment site, Line Intercept 1, is located in Map Unit 42, Lostwells-Youngston-Uffens Complex. The surface texture was a loam and the A horizon was 5 inches in depth. B horizon was 9 inches. The pH was not noted, but effervescence was noted as increasing with depth.

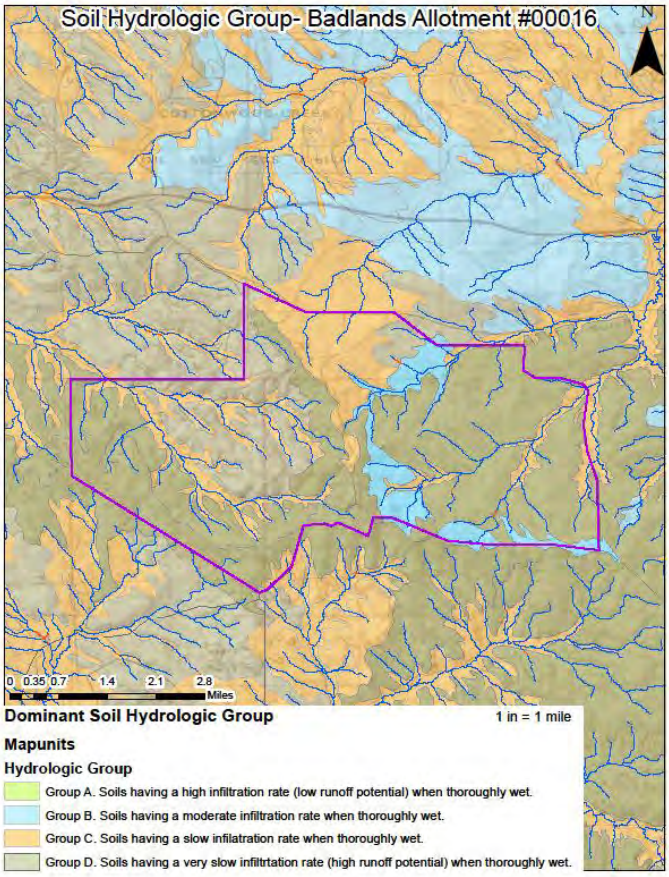
The second assessment site, Line Intercept 3, is located in Map Unit 84, Youngston-Uffens-Lostwells Complex. The surface texture was silty clay loam and was 4 inches in depth. The B horizon depth was 5 inches. There was no surface effervescence, but salts increase with depth and cooperated by an EC value of 2.2. The pH for A horizon was 8.1 and B horizon was 8.5. The natural water drainage pathways from the surrounding badlands noted through the allotment increases pH and salts.

The third assessment site, Step Point 5, is located in Map Unit 57, Persayo-Rock Outcrop Association. The surface texture was clay loam. The A horizon was 4 inches deep, and B horizon was 8 inches deep. There was mild effervescence throughout the soil profile with a EC reading of 3.4. The pH for the A horizon was 8.5 and B Horizon was 9.1.

The fourth assessment site, Step Point 7, is located in Map Unit 23, Fruita-Neiber-Muff Assocation. The surface texture was clay loam. The A horizon was 2.5 inches in depth and B Horizon was 7 inches in depth. There was no surface effervescence, but the B horizon was strongly effervescent. The pH at the A/B horizon border was 9.1.

Hydrologic Group B, C and Hydrologic Group D soils %

The soil hydrologic group displays the distribution of the dominant soil hydrologic group that is assigned to the watershed. Group B type soils are those with moderate/high infiltration rates, locally in the watershed these areas are located within the floodplain area of the East Fork of Nowater and other sandy ranges sites near ridge tops and channel bottoms in the East Fork Nowater watershed and surrounding area. The group C soils are from loamy range sites in the watershed and are located along slopes less than 10 percent. The group D soils are very common in the eastern and badland sections of the watershed where rock out crops are common, slopes are greater than 10 percent, and the depth to the bedrock is less than 50 centimeters.



2.4 Hydrology / Riparian

2.4.1 Surface Water

The Badlands Allotment is situated along a watershed divide between three different level #5 watersheds (Map 3). This allotment contains upper areas of the Sand Draw-Nowood River, Big Cottonwood Creek, and East Fork of Nowater Creek level #5 watersheds.

Within the Badlands Allotment there are five different level #6 sub-watersheds that are identified by the United States Geological Survey (USGS) by name and Hydrologic Units Codes or (HUC) (Table 1). In total 47 percent of the allotment is located in the Upper Big Cottonwood Creek sub-watershed consisting of 14.7 percent of the total sub-watershed. In addition 43 percent of the allotment is located in the Upper Sand Creek sub-watershed consisting of 12.2 percent of the sub-watershed. The other sub-watershed areas in the allotment are further described below in the table.

The Sand Creek and Big Cottonwood Creek watersheds drain to the north and eventually confluence with the Nowood River approximately 25 miles to the north and northeast of the allotment. All of the East Fork of Nowater Creek sub-watersheds drain into Nowater Creek 18 miles downstream and west of the allotment boundary and confluence with the Bighorn River south of the town of Worland Wyoming.

Watersheds of Badlands Allotment #00016				
Watershed (HUC) Level #5	**Acres (mi²)**	**Allotment Acres (mi²)**		
Nowood River- Sand Creek (1008000807)	181098 (283)	4002 (6.3)		
Nowood River- Big Cottonwood Creek (1008000805)	176000 (275)	4912 (7.7)		
East Fork Nowater Creek (1008000709)	98790 (154)	508 (0.8)		
Sub-watershed (HUC) Level #6	**Acres (mi²)**	**Acres (mi²) Within Allotment**	**% of Allotment**	**% of Acres of Sub-watershed in the Allotment**
Upper Big Cottonwood Creek (100800080505)	29952 (46.8)	4416.4 (6.9)	47	14.7
Upper Sand Creek-Nowood River (100800080706)	32692(51.1)	4002.1 (6.3)	43	12.2
Lower Big Cottonwood Creek (100800080506)	29777 (46.5)	(496.4) (0.8)	5	1.7
East Fork Nowater Creek (100800070903)	32588 (50.9)	354.1 (0.6)	4	1.1
Hawks Nest Fork (100800070901)	31218 (48.8)	154.4 (0.2)	1	1.5

The overall total miles of ephemeral/intermittent channels for the Badlands allotment is 49.2 total miles that consist of 2.1 within the East Fork Nowater Creek, 22.8 channel miles in the Upper Sand Creek sub-watershed, and 24.3 miles in the Big Cottonwood Creek watershed. Rainfall patterns in arid and semi-arid regions influence when stream flow is most likely (EPA,2008). The high amount of ephemeral channels is indicative of the steep badland topography of the allotment.

Allotment	Total Miles Intermittent/Ephemeral Channels	Watershed (HU 10)					
		East Fork Nowater	(%) of Total East Fork Nowater Channel Length	Nowood R-Sand Ck	Bighorn R-Sage/Slick Ck	Nowood R-Big Cottonwood Ck	Nowater Ck
HoneyCombs	179.6	179.6	25	0	0	0	0
Worland Cattle Group	162.6	100.8	14	0	22.8	0	39
Denver Jake	81.6	81.6	11	0	0	0	0
Demer Nowater	116.5	81.6	11	0	0	0	34.9
East Fork	64.0	64.0	9	0	0	0	0
Antelope Draw	82.2	60.6	9	0	0	0	21.6
Mileski	58.5	58.5	8	0	0	0	0
Healy	112.2	55.3	8	56.9	0	0	0
Slickwater	68.9	19.6	3	0	49.3	0	0
Nowater	60.5	8.6	1	0	0	0	51.9
Badlands	**49.2**	**2.1**	**0**	**22.8**	**0**	**24.3**	**0**
Total	**1035.8**	**712.3**	**100.0**				

Rosgen Types- These channels are dominantly Rosgen G5type streams that are defined as (Rosgen,1996) entrenched, narrow, and deep channels with a low to moderate sinuosity. These types have high bank erosion rates and a high sediment supply. The main channel material or d50 for the East Fork is a classified as sand material size. These channel types generate naturally high bed-load and sediment transport rates and flow only in response to precipitation events between 2-5 percent of the total days in the average year (Hedman, 1983). Rosgen F5 type channels are described as entrenched, meandering channels which are deeply incised in valleys of relatively low relief such as the Sand Creek and Big Cottonwood Creek sub-watersheds. They contain highly weathered rock and erodible materials, and high lateral extension rates and bar deposition following infrequent storm events. Other less entrenched reaches are classified as Rosgen C5 channels, where there is still periodic flooding and access to the floodplain from high flow events. The average main channel slope is 0.51 percent.

Allotment	Main Channel	Average Main Channel Slope	Rosgen Channel Types
Badlands	East Fork Sand Creek	0.51	G5b,F5b

2.4.2 Groundwater

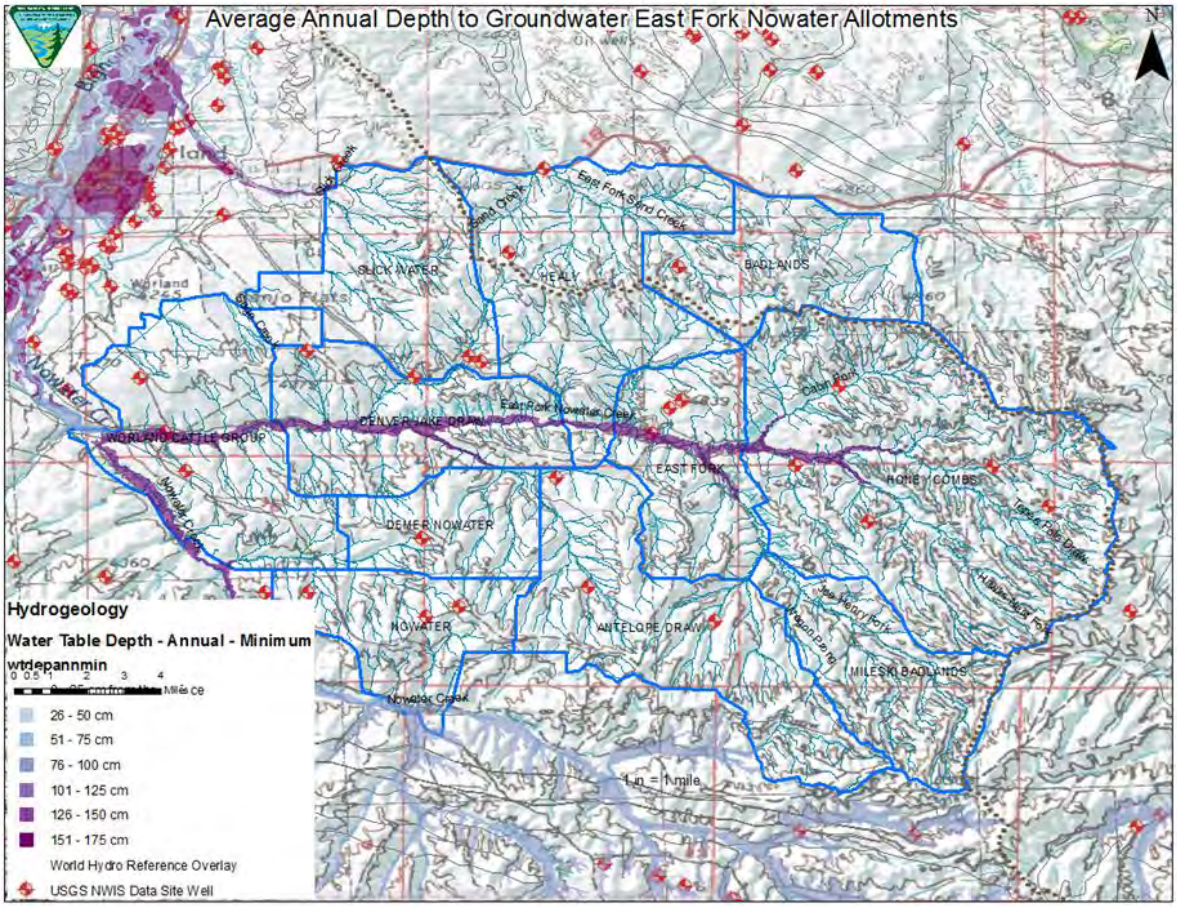
The area is located in a highly erosive area with high amounts of runoff and very low permeability due to very fine grained geologic outcrops of primarily Tertiary aged outcrops of the Willwood and Fort Union Formations. The northern half of the allotment is dominantly mapped as the Tertiary Willwood Formation. The southern portions of the allotment are mapped as the Fort Union Formation. There are minor amount of Quaternary alluvium and colluvium unconsolidated deposits that are mapped along the lower portions of the main drainages.

The average annual minimum depth to groundwater is found along the floodplain areas of the main drainages and is mapped at a depth of 151-175 centimeters annually. There are no known springs or seeps in the allotment.

Ground-water recharge in arid and semi-arid regions has generally been viewed as the sum of several different distinct pathways including mountain-block recharge, mountain-front recharge, spatially distributed recharge, and ephemeral stream channel recharge. Recent research has expanded this view to include the mediating role of vegetation (i.e. water use by vegetation), and the greater role of

ephemeral stream channel recharge in basin floors (EPA,2008 p.22). The ground-water recharge for this watershed is likely in the form of ephemeral stream channel recharge.

Average Annual Depth to Groundwater



There is one groundwater well (not a range improvement project) on record in the allotment that is located in T46N R91W Sec2 that is a 1400 foot deep well that is completed in the Lance Formation. Other groundwater is likely encountered at various depths from other oil wells that are present within the allotment.

2.4.3 Water Quality

The main drainages of East Fork Sand Creek and Big Cottonwood Creek and other tributaries in the allotment are classified by the Wyoming Department of Environmental Quality (DEQ) as class 3B type streams. The associated beneficial uses for class 3B streams are found in the table below. These streams support other aquatic life, recreation, wildlife, agriculture, industry, and provide scenic value throughout portions of the year.

WY DEQ Use Designations										
Surface Water Classes	**Drinking Water**	**Game Fish**	**Non-Game Fish**	**Fish Consumption**	**Other Aquatic Life**	**Recreation**	**Wildlife**	**Agriculture**	**Industry**	**Scenic Value**
2AB	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2C	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3B	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

2.4.4 Riparian

The East Fork of the Sand Creek is the main drainage in the allotment and it supports a limited number of Cottonwood trees throughout the segment. These stands are supported by groundwater that is at depths greater than 170 centimeters throughout the year. The depth to available water prohibits the establishment of a herbaceous riparian/wetland area.

2.5 Upland Vegetation

The vegetation in the allotment consists of mid and short cool-season perennial upland grasses, big sagebrush, and a variety of forbs; there are salt tolerant grasses, shrubs, and forbs also present throughout the allotment. Vegetation in the allotment is variable and dependent upon the range site.

The native plant species identified at the first assessment site, Line Intercept 1, (N 43.96779° – W107.67863°') includes the following: Bluebunch Wheatgrass (*Psuedoroegneria spicata),* Needle and thread (*Hesperostipa comata*), Indian ricegrass (*Achnatherum hymenoides*), Sandberg bluegrass (*Poa secunda),* Textile Onion (*Allium textile*), Sego lily (*Calochortus nuttallii*), Plains pricklypear cactus (*Opuntia polyacantha*), Aster (*Symphyotrichum* spp.), Phlox (*Phlox spp.),* Wyoming big sagebrush *(Artemisia tridentata* spp. *Wyomingensis)*, Gardner's Saltbush (*Atriplex gardneri),* Shadscale saltbush (*Atriplex confertifolia),* Broom Snakeweed (*Gutierrezia sarothrae),* Woody Aster (*Xylorhiza glabriuscula),* and biological crusts and lichens.

The native plant species identified at the second assessment site, Line Intercept 3, (N 43.96944° – W107.70694°') includes the following: Needle and thread (*Hesperostipa comata*), Indian ricegrass (*Achnatherum hymenoides*), Sandberg bluegrass (*Poa secunda),* Blue Grama (*Bouteloua gracilis),* Woolly Plantain (*Plantago patagonica),* Bottlebrush Squirreltail (*Elymus elymoides),* Alkali sacaton (*Sporobolus airoides),* Sixweeks fescue (*Vulpia ocotoflora),* Textile Onion (*Allium textile*), Sego lily (*Calochortus nuttallii*), Plains pricklypear cactus (*Opuntia polyacantha*), Aster (*Symphyotrichum* spp.), Phlox (*Phlox spp.), Astragalus spp.* Wyoming big sagebrush *(Artemisia tridentata* spp. *Wyomingensis)*, Gardner's Saltbush (*Atriplex gardneri),* Greasewood (*Sarcobatus vermiculatus),* Woody Aster (*Xylorhiza glabriuscula),)*and biological crusts and lichens.

The native plant species identified at the second assessment site, Step Point 5, (N 43.97899° – W107.66758°') includes the following: Indian ricegrass (*Achnatherum hymenoides*), Sandberg bluegrass (*Poa secunda),* Bottlebrush Squirreltail (*Elymus elymoides),* Textile Onion (*Allium textile*), Sego lily (*Calochortus nuttallii*), Plains pricklypear cactus (*Opuntia polyacantha*), Aster (*Symphyotrichum* spp.), Phlox (*Phlox spp.),* Wyoming big sagebrush *(Artemisia tridentata* spp. *Wyomingensis)*, Gardner's Saltbush (*Atriplex gardneri),* Bud sagebrush (*Picorthamnus desertorum),* and biological crusts and lichens.

The native plant species identified at the second assessment site, Step Point 7, (N 44.00063° – W107.69545°') includes the following: Indian ricegrass (*Achnatherum hymenoides*), Sandberg bluegrass (*Poa secunda),* Bottlebrush Squirreltail (*Elymus elymoides),* Textile Onion (*Allium textile*), Sego lily (*Calochortus nuttallii*), Plains pricklypear cactus (*Opuntia polyacantha*), Aster (*Symphyotrichum* spp.), Phlox (*Phlox spp.),* Wyoming big sagebrush *(Artemisia tridentata* spp. *Wyomingensis)*, Gardner's Saltbush (*Atriplex gardneri),* Bud sagebrush (*Picorthamnus desertorum),* and biological crusts and lichens.

2.6 Invasive Species

Noxious weed species inventoried within the allotment include saltcedar (Tamarix chinensis) and Canada thistle (Cirsium arvense).. Occurrence is primarily near roads and reservoirs or other previously disturbed areas. Cheatgrass (Bromus tectorum), Field Brome

(Bromus arvensis), Annual Pepperweed (Brassica spp) and Halogeton (Halogeton glomeratus) are within the allotment and readily observed in in some areas of the allotment while non-existent or nearly so in other areas of the allotment.

2.7 Livestock Grazing Management

The Washakie RMP was signed on 9/2/1988, and in the spring of 1989 a new grazing permit was issued. Since that time, the permit has not changed. The Badlands Allotment is permitted for use by one (1) permittee and the permit has remained the same since 1989. Grazing permit GR4901002 authorizes the following use:

Badlands #00123

600 Sheep	04/23 to 04/33	89% Public Land	28 AUMs
1400Sheep	05/01 to 05/31	89% Public Land	254 AUMs
1400Sheep	12/01 to 01/16	89% Public Land	385 AUMs
Permitted Use (AUMs)	667 Active	601 Suspended	1260 AUMs

The calculated livestock grazing use since 1989 is shown below.

Livestock Grazing Use			
	Estimated Used (AUMs)		
Year	winter	spring	Total Use
1989	385	282	667
1990	385	282	667
1991	385	282	667
1992	385	282	667
1993	385	282	667
1994	385	282	667
1995	385	282	667
1996	385	282	667
1997	385	282	667
1998	385	282	667
1999	385	282	667
2000	385	282	667
2001	385	282	667
2002	0	282	282
2003	385	0	385
2004	0	123	123
2005	281	0	281
2006	633	0	633
2007	364	98	462
2008	398	112	510
2009	198	140	338
2010	410	137	547
2011	376	0	376
2012	283	0	283
2013	327	140	467
Avg	**346**	**188**	**534**

The 25 year average of total AUMs utilized prior to the rangeland health assessment is 534 AUMs.

From 1988 to 2013, the use on the allotment was 80% of total permitted AUM. The 25 year average for winter AUMs is 346 (90%) and for spring AUMs is 188 (67%).There is a distinct split with the patterns of use the allotment received over 25 years. The first pattern of use is from 1988 to 2001, the use on the allotment was 100% of total permitted use. The second pattern of use is from 2002 to 2013, the average use of total permitted AUMs is 59%. The average spring use for 2002 to 2013, is 86 AUMs or 30% of permitted spring AUMs available. Average winter use for 2002 to 2013, is 305 AUMs or 79% of permitted winter AUMs available for use While use over the years has varied over certain time periods in accordance with drought years, the one consistency in the grazing management of the allotment is that critical growing season use occurs almost every year for the last 24 years (5 years have no spring use).

2.8 Wildlife

The Badlands allotment provides habitat for a variety of wildlife species, including crucial winter range for antelope and winter/yearlong habitat for mule deer and antelope, limited sagebrush habitats for sagebrush obligate bird species like the sage thrasher, sage and Brewer‘s sparrow, and saline upland habitats for white-tail prairie dogs, mountain plover and burrowing owls. The northern boundary of the allotment provides a small portion of antelope crucial winter range, and antelope and mule deer could be expected throughout the allotment in low densities, particularly where the limited amounts of sagebrush habitats occur, (see Wildlife Resources map).

The primary vegetative habitat types of importance to wildlife are the sagebrush steppe community and saline uplands. These sagebrush habitats are particularly important to wintering mule deer, antelope and wintering and nesting sage grouse, as well as other sagebrush obligate passerines like the sage thrasher, sage sparrow, and Brewer’s sparrow. Wintering mule deer, antelope and sage-grouse depend on the sagebrush plants for forage and the avian sagebrush obligates depend on both the sagebrush and standing herbaceous residue for nesting cover. The sagebrush steppe communities within this allotment are small and patchy and comprise approximately 30% of the vegetative cover. The sagebrush habitats within this allotment are not HCPC (historical climax plant community). Data collected at Step Pt 7, LI 1, and LI 3 monitoring sites indicates that these sagebrush steppe communities are better described as Salt Tolerant Shrub/Bare Ground Plant Community (Step Pt 7 and LI 3) and Big Sagebrush/Bare Ground Plant Community (LI 1). The Salt Tolerant Shrub/Bare Ground Plant Community exhibits a low level of plant species diversity due to the accumulation of salts near the soil surface. It may provide some thermal and escape cover for deer and antelope if no other woody community is nearby, but in most cases, it is not a desirable plant community to select as a wildlife habitat management objective. The Big Sagebrush/Bare Ground Plant Community can provide important winter foraging for mule deer and antelope, as sagebrush can approach 15% protein and 40-60% digestibility during that time. This community provides excellent escape and thermal cover for large ungulates, as well as nesting habitat for sage grouse.

The saline upland sites typically would be dominated by salt tolerant plants and drought resistant mid cool-season perennial grasses. The expected plant composition is 50% grasses, 10% forbs, and 40% woody plants, (see SU 5-9” ESD for Step Pt 5 in section 3.1). These sites can be important foraging areas for mule deer and pronghorn, particularly in the spring and summer when diets shift from shrubs to herbaceous plants. Data collected at the saline upland site (Step Pt 5) indicates that the site is best described as Gardner’s saltbush/Bottlebrush Squirreltail community state. This community with the combination of shrubs, grasses, and forbs can provide a forage source for large animals. Suitable thermal and escape cover for these animals are limited due to the low quantities of tall woody plants. When found adjacent to sagebrush dominated states, this plant community may provide lek sites for sage grouse. Other birds that would frequent this plant community include western meadowlarks, horned larks, and golden eagles. Some grassland obligate small mammals would occur here.

Another important habitat type within this allotment is the riparian/wetland areas associated with reservoirs. Riparian areas and their associated aquatic and wetland vegetation provide forage and cover for shorebirds, waterfowl and some passerines. These wet areas with succulent vegetation and abundant insects are also important foraging areas for sage grouse broods, particularly when upland vegetation has cured out.

2.9 Threatened, Endangered, Candidate, or Sensitive Species

The sagebrush steppe habitats mentioned above, in addition to providing habitat for antelope and mule deer also provide breeding, nesting and foraging habitat for sagebrush obligate bird species, like sage and Brewers sparrows, sage thrashers, and potentially sage-grouse. Occurrence of these sagebrush obligate bird species has not been documented within this allotment, and sage-grouse breeding and wintering have been inventoried within the last 8 years. As stated above these Wyoming sagebrush habitats are small and patchy and comprise approximately 30% of the allotment, and in general are not in healthy condition. There are no known sage-grouse leks or winter concentration areas in the allotment and the Core area boundary is approximately 1 mile east. There are 3 occupied leks within

3.6 miles east of the allotment's eastern boundary, with the closest being 2.5 miles. Because of the proximity to these leks sage-grouse nesting could be occurring within the allotment, but this has not been documented and nesting habitat conditions are marginal with low frequency of cool season bunch grasses and high frequency of invasive plants (see Section 3.0 Table __ Rangeland Health Indicators/Ratings---Badlands Allotment). The saline upland sites mentioned above can also contain white-tailed prairie dog colonies, and the colonies themselves provide habitat for other sensitive species like the burrowing owl and mountain plover, as well as foraging habitat for the ferruginous hawk. There is one known white-tailed prairie dog colony in the north central portion of the allotment. There are no known threatened or endangered wildlife species within this allotment, but the sage-grouse, sage thrasher, sage and Brewers sparrow, white-tail prairie dog, mountain plover, burrowing owl and the ferruginous hawk, are all Wyoming BLM sensitive species.

3.0 Summary of Monitoring Data / Assessments

3.1 Monitoring Data

In the summer of 2013, 4 vegetation monitoring sites were selected in the allotment as part of the Rangeland Health Assessment process. Ecological site, soil type, vegetative community, topography, location of water sources, and livestock grazing history are some of the factors that were considered in the selection of these monitoring sites to represent the allotment.

Line intercept cover transects and step point transects (approximately 200 points per line intercept transect and 100 points per step point transect) were completed in each monitoring site. A summary of the cover data collected from each monitoring site is shown below.:

Vegetation Monitoring Data						
Monitoring Site	**Ecological Site**	**Basal Vegetative Cover**	**Litter**	**Bare Ground**	**Sagebrush Canopy Cover**	**Brte presence ((hits/transect pts)*100)**
Step Pt 5	Saline Upland 5-9"	7.9%	42.6%	49.5%	18.8%	6
LI 3	Loamy 5-9"	4%	56.7%	39.3%	19.3%	17
Pt 7	Loamy 5-9"	21%	28%	51%	45.2%	1
LI 1	Loamy 5-9"	15.3%	51.3%	33.4%	22%	23

Cheatgrass presence is derived from total "hits" on cheatgrass, canopy or basal, throughout the transect. It is a representation of the amount times the plant was encountered along a transect in relation to the amount of points observed on the transect.

Rangeland Health Assessments were conducted at the monitoring sites by an interdisciplinary team on 08/02/2013 using the 17 Indicators of Rangeland Health as described in BLM Technical Reference 1734-6. Field observations were compared to the Reference Sheet for the Saline Upland 5-9" Precipitation Zone (R032XY144WY) at the Step Pt 5 Site, and the Reference Sheet for the Loamy 5-9" Precipitation Zone (R032XY122WY) at the LI 3, Pt 7, and LI 1 sites, to determine departures from normal. Individual ratings for the *Rangeland Health Indicators* are displayed for each monitoring site below.

Rangeland Health Indicator Ratings for each Assessment Site				
	Departure from Reference Sheet			
Indicator	St Pt 5	St Pt 7	LI 1	LI 3
1. Rills	N-S	N-S	N-S	N-S
2. Water-flow patterns	N-S	S-M	S-M	S-M
3. Pedestals and/or terracettes	S-M	M	S-M	N-S
4. Bare ground	S-M	S-M	S-M	N-S
5. Gullies	M	N-S	M-E	M-E
6. Wind-scoured, blowouts, and/or deposition areas	S-M	N-S	N-S	N-S
7. Litter movement	N-S	S-M	M	N-S
8. Soil surface resistance to erosion	S-M	S-M	M	M
9. Soil surface loss or degradation	N-S	S-M	S-M	S-M
10. Plant community composition and distribution relative to infiltration	S-M	M	M	M-E
11. Compaction layer	N-S	N-S	N-S	N-S
12. Functional / structural groups	S-M	M	M	M-E
13. Plant mortality / decadence	N-S	M-E	S-M	S-M
14. Litter amount	M	N-S	M	M
15. Annual production	N/A	N/A	N/A	N/A
16. Invasive plants	M	M	M-E	M-E
17. Reproductive capability of perennial plants	N-S	N-S	N-S	N-S
Soil and Site Stability Rating (1,2,3,4,5,6,7,8,9,11)	S-M	N-S	M	S-M
Hydrologic Function Rating (1,2,3,4,5,8,9,11,14)	S-M	N-S	M	M
Biotic Integrity Rating (8,9,11,12,13,14,15,16,17)	S-M	N-S	M	M-E
N-S None to Slight S-M Slight to Moderate M Moderate M-E Moderate to Extreme E -Extreme				

3.2 Soils and Site Stability

Data collected for the Rangeland Health Assessments were used to evaluate soil and site stability on the allotment. Standard 1 for Healthy Rangelands was evaluated based on the attribute ratings for *Soil and Site Stability* and *Hydrologic Function* using rangeland health indicators 1 through 11 and 14.

The rangeland health assessments conducted in the were compared to the Reference Sheet for the Loamy 5-9 inch precipitation zone (R032XY122WY) ecological site dated 2/19/2008 to determine departures from normal (Line Intercept 1, Line Intercept 3, Step Point 7). Except for Step point 5 which is compared to Reference Sheet for Saline Upland 5-9 inch precipitation zone (R032XY144WY) ecological site dated 2/19/2008

Assessment One Line Intercept 1

Rill formation was not observed. Isolated water flow patterns were found. Pedestals were less than 2 inches on average and rounded; no terracettes were observed. Transect data determined bare ground to be 23 percent (25 – 35percent expected) and litter cover to be 51 percent (20 – 30 percent expected). Gullies were moderate to extreme along the shoulders of the drainage with a heal/cut pattern. No wind scoured or blow-out areas were observed. Some small class of litter are visible and observably moving to depressions and catching on obstructions. The soil stability index (SSI), an indicator of the soil surface resistance to erosion, was 4 with a greater than or equal to 5 expected. Coverage of biological soil crusts was 30% of basal vegetative hits composition. When the SSI is combined with vegetation, litter, and soil crust cover, the soil is reasonably stable and possesses a limited resistance to rain drop impact and to the erosive force of overland flow. The plant cover and litter are at 67%. A plant cover and litter at 60% or greater of soil surface

maintains soil surface integrity. The presence of a 5-inch A horizon indicates there has been no historic soil surface loss. No soil compaction was observed.

Assessment Two Line Intercept 3
Rill formations were not observed. Water flow patterns were observed near the edges of drainages and bare interspaces. Pedestals were not observed. Transect data determined bare ground to be 29 percent (25 – 35 percent expected) and litter cover to be 57 percent with 20 to 30 percent expected. Gullies were present and active with a heal/cut system on shale sites along the main drainage. No wind scoured or blow-out areas were observed. There was no litter movement observed. The soil surface resistance to erosion was significantly reduced in at least half of the plant canopy interspaces, or moderately reduced throughout the site. The SSI was 3.6 and should be greater than or equal to 5. Plant cover and litter was 71 percent which helps to maintain soil surface integrity. The presence of a 4-inch A horizon indicates there may have been some historic soil surface loss. No soil compaction was observed.

Assessment Three Step Point 7
Rill formation was not observed. Water-flow patterns were present, but short in length. Pedestals were common throughout out and up to two inches in height, but no roots were exposed. No terracettes were observed. Transect data determined bare ground to be 42 percent with 25-35 percent expected. Litter cover was 28 percent with 20 – 30 percent expected. Gullies were not observed. No wind scoured or blow-out areas were observed. The soil surface resistance to erosion was 4., which was below what was expected for the site at 5. Plant cover and litter was 58 percent or close to the 60 percent expected to help maintain soil surface integrity. The presence 2.5 inch A horizon indicates there may have been some historic soil loss and also increased the influence of salts on the site. No soil compaction was observed

Assessment Three Step Point 5 (Saline Upland Ecological Site Description)
Rill formation and water flow patterns were not observed. Pedestals were less than one inch in interspaces. Transect data determined bare ground to be 41 percent with 30-40 percent expected. Litter cover was 42.6 percent with 10 – 15 percent expected. Gullies were present and the heal/cut pattern was present for a short distance in the drainage and edges of slopes. No wind scoured or blow-out areas were observed. There was some litter movement four inches on the leeward side of shrubs and depressions. The soil surface resistance to erosion was 3.6 which is below what is expected for the site at 4 or greater. Plant cover and litter was 59 percent or above the 50 percent expected to help maintain soil surface integrity. Soil surface loss was none to slight. No soil compaction was observed.

Based on the observations made at the monitoring sites, the attribute ratings for *Soil and Site Stability* and *Hydrologic Function* were rated ranging from "None to Slight" to "Moderate" from the reference sheet. Step Point 5 was rated "Slight to Moderate" for *Soil and Site Stability* and *Hydrologic Function*. Step Point 7 was rated "None to Slight" for *Soil and Site Stability* and *Hydrologic Function.* Line Intercept 1 was rated "Moderate" for *Soil and Site Stability* and *Hydrologic Function*. Line Intercept 3 was rated "Slight to Moderate" for *Soil and Site Stability* and "Moderate" for *Hydrologic Function.*

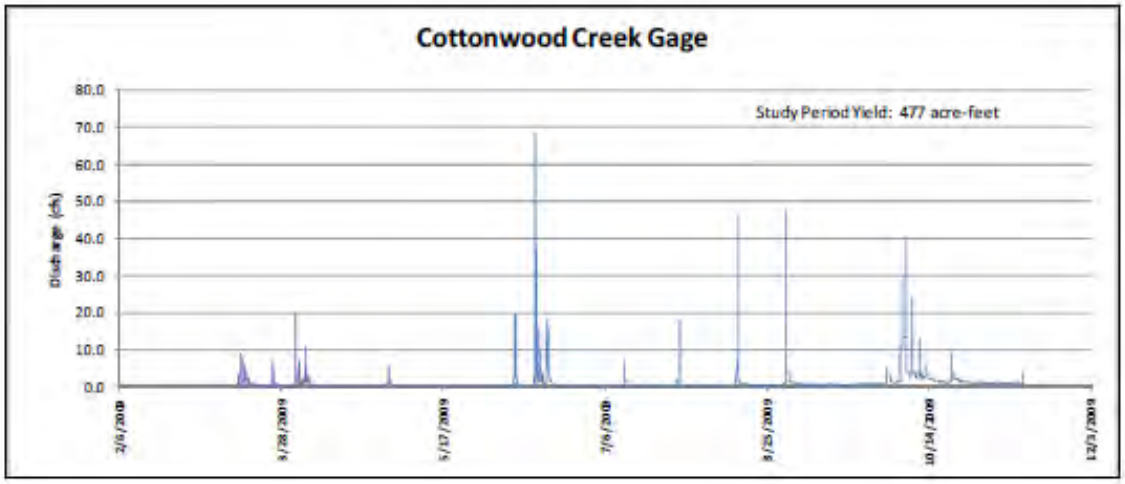
3.3 Hydrology

3.3.1 Surface Water

The amount of surface water data from the East Fork of Sand Creek is limited due to the ephemeral flow regime of the drainage. The drainage flows in response to snow melt runoff and following storm events that primarily occur from the months of April-June. There was flow data collected from Big Cottonwood Creek by the Wyoming Water Development Commission (Anderson,2009); this data depicts an assumed the typical hydrograph and associated runoff in the Big Cottonwood Creek watershed.

Several high flows in Big Cottonwood during the 2009 field season occurred and created a scour line at the bank full stage. Due to the instability of the channel major sloughing of side banks were observed during the field investigation. During a study by the Wyoming Water Development Commission (Anderson, 2009) there was a pressure transducer installed and a typical hydrograph for the creek was established. The channel is mostly dry throughout the summer months with flows reaching 40-60 cfs during a 24-48 hour period following an event and returning to an essentially dry channel.

Hydrograph Big Cottonwood Creek (Anderson, 2009)



BLM- Range Hydrologic Condition- The current conditions of runoff specific to the allotment are tied to the upland health hydrologic indicators. The overall hydrologic indicators measured for these 6 monitoring sites of the monitoring sights were slight to moderate sites, a moderate overall departure from reference conditions at two sites, and none to slight at the final site. Low amounts of infiltration and high amount of water flow patterns in the form of pedestals and terracettes with active shift in plant community and low soil surface resistance to erosion were noted to have a moderate and moderate to extreme departure at the North Pasture Transect 2. Although semi-arid ecological sites naturally have these features, they were expressed beyond normal reference conditions and rated accordingly as moderate. All of the others hydrologic ratings are given in the indicator table above.

Human Influence-

Anthropogenic uses and activities on the landscape can have significant impacts – both adverse and beneficial– on water quality and the health of a watershed. Human-related disturbances are numerous and include livestock grazing, land clearing, mining, timber harvesting, ground- water withdrawal, stream flow diversion, channelization, urbanization, agriculture, roads and road construction, off-road vehicle use, camping, hiking, and vegetation conversion. Biological stressors include habitat loss, alteration, effluent discharge, and degradation from decline in water quality, and changes in channel and flow characteristics (EPA,2008 p.65).

Many of the first order tributaries in the basin can be classified as G-Type channels, or gullies. These channels are highly erosive, generate high sediment volumes, and can result in the loss of productive lands and destabilize upland conditions. Observation of many of these channels indicates that while the major stream channels appear to have achieved a level of stability, the upper reaches of the watershed are still suffering a level of destabilization. These channels could be forming in response to one or more of numerous stimuli including but not necessarily limited to: channel realignment (straightening), road and culvert construction, rangeland management practices, or base-level lowering associated with main channel incision (Anderson,2009 p.3.100).

The nearest population center is Worland Wyoming that is located 16 miles to the northwest of the allotment. There are cattle and sheep grazing that occurs throughout the watershed and is discussed in greater detail in other sections of this document. There are numerous historic prospecting wells (oil and gas), active, and abandoned wells that were drilled throughout 1950's- through 1970's. Human activity has created demand for existing roads in the watershed.
The majority of the reservoirs were constructed from the 1950's-1970 and these impoundments have altered the runoff volume and sediment transmission rates from impounded drainages.

There are 3 miles of two track and 15 miles of BLM improved roads. From the miles of road, the total disturbance was 60 acres. This was derived from digitized roads using a 30 foot width for improved roads and 15 foot width for primitive.

3.3.2 Ground Water

The estimated depth to groundwater is estimated to be greater than 100 feet in upland areas. The amount of evaporation as indicated in the Wyoming Climate Atlas is 30 inches per year for the Worland area. This exceeds the annual precipitation of 7 inches per year, and therefore the amount of groundwater recharge into the primary Willwood and Fort Union aquifers from upland areas in the areas is minimal. The majority of local rainfall events generate surface water runoff and minimal ground water recharge. The shallowest available groundwater is found along the floodplains of East Fork Nowater and Sand Creek. The sand material in the channel and hydrologic B type soils provide for increased groundwater recharge in floodplain areas. There are no major water wells within the allotment.

3.3.3 Water Quality

BLM Observations

The tributaries contain active head-cuts that appear to be migrating upstream. These areas are where new sediment is delivered into the drainage system. The watershed transmits large amounts of in-channel sediment into the system during primary snowmelt, and other storm events that are large enough to trigger overland flow.

Wyoming DEQ

The drainages are classified by the WYDEQ as class 3B streams by default. The East Fork Nowater Creek is not on the WYDEQ 2012 305b as impaired.

USGS Data

Water samples were taken during the months of March through July and were analyzed for conductance, turbidity, a full suite of metals, hardness etc. For a full detailed table visit (USGS,2009). The data indicates naturally very large amounts of sediment are transported through the watershed especially following large flow rainstorm events. The amount of suspended sediment ranged from 18 tons per day in July of 1981 to 509,000 tons per day following high flow event in April of 1978. The presentation of these data (1978 and 1981) assumes that the same range conditions, climatic conditions/events, management activities on the landscape are the same or similar to now in order to speculate that same would be true today which may not be true.

3.3.4 Riparian

There are no naturally occurring riparian areas or wetlands within the allotment that have been documented, verified, and monitored.

3.4 Upland Vegetation

Data from the line intercept cover transects, the 17 Indicators of Rangeland Health, and other field observations were used to evaluate the vegetative community on the allotment. Standard 3 for Healthy Rangelands was evaluated based on the attribute ratings for Biotic Integrity using rangeland health indicators 8 through 9, and 11 through 17.

The vegetative community, ground cover, and soil surface attributes for the assessment sites were noted, measured and compared to the ecological site description (ESD) and corresponding reference sheet Loamy 5-9 inch precipitation zone (R032XY122WY date approved: 5/2/2008) and Saline Upland 5-9 inch precipitation zone (R032XY144WY date approved: 5/2/2008).

There are three assessed upland sites (Step Pt 7, LI 1, and LI 3) located on a Loamy range site in the 5-9 inch precipitation zone (Loamy 5-9" ESD was used). The Historic Climax Plant Community for this site is a Bluebunch wheatgrass/Rhizomatous wheatgrass/Needle and thread plant community. This community would be dominated by cool season grasses (75%) followed by a nearly even balance of woody species (15%) and forbs (10%). With moderate continuous season long grazing or extended droughts a transition from HCPC to a Perennial Grass/Big sagebrush state may occur. This state is dominated by cool season grasses but short warm season grasses and various forbs are present and shrubs would be a conspicuous part of the site. The state has a hydrologic, soil, and biotic community that is stable and intact. From this state, with frequent and severe grazing, lack of fire, extended droughts or a severe grazing in conjunction with wildfire or brush control the vegetative state can be converted to a Blue grama sod community, a Big Sagebrush/bare ground community, a salt tolerant shrub/ bare ground community and from there to a salt tolerant shrub/rhizomatous wheatgrass state. States beyond the Perennial grass/Big sagebrush community are likely to have a biotic, soil, and hydrologic function that is at risk or not functioning. Herbaceous production will decline, the undesirable species increase as the desirable species decrease,

and the ability to move towards HCPC is diminished without mechanical treatments, reseeding efforts, soil remediation efforts, and intense grazing management.

Step Pt 7

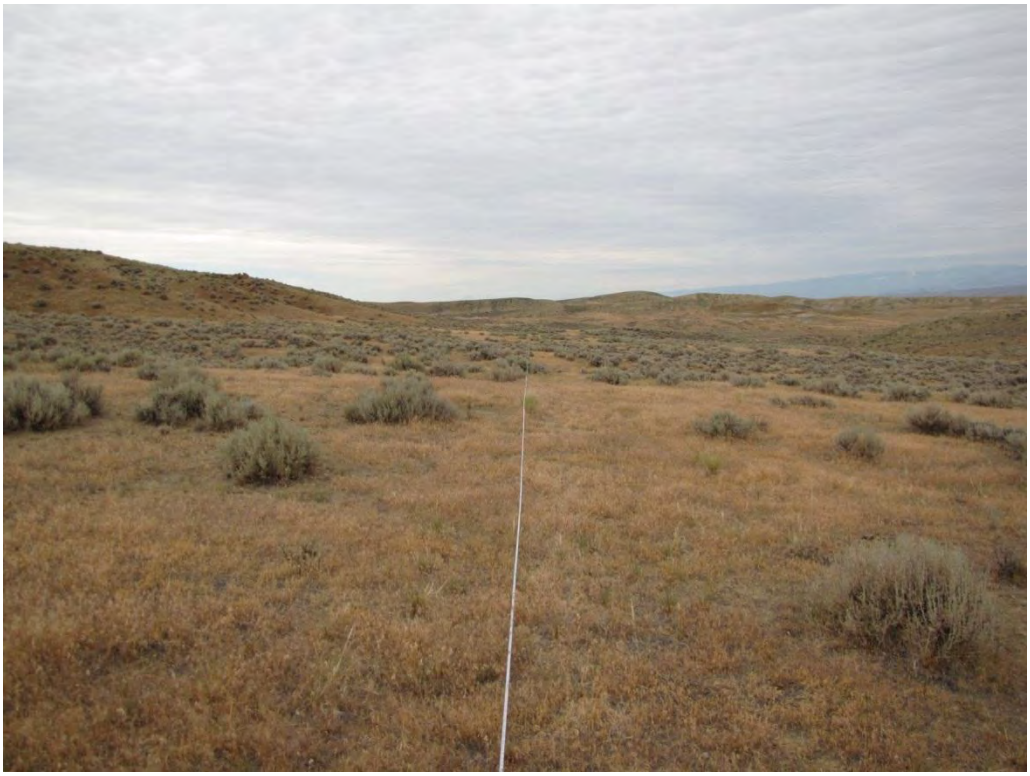
At Site Step Pt 7 the ground cover was determined to be 58% (28% litter/21% vegetation) which yields 42% bare ground. The ESD/Reference Sheet prescribes a range of 25-35% bare ground. Of the vegetative hits encountered in the cover transect; grasses/grass-likes accounted for approximately 57%, forbs accounted for 9.5% of which most were small annual forbs, and woody species accounted for 19%. The data collected indicates that the site is in the Salt Tolerant Shrub/Bare Ground Community. While there is a component of annual forbs and cheat grass as an understory the Ecological Site Descriptions do not recognize or define them as a structural/functional component. As such, the ecological state that is most represent by the data on site is the Salt Tolerant Shrub/Bare Ground community. This site is dominated by salt tolerant cool season grasses, forb, and shrub species. Cool season bunch grasses are much reduced on site. The vegetative community, the ground cover, and soil surface attributes were noted, measured and compared to the Ecological Site Description (ESD) produced by the NRCS to determine a rating to apply to the Biotic Integrity portion of the assessment through the use of the 17 indicators of rangeland health (Indicators 8, 9, and 11 through 17). The rating is dependent upon the assessment of the indicators and can vary from "none to slight" to "extreme" deviation from the applicable ESD and corresponding reference sheet. The Biotic Integrity for this site was rated as a "moderate" departure from the ESD/Reference Sheet due to the higher percentage of bare ground and the loss of desired cool season grasses as the dominant plant species on site. This site is typical and representative of the benches, terraces, and moderate to gentle slopes of the eastern half of Badlands Allotment.

Badlands, Step Pt 7, Salt Tolerant Shrub/Bare Ground Community

LI 1

At LI 1 the ground cover was determined to be 67% (51.3% litter/15.3% vegetation) which yields 23% bare ground. The ESD/Reference Sheet prescribes a range of 25-35% bare ground. From the trend transect data collected in 2013 and based upon composition by weight; grasses/grass-likes accounted for approximately 61% of total composition, forbs accounted for 4%, and woody species accounted for 1% (Sagebrush accounts for a much higher percentage of the canopy (approximately 22%)). The data collected indicates that the site Big Sagebrush/Bare Ground community state. While there is a component of annual forbs and cheat grass as an understory the Ecological Site Descriptions do not recognize or define them as a structural/functional component. As such, the ecological state that is most represent by the data on site is the Salt Tolerant Shrub/Bare Ground community. There is a desirable vegetative component on site but less desirable species such as annual grasses and forbs control the site. When compared to HCPC the site is lacking an adequate composition of desirable forbs/grasses and there are more annuals than one would expect. The vegetative community, the ground cover, and soil surface attributes were noted, measured and compared to the Ecological Site Description (ESD) produced by the NRCS to determine a rating to apply to the Biotic Integrity portion of the assessment through the use of the 17 indicators of rangeland health (Indicators 8, 9, and 11 through 17). The rating is dependent upon the assessment of the indicators and can vary from "none to slight" to "extreme" deviation from the applicable ESD and corresponding reference sheet. The Biotic Integrity for this site was rated as a "moderate" departure from the ESD/Reference Sheet, due to the higher litter amounts, the dominance of Cheatgrass, and the loss of cool season bunch grasses as the dominant plant species on site. This site is representative of the sagebrush dominated bowl located on the eastern side of the allotment in the Badlands Allotment

Badlands, LI 1, Big Sagebrush/Bare Ground Community

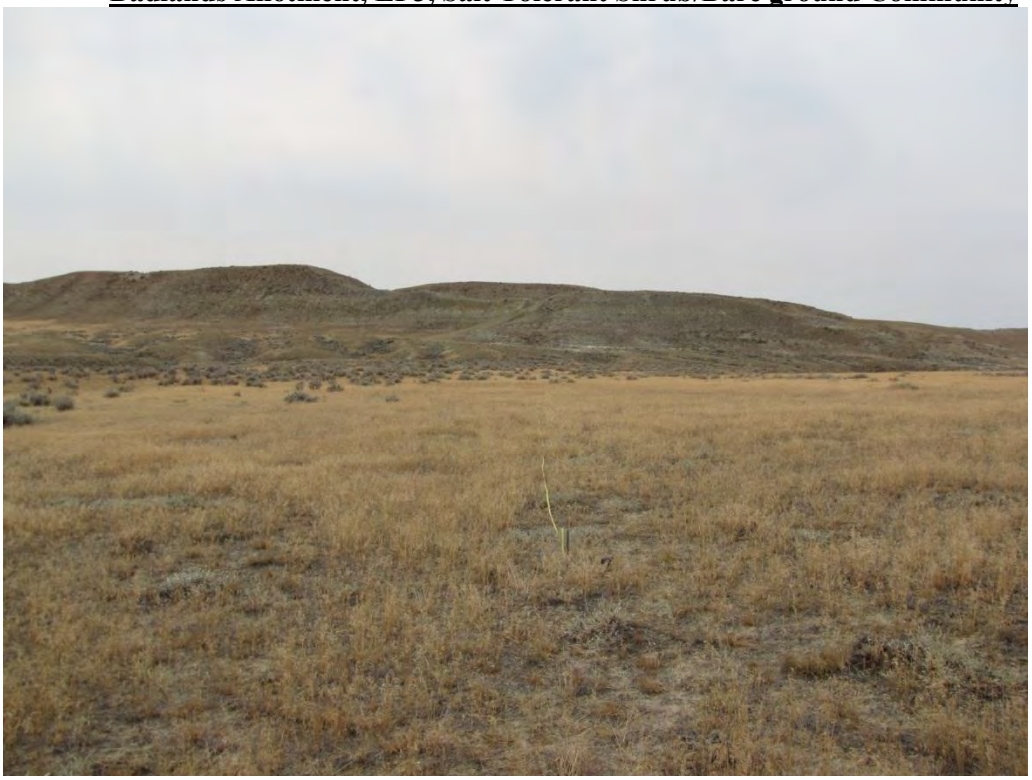


LI 3

At LI 3 the ground cover was determined to be 71% (56.7% litter/4% vegetation) which yields 29% bare ground; the bare ground would be much higher if the annual litter was removed from vegetative hits. The ESD/Reference Sheet prescribes a range of 25-35% bare ground. Of the vegetative hits encountered in the cover transect; grasses/grass-likes accounted for approximately 83.3 %, forbs accounted for 16.7% of which most were small annual forbs, and woody species accounted for 0%. The data collected indicates that the site is in the Salt Tolerant Shrub/Bare ground community state. While there is a large compoenet of annual forbs and cheat grass as an understory the Ecological Site Descriptions do not recognize them or define them as a Structural/Functional component in any ecological state. As such, the ecological state that is most represented by the data collect on site is the Salt Tolerant Shrub/Bare Ground

community.. This site is dominated by annuals that make up 50% of the vegetative hits. Cool season, desirable bunch grasses are extremely reduced on site. The vegetative community, the ground cover, and soil surface attributes were noted, measured and compared to the Ecological Site Description (ESD) produced by the NRCS to determine a rating to apply to the Biotic Integrity portion of the assessment through the use of the 17 indicators of rangeland health (Indicators 8, 9, and 11 through 17). The rating is dependent upon the assessment of the indicators and can vary from "none to slight" to "extreme" deviation from the applicable ESD and corresponding reference sheet. The Biotic Integrity for this site was rated as a "moderate to extreme" departure from the ESD/Reference Sheet, due to the high amount of litter, the dominance of cheatgrass and other annual plant species, the loss of cool season bunch grasses and desired woody shrubs. This site is typical and representative of the broad terraces above the ephemeral drainages of the Allotment.

Badlands Allotment, LI 3, Salt Tolerant Shrub/Bare ground Community



There was one assessed upland site (Step Pt 5) in the Badlands allotment which is located on a saline upland range site in the 5 inch precipitation zone (SU 5-9" ESD was used) that represents the benches of the shale/rock outcrop soil complex. The Historic Climax Plant Community for this site is a Gardner's saltbrush (40%)/Indian ricegrass/Bottlebrush Squirreltail plant community. This community would be dominated by salter tolerant plants and drought resistant mid cool-season perennial grasses. The expected plant composition is 50% grasses, 10% forbs, and 40% woody plants. With moderate continuous season long grazing or extended droughts a transition from HCPC to a Gardner's saltbrush (<50%)/Bottlebrush Squirreltail state may occur. This state is dominated by salt tolerant species (Gardner's saltbrush/Bottlebrush Squirreltail but desirable species such as Indian ricegrass and winterfat have decreased and shorter grasses/grass-likes and birdfoot sagebrush have increased. It is possible with proper prescribed grazing to convert back to HCPC. The state has a hydrologic, soil, and biotic community that is stable and intact. With frequent and severe grazing, lack of fire, or a severe grazing in conjunction with wildfire or brush control the vegetative state can be converted to a Gardner's Saltbrush/Bare Ground community, or a Halogeton state. States beyond the Gardner's saltbrush (<50%)/Bottlebrush Squirretail community are likely to have a biotic, soil, and hydrologic function that is at risk or not functioning. Herbaceous production will decline, the undesirable species increase as the desirable species decrease, and the ability to move towards HCPC becomes is greatly diminished without mechanical treatments, reseeding efforts, soil remediation efforts, and intense grazing management.

Step Pt 5

At Step Pt 5 the ground cover was determined to be 59% (42.6% litter/7.9% vegetation) which yields 41% bare ground. The bare The ESD/Reference Sheet prescribes a range of 30-40% bare ground. Of the vegetative hits encountered in the cover transect; grasses/grass-likes accounted for approximately 75%, forbs accounted for 0%, and woody species accounted for 12% (woody species (woody aster, gardner's saltbrush, and sagebrush account for approximately 53% of the vegetative canopy). The data collected indicates

that the site is Gardner's saltbush/Bottlebrush Squirreltail community state. When compared to HCPS the site displays a lack of Indian ricegrass, it does display a variety of other cool season bunch grasses but is occupied by more saltbrush than HCPC. The vegetative community, the ground cover, and soil surface attributes were noted, measured and compared to the Ecological Site Description (ESD) produced by the NRCS to determine a rating to apply to the Biotic Integrity portion of the assessment through the use of the 17 indicators of rangeland health (Indicators 8, 9, and 11 through 17). The rating is dependent upon the assessment of the indicators and can vary from "none to slight" to "extreme" deviation from the applicable ESD and corresponding reference sheet. The Biotic Integrity for this site was rated as a "slight to moderate" departure from the ESD/Reference Sheet, due to higher amounts of litter, the lack of cool season bunch that should be dominant on site, and the increase of Cheatgrass as a part of the plant community composition. This site is typical and representative of the saline upland range sites of the terraces/benches that receive regular grazing use in the allotment on the western half of the allotment.

Badlands Allotment, Site Step Pt 5, Gardner's Saltbush/Bottlebrush Squirreltail community state

4.0 Conclusions

This section draws conclusions and makes determinations regarding:
Progress towards or attainment of the standards for rangeland health, and
Whether livestock management is in conformance with the guidelines, and
Whether existing grazing management or levels of grazing use are significant factors in failing to achieve the standards or conform to the guidelines.

4.1 Standard 1

Within the potential of the ecological site (soil type, landform, climate, and geology), soils are stable and allow for water infiltration to provide for optimal plant growth and minimal surface runoff. ***MET/not met***

Rationale:

Within the potential of the ecological site (soil type, landform, climate, and geology), soils are stable and allow for water infiltration to provide for optimal plant growth and minimal surface runoff. MET/NOT MET – see rationale
Rationale:

Badlands Allotment

Acres Meeting Standard	401
Acres NOT Meeting Standard	3640
Acres Mapped as Badlands	4251
Acres Not Being Analyzed	189
Total Acres	8481 (100%)

The rangeland health attributes of Soil and Site Stability and Hydrologic Function (Rangeland Health indicators 1 through 11 and 14) were integral to these determinations. Four Rangeland Health Determinations were conducted during the summer of 2013. The concepts developed from the monitoring locations were ground truthed by extensive on-the-ground observations and then extrapolated these concepts using satellite imagery to include the entirety of Badlands allotment.

Standard 1 for Healthy Rangelands is not being consistently met on the Badlands Allotment. While this standard is being met on the alluvial terrace remnants, referred to as benchtops throughout this analysis, it is decidedly not being met on the broad drainageways (bottomlands) and the low terrace landforms immediately adjacent to the drainage ways. In addition, field data indicates steep hills, narrow ridges and escarpments dissected by narrow ephemeral drainages meet Standard 1. Standard 1 for Healthy Rangelands is discussed below for each of these broadly defined landforms follows.

Benches
Step Pt 5 site was evaluated on the benchtop landform. The bench tops are discernible on satellite imagery, but only represent a small portion of the landscape that is a soil complex of pre-dominantly shale/rock outcrop. Runoff and erosion indicators are not strongly expressed on the bench tops. The soils are stable and protected from the forces of raindrop impact and overland flow. Soil and Site Stability and Hydrologic Function were rated as “slight to moderate” at the assessment locations. The “slight to moderate” departure assigned to the site was due to slightly larger than expected interspaces that had the potential to connect and encroachment of annuals.

Drainageways and Adjacent Terraces
Two areas were evaluated within the broad drainageways or bottom lands. These broad drainageways can also be clearly discerned by zooming in on available satellite imagery. The Rangeland Health Attributes of Soil and Site Stability and Hydrologic Function were rated as having a “moderate” departure at LI 1 and “moderate” departure at LI 3. The plant communities in both areas have shifted to annual dominated flat with shrubs as the subdominant vegetative group. Active gulllies, many with nick points, headcuts, undercut banks and sloughing dominate the bottom lands, with healing between each of the active points. The adjacent ‘badland’ hills contribute to high peak flows and to some extent, add to the instability of the drainage network. Erosion and runoff indicators (waterflow patterns, pedestalling, terracettes) are not being strongly expressed. Bare ground is not excessive in part due to the presence of weedy annuals.

Badland and Upland Hills
At Step Pt 7 located on a just below the ridge top, is representative of the upland hills. The uplands have gentler slopes and a simpler topographic and vegetative plant community complexity. The Rangeland Health Attibutes of Soil and Site Stability and Hydrologic Function were rated as having a "slight to moderate" departure at Step pt 7. The plant community has shifted from a loamy dominated plant community to a sub-dominance that with salt tolerant shrub species becoming the dominant. This shift is assumed to have occurred due to top soil loss, that is cooperated by a shallow A horizon and a high ph (9.1) within the top 5 inches of soil. Additionally, annuals are beginning to invade the site. Erosion and runoff indicators (waterflow patterns, pedestalling, and terracettes) are slightly to moderately expressed. Bare Ground was slightly higher than expected due to the dominance of salt tolerant shrub species across the site.

Mixed into the uplands are the badlands that represent this complex portion of the landscape can be characterized of consisting of steep hills, narrow ridges and escarpments dissected by narrow ephemeral drainages. The components of this landscape are so intricately combined that they cannot be distinguished at the scale under which this analysis was conducted. Unlike the broad tabletops, it is common in the narrow ridgetops for the plant community to be dominated by several different range site plant communities leading to even greater complexity. Due to the complexity of topography and vegetation, badlands were not evaluated during the assessment. It is assumed that they are all passing standards due to the difficulty of livestock accessing the slopes and narrow ridge tops, as well as a slower encroachment of annuals into the communities due to the state of the ecological plant communities ability to compete with weedy/invasive annuals. These narrow ridges do not meet Standard 1 and they often fail to meet Standard 3. Due in part to gentle slopes and their small size, runoff and erosion indicators (waterflow patterns and gullies) are not strongly expressed on these narrow ridges though there is excessive bare ground and most of the plants are pedestalled. Based on observations made at the area located on the narrow ridge the Rangeland Health Attributes of Soil and Site Stability and Hydrologic Function were rated as having a "moderate" departure from that described in the reference sheet. Standard 1 for Health rangeland is not being met on the ridge.

4.2 Standard 2

Riparian and wetland vegetation has structural, age and species diversity characteristic of the state of channel succession and is resilient and capable of recovering from natural and human disturbance in order to provide forage and cover, capture sediment, dissipate energy, and provide ground water recharge. ***Not Applicable***

Rationale:
There are no naturally occurring riparian areas or wetlands within the allotment that have been documented, verified, and monitored. While there are some vegetative components of a riparian type of area (cottonwoods) they are few, segmented, and limited by the nature of the watershed and in this case the ephemeral nature of the desert ecosystem.

4.3 Standard 3

Upland vegetation on ecological site consists of plant communities appropriate to the site which are resilient, diverse, and able to recover from natural and human disturbance. ***MET / NOT MET, see rationale***

Rationale:
Based on the assessment of the data collected as well as observations throughout the allotment, the following table summarizes the number of acres that were determined to meet Standard and Guidelines, the number of acres that were determined to not meet Standard and Guidelines, and the number of acres that no determination was made. This table is also visually represented by the map in the Appendix.

Badlands Allotment

Acres Meeting Standard	401
Acres NOT Meeting Standard	3640
Acres Mapped as Badlands	4251
Acres Not Being Analyzed*	189
Total Acres	8481 (100%)

* These acres have been reclaimed or represent reservoirs.

As described in the monitoring section above there were multiple assessment sites that, after extensive touring of the allotments, were determined to represent multiple areas within the allotment.

RATIONALE-MET: As it pertains to the acres that did meet the standard, these sites are in a dynamic equilibrium with the Historic Climax Plant Community. This means that at this time these sites have appropriate pathways available to them to respond to proper grazing strategies, favorable environmental conditions, and environmental disturbances. The sites have a vegetative community that is stable, intact, resistant to change and provides for soil and watershed stability.

These areas are the broad benches/flats above the drainages isolated by steep ridges or badlands, isolated draws, or the steep ridges of the allotment.

RATIONALE-NOT MET: Acres that were determined to have NOT MET the standard are those that have had a significant change or shift from the potential of the site and do not have an appropriate plant community capable of recovering or returning to a functional community without mechanical treatments, seedings, intensive grazing management, etc. These sites have little capability or probability of returning to a more desirable state.

The acres not meeting standards are the drainages and the northeastern quarter of the allotment that have variable low slope areas. These acres are not meeting due to the invasion of Cheat grass and the loss of or/a moderate to extreme reduction of functional structural plant groups.

The historic grazing use in the allotment prior to adjudication in 1966 was 1260 AUMs from 1936-1965, which equates to a stocking rate of 6.7 acres/AUM (52% higher than the current permit).

In contrast, the allotment now has 667 active AUMs which provides for a stocking rate of 12.7 acres/AUM annually. The 25 year average on the allotment has accounted for 534 AUM which equates to annual stocking rate of 15.8 acres/AUM. The stocking rate during the critical growing season equates to 30 acres per AUM (8462 acres/282 AUM). The NRCS tech guides utilized throughout this document indicate that a continuous season long stocking rate appropriate for the defined range sites is 10-14 acres /AUM.

The current stocking rate appears to be in line with that prescribed by the NRCS and there is no monitoring data to indicate that the current permitted livestock grazing on the allotment is contributing to further degradation of these acres. There are no indicators or data to indicate that the current grazing scheme is not in conformance with guidelines.

As such, the historic grazing use as described above in combination with the aggressive and opportunistic nature of cheat grass is determined to be the causal factor for acres not meeting the standard.

4.4 Standard 4

Rangelands are capable of sustaining viable populations and a diversity of native plant and animal species appropriate to the habitat. Habitats that support or could support threatened species, endangered species, species of special concern, or sensitive species will be maintained or enhanced. ***NOT MET***

Rationale: Four monitoring locations were identified in the allotment for evaluation purposes, primarily to measure soil and vegetative parameters for evaluating the 17 Indicators of Rangeland Health. Three were located in shallow loamy or sagebrush steppe and one in a saline upland. The field evaluations of plant community composition and distribution as well as the functional structural groups (Indicators #10 and #12) were found to have slight to moderate (S-M) deviations from site potential, and moderate (M) deviations for invasive plants (Indicator #16) for the saline upland monitoring location. For the remaining 3 monitoring locations within the 5 – 9" shallow loamy or sagebrush sites all had deviations from site potential ranging from moderate (M) to moderate - extreme (M-E), as well as moderate to moderate-extreme deviations for invasive plants, (see Section 3.0 Rangeland Health Indicators/Ratings). Because of these moderate and moderate-extreme deviations from site potential, all of these monitoring sites, as well as the remaining acreage represented by these monitoring sites, are not meeting this standard. These rangelands or habitats evaluated here are likely not providing wildlife forage and cover needs, and are not capable of sustaining viable and diverse populations of native plants, and therefore animal species also. Particularly those species dependent on sagebrush communities like mule deer and antelope as well as sage-grouse. In a study conducted in south-central Wyoming, Kirol et al. (2012) found that selection of microhabitat for sage-grouse nests was negatively correlated with cheatgrass, and Coates/Lockyer et al. (2011) in a similar study in Nevada found that adult female sage-grouse selected for perennial grasses while avoiding annual grasses at the nest site. From a wildlife habitat perspective the shallow loamy sites mentioned above with moderate to extreme deviations are lacking plant species, or adequate amounts of these plant species

necessary for the seasonal life cycle demands. And also because of the prevalence of invasive species like cheatgrass, these sites are at higher risk of more frequent wildfire occurrence and subsequent invasive species frequency increases. For these sagebrush dependent species mentioned above, frequency and composition of sagebrush and key bunchgrass species are particularly important for forage, cover and nest concealment, as well as for the long term maintenance and health of the sagebrush community itself.

Badlands Allotment

Acres Meeting Standard	0
Acres NOT Meeting Standard	4,049
Acres Mapped as Badlands	4,251
Acres Not Being Analyzed	189
Total Public Land Acres	8,481 (100%)

4.5 Standard 5

Water quality meets State standards. ***UNKNOWN***

Rationale:

There is no BLM, USGS, or other state agency water quality data for these segments. Therefore compliance with Wyoming State Water Quality Standards is unknown.

4.6 Standard 6

Air quality meets State standards. ***UNKNOWN***

Rationale:

No information is currently available to indicate that this Standard is or is not being met. An air quality monitoring station was recently established in the Bighorn Basin, but no monitoring data is available at this time. Until specific data becomes available, the determination for this Standard is UNKNOWN, per direction from the BLM Wyoming State Office.

5.0 Resource Specialist Signatures

X_____

Jessica Reinig
Rangeland Management Specialist

X_____

John Elliott
Supervisory Rangeland Management Specialist

X_____

Tim Stephens
Wildlife Biologist

X_____

Jared Dalebout
Hydrologist

X_____

Michael J. Phillips
Assistant Field Manager - Resources

X_____

Other_____

6.0 DETERMINATION

Based on the information provided in this assessment, ***I have determined that all of the standards ARE NOT being met but that livestock grazing IS in conformance with the guidelines.***

X	X
Rebecca Good Worland Field Office Manager	DATE

7.0 REFERENCES

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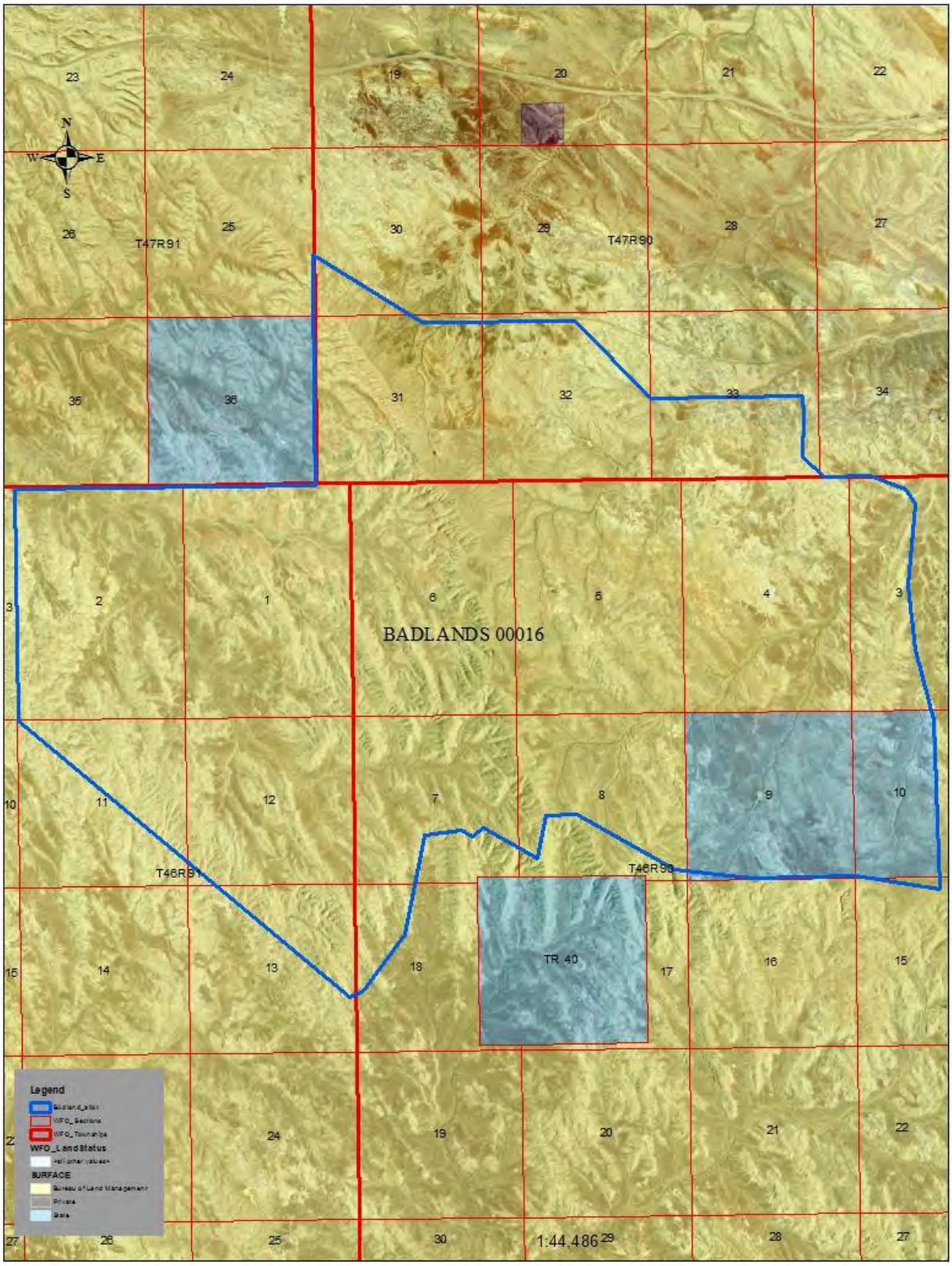
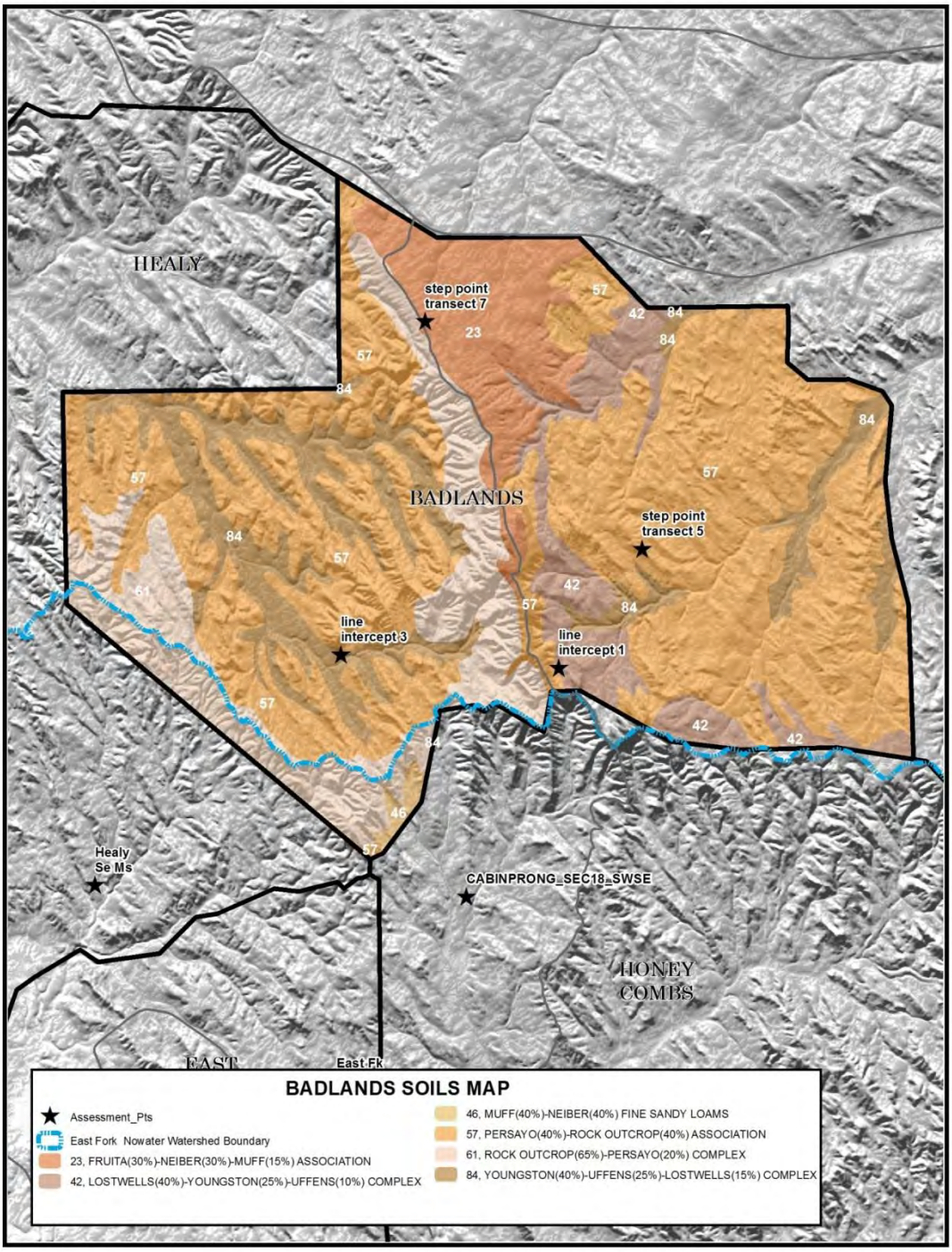
Wyoming DEQ 2012 305b Report

Allotment Map (Not to Scale)

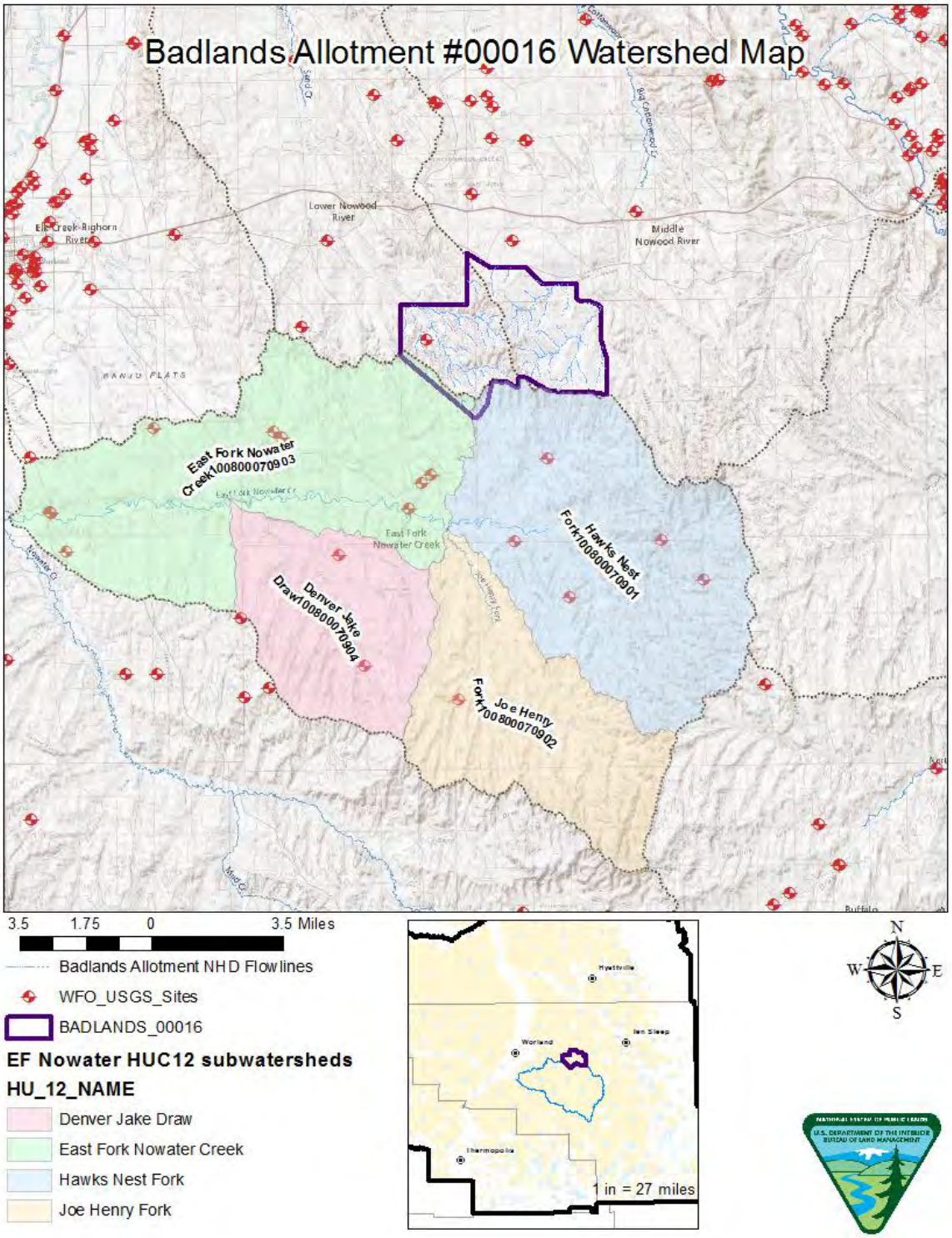


Soils and Ecological Sites

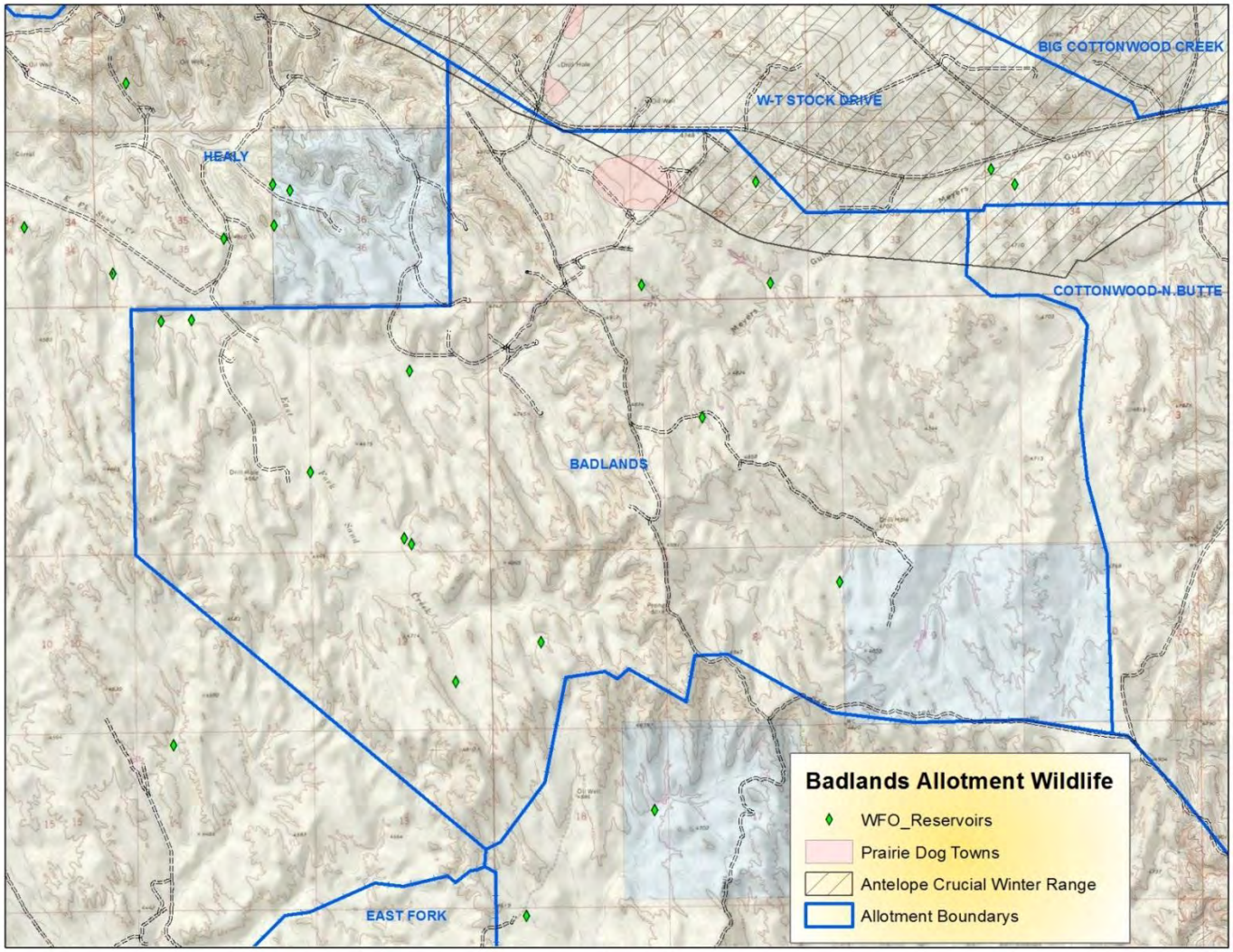


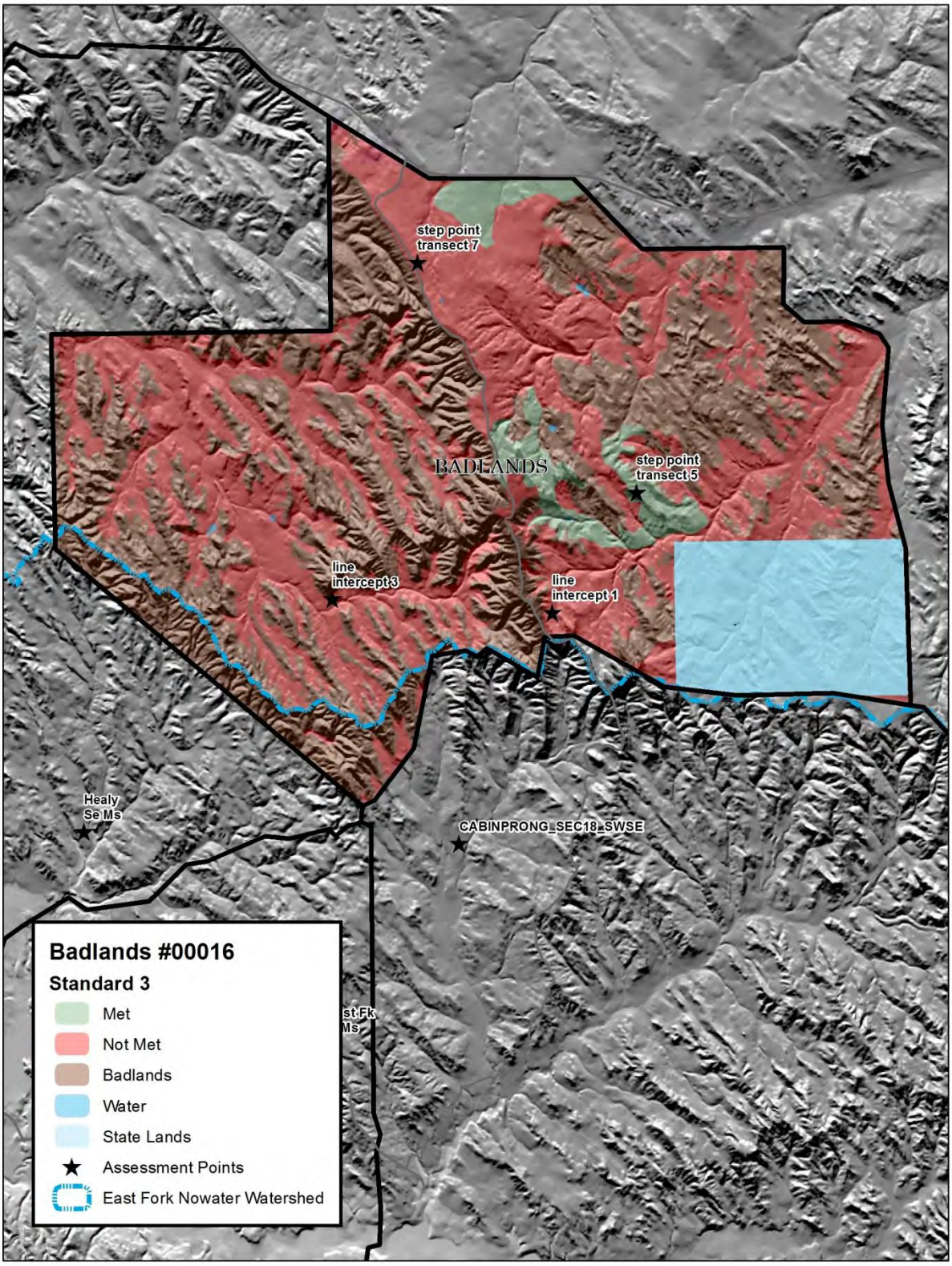
This photograph depicts the variation of drainages, badlands, and bench top plant communities.
Photo taken 7/22/2013 facing west T 46 N R 91 W Sec. 7

Hydrology / Riparian / Watershed (Not to Scale)



Wildlife Habitat Resources

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Healy
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CABINPRONG_SEC18_SWSE
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Badlands
Water
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