An Assessment of Riparian and Fish Habitat Health on Browns Gulch, Upper Clark Fork River Basin

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Introduction:

The Watershed Restoration Coalition (WRC) has been contracted by the Natural Resource Damage Program (NRDP) to assess the riparian and fish habitat of Browns Gulch in the Upper Clark Fork River Basin (UCFRB). This assessment will identify limiting factors affecting the stream corridor and fish habitat health in the private land portions (reaches) of the mainstem of Browns Gulch. This report and associated field work is a direct follow-up to the "Final Upper Clark Fork River Basin Aquatic and Terrestrial Resource Restoration Plan (2012 Restoration Plans)" (NRDP, 2012). The 2012 Restoration Plans classify Browns Gulch as a priority 1 tributary to Silver Bow Creek. The WRC, NRDP, and partners will use this assessment to prioritize reaches for restoration projects. This 2013 assessment work is building on prior WRC work from 2005 to 2013, including contracted work in 2005 by NRCS specialists and in 2011 by Pioneer Technical Services, Inc.

Browns Gulch drains an 85-square mile watershed located within north-central Silver Bow County, with its headwaters originating in the Boulder Mountains (Figure 1). The stream flows roughly 15 miles in a southwest direction to its confluence with Silver Bow Creek near Ramsay, Montana. Browns Gulch is the largest perennial stream flowing directly into Silver Bow Creek. As Silver Bow Creek is remediated and restored, its tributaries become increasingly important to restoration of Silver Bow Creek, both as sources of clean dilution water, as sources for aquatic life to re-colonize Silver Bow Creek, and as future fish spawning tributaries.

Browns Gulch has been used for agriculture and timber production for over 130 years, and was particularly important for dairy production early in the 20th century. The narrow valley concentrated the impacts of this intensive livestock agriculture along the stream channel. Current private land use along the stream includes hay production and beef-cattle grazing.

Proposed restoration actions in the 2012 Restoration Plans related to this watershed will be implemented upon completion of this riparian assessment and evaluation of the priorities. Propose restoration actions include:

1. Fish Passage: Numerous Browns Gulch diversions impair fish passage. Where appropriate, diversions will be designed and reconstructed to reestablish connectivity.
2. Riparian Habitat Protection and Enhancement Implementation: Upon further data collection and other information gathering, specific types and locations of the following actions will be made: installing riparian fencing, developing off-stream water sources, and developing grazing management strategies.
3. Channel Reconstruction/Bank Stabilization: Channel reconstruction will be implemented only after implementation of other Browns Gulch actions, and subsequent evaluation concludes reconstruction activity is warranted. Various sites on Browns Gulch exhibit severe channel instability and habitat degradation issues, resulting in a loss of channel form and function and heavy loads of fine sediment deposited in the stream channel and flushed downstream into Silver Bow Creek.
4. Fish Entrainment: Browns Gulch diversions have a potential for fish entrainment. An entrainment evaluation for the diversions will be performed. Screens for the diversions will be designed and implemented if warranted.

This report directly addresses points 2 and 3 of the NRDP Plan's Browns Gulch "Proposed Actions."

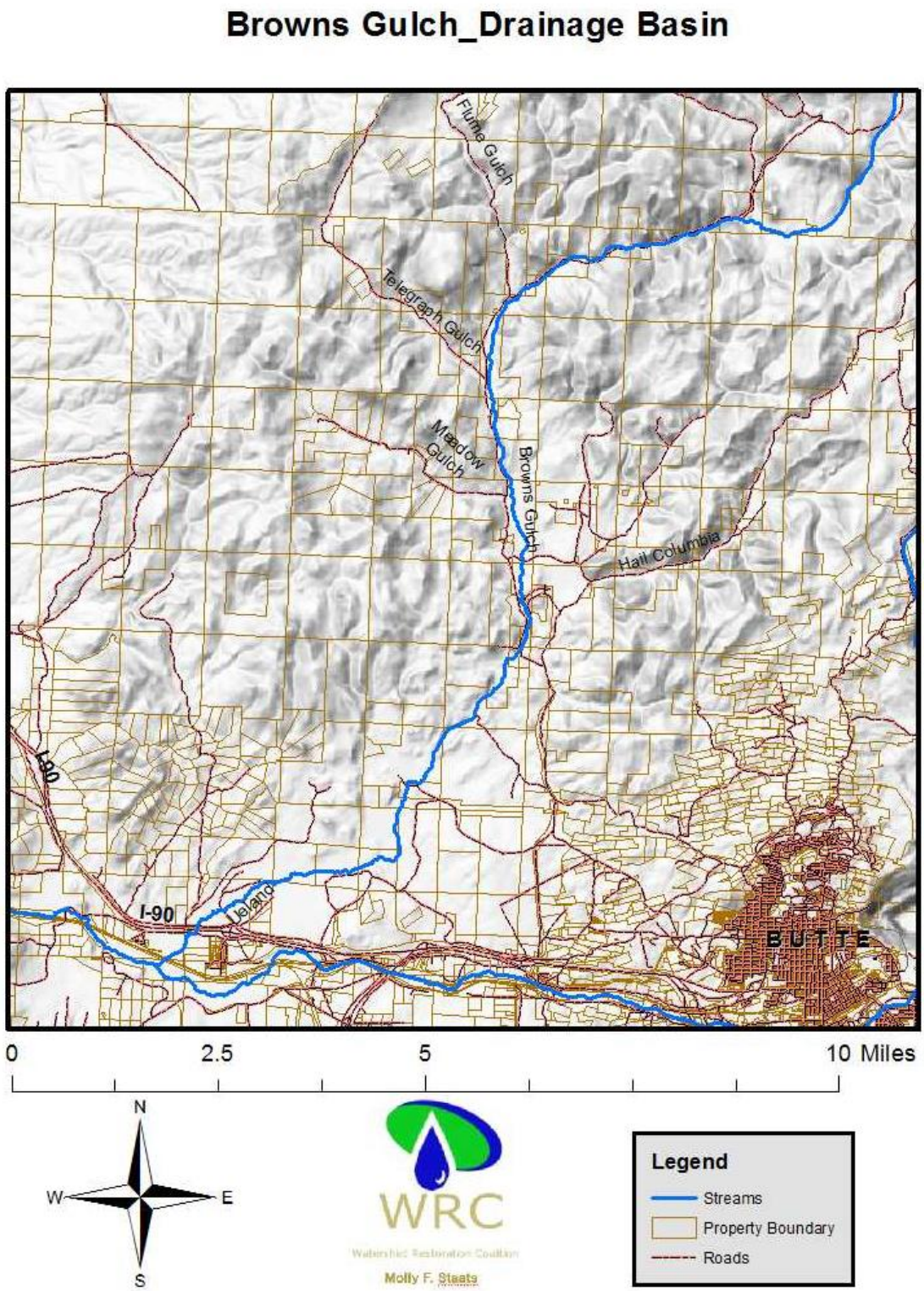


Figure 1: Browns Gulch Drainage Basin

Previous Assessment Work:

This assessment report is built on prior work conducted within the Browns Gulch watershed by WRC, its partners, and others. In 2005, the WRC contracted Kirk Engineering & Natural Resources, Inc. for a broad assessment of Browns Gulch watershed. Kirk Environmental in turn contracted NRCS specialists Tom Pick and Warren Kellogg to conduct NRCS Riparian Assessments on private properties on the mainstream of Browns Gulch from the Forest Service boundary down to its confluence with Silver Bow Creek, a distance of over 13 stream miles (Appendix A: Additional Figures, Figure 9Figure 9: 2005 NRCS Riparian Assessments by Reach). This 2005 field work gave a detailed overview of stream corridor conditions, established reach codes from BG-01 to BG-25 (which are maintained in WRC's subsequent studies including this report), and set the stage for future work.

In July, 2011, the WRC rapidly re-evaluated reaches BG_04 (river mile 12.75) to BG_18 (river mile 4) to determine if their characteristics had notably changed since 2005. Most reaches, with the notable exceptions of BG_16 and BG_17 (which had deteriorated significantly), showed no significant change from the 2005 Pick/Kellogg Riparian Assessment report. Additionally, the WRC added data to the prior assessments efforts by performing rapid bank erosion inventories in 2011 on Reaches BG_04 to BG_18.

Based on the 2005 and 2011 WRC assessments, in 2011 Pioneer Technical Services was contracted by Mile High Conservation District and WRC to conduct more detailed sediment source assessments (Bank Erosion Hazard Inventory: BEHI) and habitat assessment (DEQ Habitat Assessments) on reaches with low NRCS Riparian Assessment scores and high bank erosion rates. The reaches surveyed by Pioneer included BG_07, 08, 11, 12, 15, 17, 23B, 24.

In 2013, the WRC conducted NRCS Riparian Assessments and bank erosion inventory for the NRDP, on reaches which had not been assessed since 2005 (by Pick/Kellogg), or the reaches that were rapidly re-evaluated by WRC in 2011, but were noted to have had a major change in character since the 2005 field work. These reaches include BG_1, BG_16, BG_17, and BG_19 to BG_25. Furthermore, reach BG_00 was added as a new reach, as it is an upstream reach that had been omitted from the prior evaluations studies (River Mile 14.5). Reaches BG_01 and BG_02 were not re-evaluated because the landowner refused access to the property and BG_03 was not re-evaluated because it is USFS land. The reach locations and lengths can be found in Table 1.

Table 1: GPS locations and lengths of reaches.

Reach Code	Property Owner	Reach Length (mi)	Begin Latitude	Begin Longitude	End Latitude	End Longitude
BG_00	Heavens Valley	0.71	46.142617	-112.560472	46.137603	-112.5681
BG_01	Johnson David	0.41	46.13317	-112.584314	46.132088	-112.5925
BG_02	Johnson David	0.30	46.132088	-112.592516	46.130954	-112.5971
BG_03	US Forest Service	0.21	46.130954	-112.597108	46.129787	-112.6006
BG_04	Wood Albert	0.32	46.129787	-112.600587	46.129933	-112.6062
BG_05	Wood Albert	0.40	46.129933	-112.60618	46.126752	-112.6119
BG_06	Balentine	0.27	46.126752	-112.611887	46.124774	-112.616
BG_07	Balentine Casagranda	0.55	46.124774	-112.615967	46.119957	-112.6227
BG_08	Casagranda	1.15	46.119957	-112.622689	46.105545	-112.6245
BG_09	Brothers Jean	0.66	46.098286	-112.622618	46.090934	-112.6187
BG_10	Brothers Duhame	1.42	46.090934	-112.618714	46.074273	-112.615
BG_11	Brothers Duhame	0.36	46.074273	-112.614988	46.069945	-112.6133
BG_12	Simon_Malyevac	0.73	46.069945	-112.61329	46.060891	-112.6145
BG_13	Simon	0.68	46.060891	-112.614458	46.054404	-112.6201
BG_14	Simon	0.10	46.054404	-112.620109	46.05342	-112.6213
BG_15	Liva	0.71	46.05342	-112.621257	46.047471	-112.6296
BG_16	Ueland	0.11	46.042628	-112.635164	46.041117	-112.6347
BG_17	Ueland	0.62	46.041117	-112.634694	46.036808	-112.6416
BG_18	Ueland	0.88	46.036808	-112.641615	46.027965	-112.6455
BG_19	Ueland	0.82	46.027965	-112.645466	46.021734	-112.6532
BG_20	Ueland	0.20	46.021734	-112.653209	46.021421	-112.6562
BG_21	Ueland	0.28	46.021421	-112.6562	46.021061	-112.6595
BG_22	Ueland	0.97	46.021061	-112.659516	46.018465	-112.6741
BG_23A	Ueland	1.09	46.018465	-112.67413	46.0136	-112.6866
BG_23B	Ueland	0.63	46.0136	-112.68658	46.010594	-112.6925
BG_24	Ueland	0.92	46.010594	-112.692461	46.004468	-112.7002
BG_25	Earhart Jerry	0.15	46.004468	-112.700208	46.003328	-112.7026

Methods:

The information gathered for this riparian and fish habitat assessment is for evaluation and prioritization of potential restoration actions described in the 2012 Restoration Plans. Additional information will be needed for design and implementation of restoration actions.

Molly Staats, Watershed Scientist, was the lead contractor for this 2013 assessment work. Will McDowell, WRC Project Coordinator, provided technical assistance and project management.

NRCS Riparian and Fish Habitat Assessments:

The primary assessment tool used in this project was the USDA Natural Resources Conservation Service (NRCS) Montana Riparian Assessment Methodology (ftp://ftp-fc.sc.egov.usda.gov/MT/www/technical/environment/envtechnoteMT2.pdf) (NRCS, 2004). This is the same methodology used in 2005 by Pick and Kellogg. This assessment method was selected because it is intended for "rapidly assessing the sustainability and function of …a riparian corridor…" to provide "..an indexed rating **useful for establishing priorities** in treating riparian/stream corridor problems…" and establishing "where the greatest return for the investment exists" within a given watershed (NRCS, 2004).

The NRCS methodology was slightly modified to include a scored component that evaluated the relative condition of fish habitat in each survey reach, using an average of scores for supplementary questions S1 and S2. This score is based on visual evaluation of available substrate, cover/shading, large wood debris (LWD), and pool quality, generally following the modification made by Montana Fish Wildlife and Parks fish biologists in prior work with NRDP (Liermann, Lindstrom, & Kreiner, 2009). These scores can be represented qualitatively as follows: Scores 0-30%: Poor fish habitat; Scores 40-70%; Fair fish habitat, and Scores 80-100%: Good fish habitat quality.

A majority of the field assessment protocol entails visual examination of stream and riparian condition. Quantitative measurements collected for each reach included reach length, and bankfull width and bankfull depth at a representative cross-section. Other portions of the assessment, including Rosgen channel type classification, were based on visual observations and parameter estimates. This methodology provides a quick, semi-quantitative evaluation of riparian condition. It focuses on the stability and sustainability of current physical and ecological processes observed in a stream reach as an indication of stream corridor health. It is not designed to give a highly quantitative or comprehensive analysis of these processes. The end result is a stream health rating score from 0-100%. The stream health score fits into three categories (NRCS, 2004):

- **Sustainable** – The score is 80 to 100% of capability. All key geomorphic and ecological processes are functioning, and the reach is stable. The word "capability" means the highest "ecologically stable state" possible for a reach within the local constraints (e.g. roads, dams, watershed land use). All necessary attributes and processes (floodplain access, water storage, sediment transport, vegetative diversity and re-growth, energy dissipation, etc.) are in place and functioning properly to assure long-term stability, i.e. ability to rapidly recovery following a disturbance such as a 20-yr return interval flood.
- **Sustainable, At Risk** – The score is 50 to 80% of capability. Most of the processes and attributes are in place and working at present, however, one or more components that are

critical to the continued stability of the area may be lacking or diminished compared to the capability. "Sustainable, At Risk" reaches may be given priority for additional planning and potential treatment, especially when downward or degrading trends are noted.

- **Not Sustainable** – The score is less than 50% of capability. The stream and riparian area clearly lack adequate vegetation and/or functional characteristics to dissipate energy, trap sediment, build banks, or any of the other processes that are expected given the capability of the reach. "Not Sustainable" reaches should rank as a high priority for planning and application of conservation practices. Additionally, "Not Sustainable" reaches that are not so degraded that some treatment may still be beneficial should be prioritized for treatment to prevent further degradation.

These categories aid in the prioritization of reaches which deserve more quantitative assessment and potential restoration projects.

WRC Bank Erosion Inventory:

The Rapid Bank Erosion Inventory was completed using a method developed by the WRC in 2011 and 2013. The inventory is intended to quantify actively eroding banks in each reach, so that the relative importance of each reach to watershed sediment supply can be evaluated. The primary bank erosion processes noted by this type of assessment are annually recurring fluvial entrainment, surface erosion and dry ravel, although recent mass failures and other types of recent bank failures are counted if bank soils are still bare. Hence, some areas of long-term instability which have begun re-vegetating, and older erosion scars, generally are not included. The method simply compares amounts of active annual erosion by reaches, it does not quantify annual sediment supply as does the Bank Erosion Hazard Index (Rosgen & Silvey, 1996).

The methodology involves measuring the height and length of all eroding banks along a given reach using a measuring tape/stick (to the nearest foot). Eroding banks where characterized by channel walls that directly delivered sediment to the stream through light prodding of the bank with a wading staff. Erosion measurements were delineated by right and left bank. Each segment of bank erosion was given a visually determined cause of erosion (Appendix C: Field Forms). Field assessment form can also be found in Appendix C: Field Forms. The quantitative measurements result in total bank area (ft^2) erosion for the left, right and entirety of a given reach. Additionally, the percentage of linear erosion occurring along the reach can be calculated:

$$\%\,Linear\ Erosion = \left(\frac{(Length\ of\ LEW\ Erosion) + (Length\ of\ REW\ Erosion}{2\ \times Length\ of\ Reach}\right) \times 100$$

$*\ All\ measurments\ done\ in\ feet$
$*\ LEW: Left\ Edge\ of\ Water, *\ REW: Right\ Edge\ of\ Water$

Photographic Documentation:

The WRC collected digital photographs during the 2013 assessment with a Canon PowerShot A11001S Digital Camera. Photographs were taken consistently at the top (upstream end) of each reach, depicting the general character of the riparian area and stream channel. Additionally, photographs were used to provide visual evidence of current issues within reaches, such as high

erosional areas, location of incisement/knick points, man-made structures, etc. GPS locations were taken at all photographed points, along with a description, and indication if the view is upstream or downstream. All pictures can be found in Appendix E, which is a separate document from this report (due to file size).

Reach Narrative:
In order to facilitate interpretation of the various data sources, data from each reach is summarized into a reach narrative (results). The NRCS Riparian Assessments, Bank Erosion Inventory, photographic documentation, and Narrative Field Sheet (Appendix C: Field Forms) were used to compile these reach narratives. Theses narratives contain a description of geomorphic, riparian vegetation, stream bank erosion, and fish habitat characteristics derived from the data sheets. Along with the summary of characteristics of each reach, the main problems, possible causes, and associated potential types of restoration projects are enumerated.

Additional narratives and pictures can be found in the Pick/Kellogg 2005 report and the Pioneer 2011 Report listed in the References.

Results:

General Results:
A key result of this assessment is a comparison of the sustainability of each reach, as defined by its NRCS Riparian Assessment score. These results are compiled in the second to last column of Table 2 below, as "2005/2013 NRCS Score." Color codes for NRCS scores are used to facilitate easy interpretation. They are green sustainable" 80 – 100%, yellow= "sustainable, at risk" 50 – 80%, and pink= "not sustainable" < 50%. Complementary data from the prior studies is summarized by these same reach codes in order to enhance and corroborate the NRCS score. Table 2 includes data compiled from 2005, 2011, 2013 field work. This data is also represented visually in Figure 2, Figure 5, **Error! Reference source not found.**, and Figure 6, Figure *6*, Figure 7, and Figure 8.

Table 2: Summary of NRCS Riparian Assessment and Habitat Scores and Bank Erosion Data

Reach Code	Property Owner	Primary Land Use	Rosgen Type	Reach Length (mi)	2011/13 Eroding Banks (%)	2011 BEHI (tons/ mi/yr)	2011 DEQ Habitat Score (%)	2005/13 NRCS Score (%)	2013 Fish Habitat Score (%)
BG_00	Heavens Valley	Forest, grazing	B/E	0.71	6	-	-	62	70
BG_01	Johnson David	Forest	B	0.41	-	-	-	87**	-
BG_02	Johnson David	Irrigated hay/ pasture	E	0.30	-	-	-	58**	-
BG_03	US Forest Service	Forest	D	0.21	-	-	-	97**	-
BG_04	Wood Albert	Irrigated hay/ pasture	B	0.32	5*	-	-	75**	-
BG_05	Wood Albert	Irrigated hay/ pasture	B	0.40	4*	-	-	52**	-
BG_06	Balentine	Range	B	0.27	4*	-	-	60**	-
BG_07	Balentine	Irrigated hay/ pasture	B	0.55	5*	6.7	74	57**	-
						26	63		
BG_08	Casagranda	Irrigated hay/ pasture	B	1.15	6*	35	71	63**	-
						112	48		
BG_09	Brothers Jean	Irrigated hay/ pasture	G ***	0.66	4*	-	-	58**	-
BG_10	Brothers Duhame	Irrigated hay/ pasture	B	1.42	**12***	-	-	58**	-
BG_11	Brothers Duhame	Irrigated hay/ pasture	G	0.36	**10***	68	56.3	38**	-
BG_12	Simon, Malyevac	Irrigated hay/ pasture	G	0.73	1*	12	68.1	63**	-
BG_13	Simon	Irrigated hay/ pasture	G	0.68	7*	-	-	50**	-
BG_14	Simon	Irrigated hay/ pasture	G	0.10	**11***	-	-	82**	-
BG_15	Liva	Irrigated hay/ pasture	G	0.71	**10***	12	49.4	78**	-

Reach Code	Property Owner	Primary Land Use	Rosgen Type	Reach Length (mi)	2011/13 Eroding Banks (%)	2011 BEHI (tons/ mi/yr)	2011 DEQ Habitat Score (%)	2005/13 NRCS Score (%)	2013 Fish Habitat Score (%)
BG_16	Ueland	grazing	G	0.11	**25***	-	-	37	70
BG_17	Ueland	Irrigated hay/ pasture	G	0.62	**30***	**284**	35.6	30	50
BG_18	Ueland	Irrigated hay/ pasture	G	0.88	7*	-	-	48**	
BG_19	Ueland	Irrigated hay/ pasture	E	0.82	6	-	-	58	70
BG_20	Ueland	Irrigated pasture	G/E	0.20	7	-	-	50	65
BG_21	Ueland	Irrigated pasture	E	0.28	**14**	-	-	53	85
BG_22	Ueland	Irrigated pasture	E	0.97	7	-	-	45	85
BG_23 A	Ueland	grazing	E/G	1.09	5	-	-	57	30
BG_23 B	Ueland	grazing	E	0.63	**13**	59.9	41.3	55	30
BG_24	Ueland	grazing	G/E	0.92	**10**	**338.9**	26.3	23	30
BG_25	Earhart Jerry	grassland reclamation	E	0.15	0	-	-	65	65

Note: Colored cells of the NRCS Assessment Scores relate to the following; Green: Sustainable, Yellow: Sustainable, At Risk, Red: Not Sustainable

Note: Colors cells of the DEQ Habitat Assessment Scores relate to the following; Yellow: Sub-optimal, Red: Marginal

* Bank Erosion Inventory completed by WRC in 2011

** NRCS Assessment completed by Tom Pick and Warren Kellogg in 2005

***Rosgen channel type F was identified in 2005 for several reaches. These proposed F channels appear to be Rosgen channel type G.

[a] BEHI: Bank Erosion Hazard Inventory completed by Karin Boyd (Pioneer sub-contractor) in 2011.

Figure 2: Accumulated 2005 and 2013 NRCS Riparian Assessment scores for all of Browns Gulch.

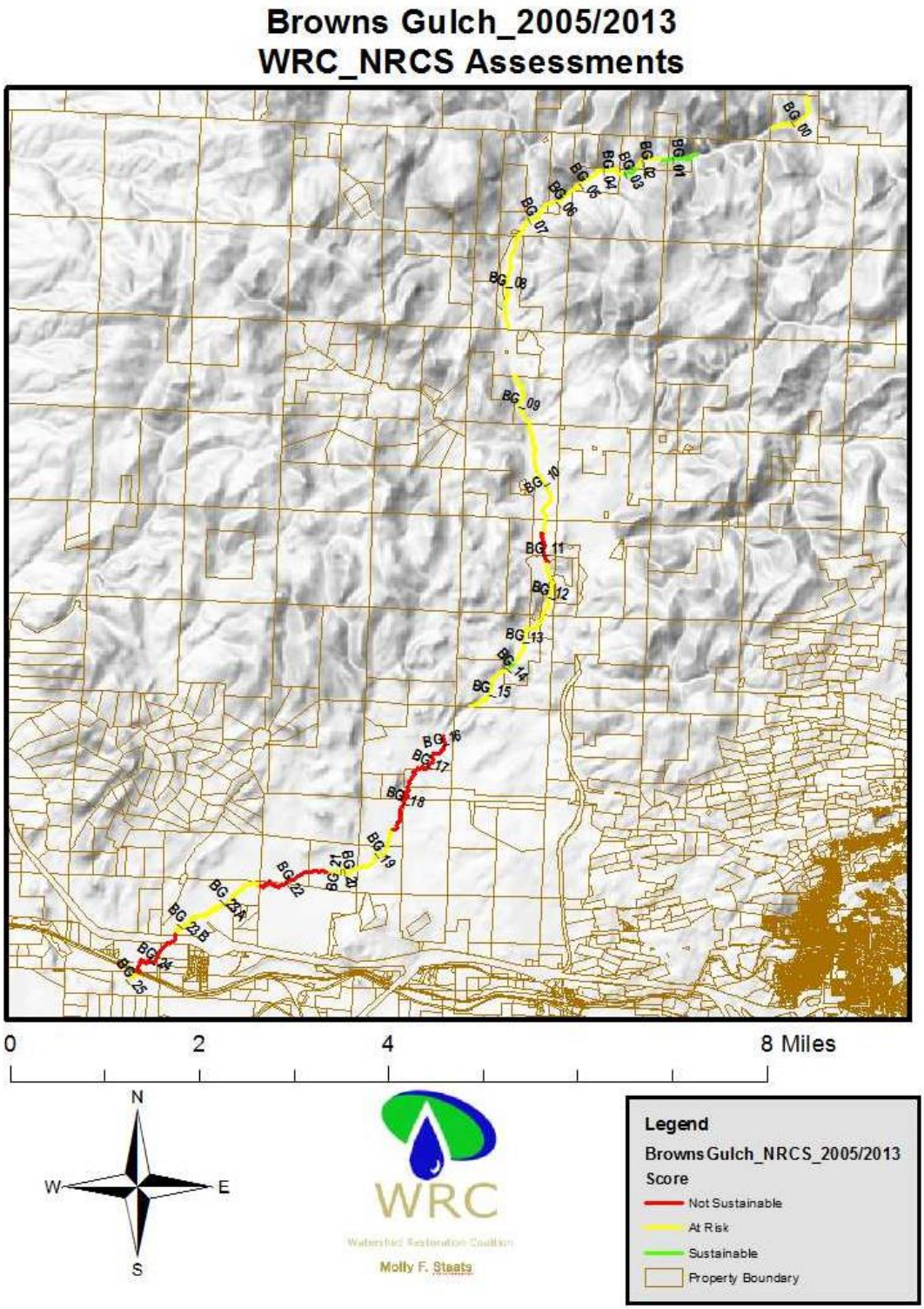


Figure 3: Accumulated 2005 and 2013 NRCS Riparian Assessments scores for Upper Browns Gulch.

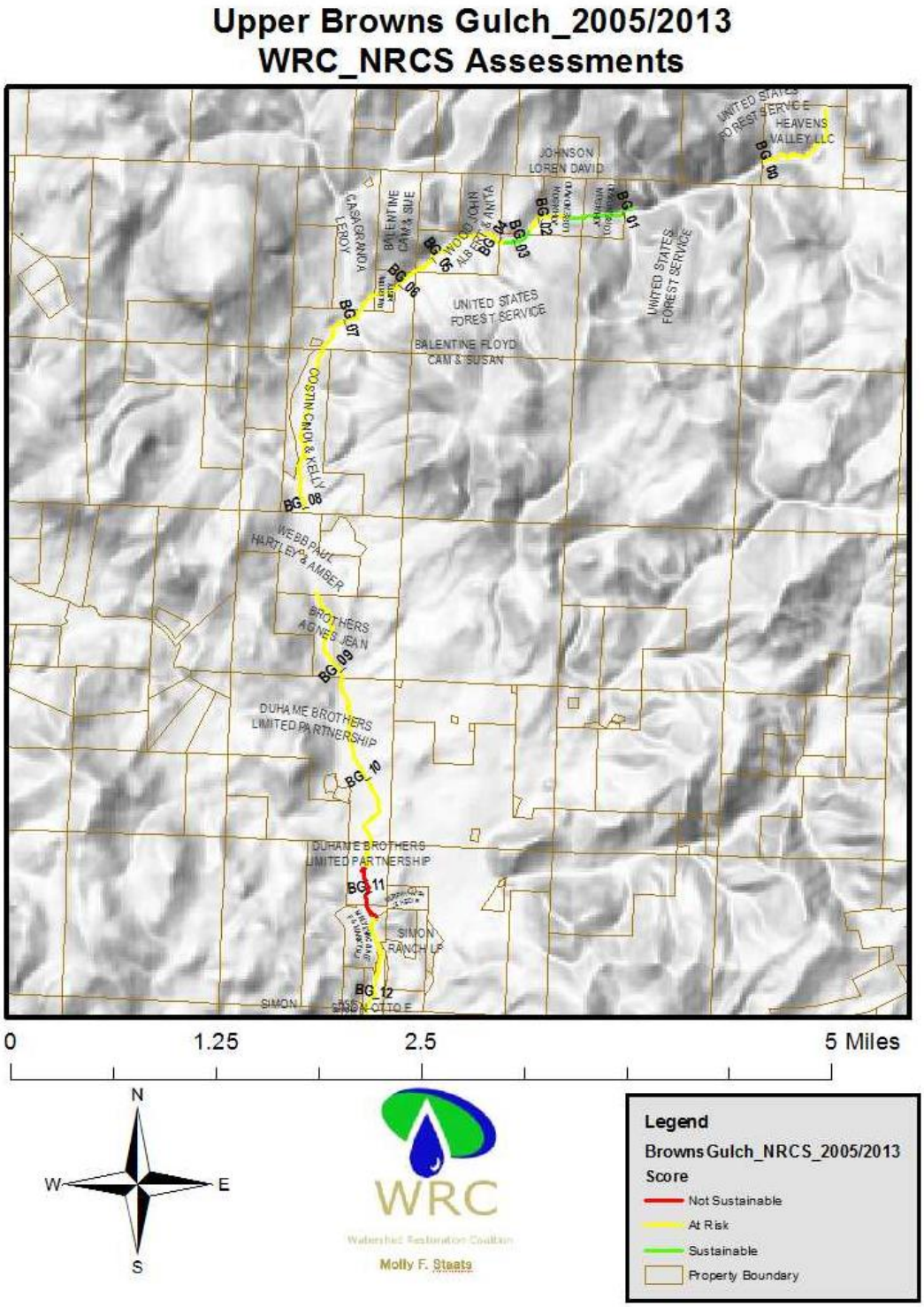


Figure 4: Accumulated 2005 and 2013 NRCS Riparian Assessment scores for Lower Browns Gulch.

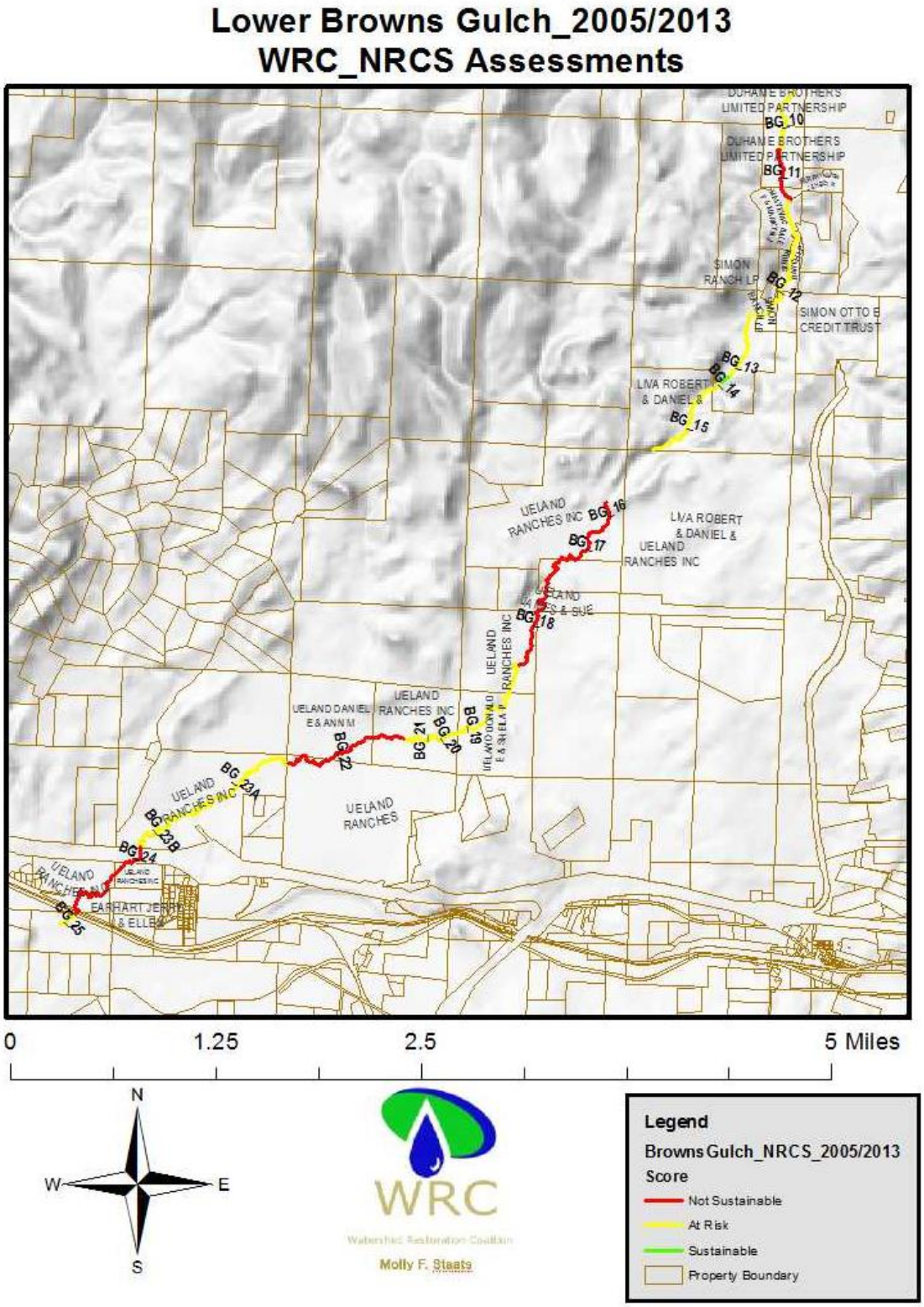


Figure 5: 2005 NRCS Riparian Assessment scores on Lower Browns Gulch

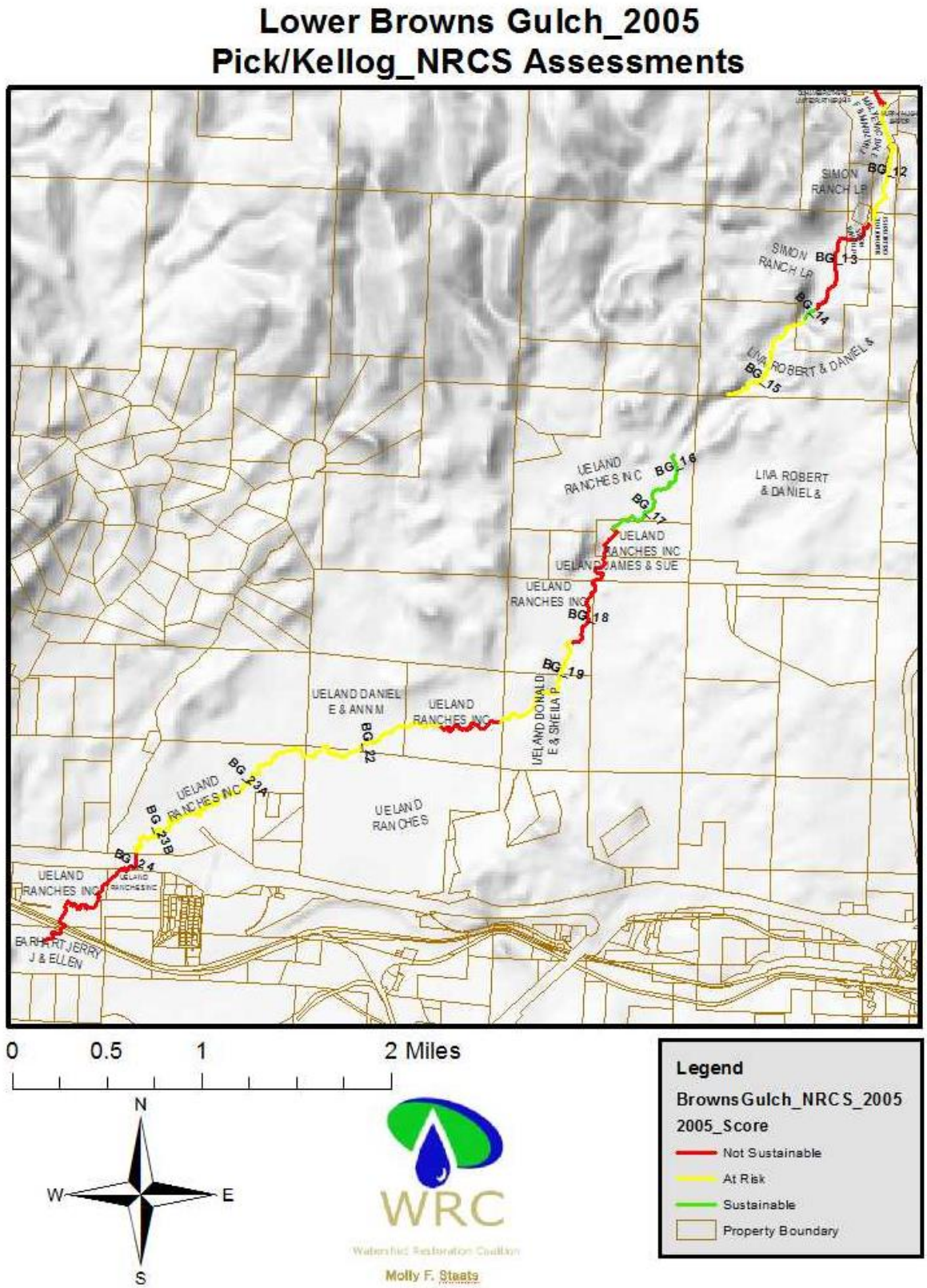


Figure 6: 2011/2013 WRC Rapid Bank Erosion Inventory by reach for all of Browns Gulch.

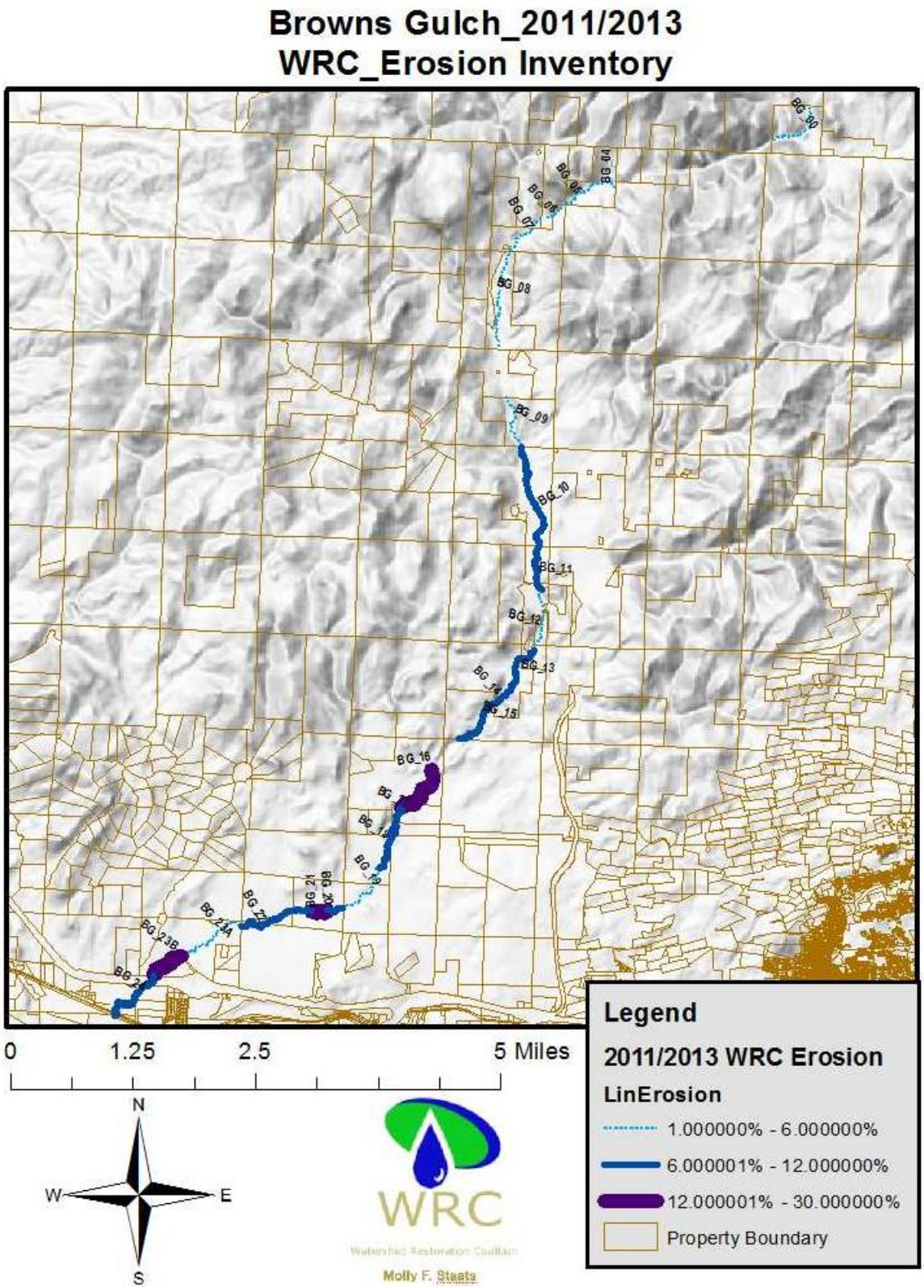


Figure 7: 2011/2013 WRC Rapid Bank Erosion Inventory by reach for Upper Browns Gulch.

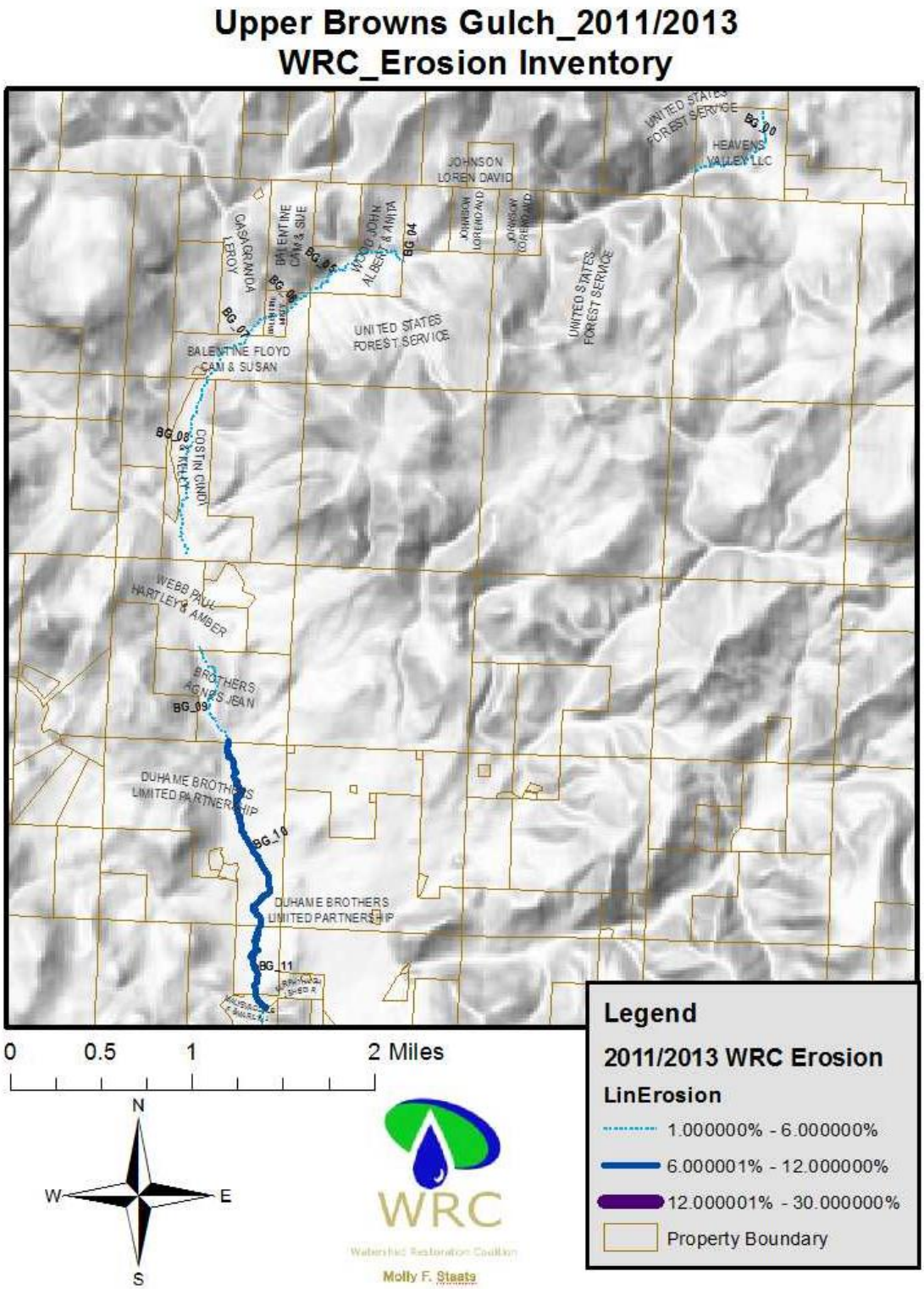
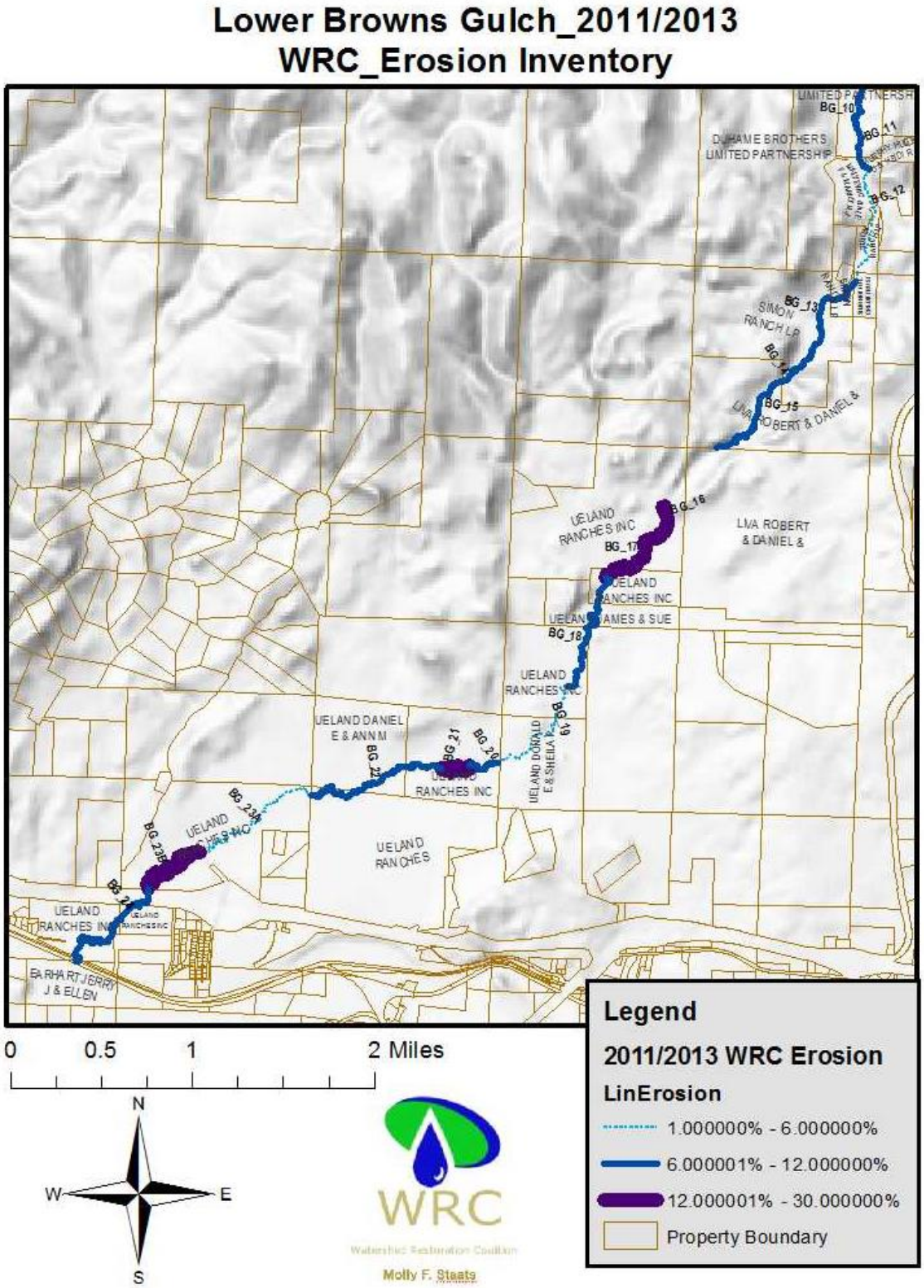


Figure 8: 2011/2013 WRC Rapid Bank Erosion Inventory by reach for Lower Browns Gulch.



Reach Narrative Results:

Note: All pictures referred to in the reach narratives can be found in Appendix E: Photographs, which is a separate document from this report (due to file size).

BG_00: NRCS Score = 65%, "Sustainable At Risk," Fish Habitat = Fair

This sub-reach BG_00 was visually classified as a Rosgen B channel type that has evolved into a beaver induced E channel type located within a type VIII Rosgen valley type. This classification is based on a bankfull width- to-depth ratio estimate of 3, a sinuosity >1.2, a cobble/gravel dominated channel bed, and an estimated channel gradient of <2%. Geomorphically this channel is moderately stable, having little to no active/current downcutting, and a moderate amount of human-induced erosion of inner and outer banks (Photo BG_00_01), including historical erosion of terrace toes. Bank erosion is primarily due to reduced riparian vegetation and livestock physical impact. Additionally, there are some sites of widening and shallowing, resulting in enlarged point bars.

During the time of this assessment there were several large sediment deposits on the floodplain indicating that the stream has access to its floodplain. Also, at this time stream flow appeared low to normal with an estimated discharge of 3 cfs. Density of woody riparian vegetation within this sub-reach is low to moderate (BG_00_02) and dominated by willow, conifers, and upland shrubs (Nez Perce Code: SR2/ CD1). There is moderate browse by cattle, with minimal regeneration (from old rootstock), and a moderate distribution of age classes of woody species (mostly mature, some seedlings/saplings).

The primary problems noted within this sub-reach consist of bank and bed form alterations caused by livestock, such as trampling of bed and banks, and lack of binding root-mass type vegetation, resulting in areas of channel over-widening. Lateral bank erosion also results in sedimentation of channel bed pool features. There appears to be some water quality degradation issues due to nutrients as indicated by the extensive overgrowth of aquatic vascular plants (Photo BG_00_03).

Fish habitat assessment noted moderate number of deep pool habitat elements, high substrate quality, moderate amounts of cover/shading due to riparian vegetation and overhanging banks, and sufficient flow.

The issues described above result in a 65% NRCS score and a fair to good fish habitat score. This reach is located on private property sandwiched between grazing allotments on public USFS land near the upper end of the watershed. It appears that the reach sees high cattle pressure at certain times during the year but for short duration.

Potential restoration projects could center on improved grazing management.

Narratives from 2005 (BG_01 to B_15):
The following reach descriptions BG_01-BG_15 are summarized from WRC's 2005 report (by Pick and Kellogg) for reaches which did not appear to have changed significantly by 2011, and hence were not reassessed in 2013:

Reach BG_01: NRCS Score (2005): 82% "Sustainable," Fish Habitat Score: N/A
This reach is characterized by good riparian vegetative community diversity and vigor that serves to demonstrate the potential of the riparian community and channel attributes. The valley is relatively narrow here due to the more resistant Tertiary-age volcanic rock. Beaver dams are common, although the road encroaches on the floodplain in a few places. Common plants are Geyer willow and several sedge species. Upland vegetation is primarily Douglas fir forest, where some pine bark beetle damage is evident. Invasive species are musk thistle and spotted knapweed that is found mainly along the road. Browse use by wildlife and livestock is light. The land use is primarily grazed forest land and range land.

Potential restoration projects in BG_01 include weed control and road drainage improvements.

BG_02: NRCS Score (2005): 58% "Sustainable at Risk," Fish Habitat Score: N/A
This reach is in poorer condition than BG_01, as the channel passes through a small irrigated pasture with non-native plants, sporadic woody vegetation, and heavy browse. But this reach still still has some positive attributes in terms of channel morphology and stability.

BG_03: USFS
NRCS Score (2005): 97% "Sustainable," Fish Habitat Score: N/A
This USFS parcel is in very good condition, with extensive beaver activity. A complex of active beaver ponds and willows fills much of the narrow valley bottom. The channel type resembles a Rosgen D because of the extensive beaver activity. This site was suggested in 2005 to be a "reference" site for upper Browns Gulch.

BG_04 through BG_07: Various private owners
NRCS Scores (2005): 52% to 75% "Sustainable at Risk," Fish Habitat Score: N/A
Pick and Kellogg treated these reaches as sharing many common attributes. Range and irrigated pasture are the primary land uses in a narrow valley that gradually widens to with several older irrigation diversions and small flood-irrigated hayfields. Rosgen B channel type in narrow forested valley with a gradual opening into small hayfields and pastures.

Woody riparian vegetation has been mostly cleared except for some areas with a very narrow band of willows and alder along the stream banks. Woody vegetation often exhibits moderate to heavy browse pressure from cattle which winter here, and sheep which graze year-round. The stream channel becomes more incised as it progresses downstream. Stream bank erosion is mostly moderate (one bank protection project completed in 2013 at corrals). Several sub-reaches from BG_06 to BG_09 have been historically straightened, and these straightened reaches show increasing frequency of eroding banks. Several road crossings, rustic irrigation diversions and road encroachment disturb the stream corridor, cause erosion, or deliver sediment. Invasive weeds increase relative to upstream sites and include Canada thistle, henbane, musk thistle and leafy spurge, as well as spotted knapweed.

Potential projects include improvement of irrigation and crossing structures, weed control,

riparian grazing management, localized bank stabilization or re-naturalizing/revegetating straightened channel segments. Agricultural use of this corridor is intensive, with hay production nearly up to the stream banks, followed by fall and winter grazing, making restoration a challenge.

BG_08:
NRCS Score (2005): 63% "Sustainable at Risk." Fish Habitat Score: N/A.
This 1.15 mile reach is a large hay meadow in a wider valley type. The channel is a Rosgen B type with a narrow floodplain, which becomes an incised G channel below Telegraph Creek confluence (likely was an E channel here), where some historic channel straightening apparently occurred . There is a double-culvert crossing below the driveway, partly occluded, which is causing significant downstream bank erosion. Woody vegetation is present in a narrow corridor upstream of the driveway but diminishes considerably below Telegraph Creek. Alder and willow are dominant shrubs with sedges and baltic rush in the understory. Vegetation shows moderate to heavy browse although the riparian corridor is in better condition than BG_06 and BG_07 reaches. The noxious weeds include Canada thistle. Cattle graze this meadow in fall and winter. An irrigation diversion is located on the lower end of reach in 2005. This diversion consists of a 2' canvas check dam. Approximately 80' down-ditch, the ditch lateral was breached into the stream. A headcut has started where water was re-entering the stream.

Potential projects could include grazing management, renaturalization of channel below Telegraph Creek. Landowner initially resistant to any fencing along riparian corridor.

Below Casagranda/Costin (Reach BG_08) there is an unassessed reach belonging to Webb, where permission for access has never been given. There is a stark contrast in form as the channel resumes an E channel sinuosity and vigorous mature willow growth at the fenceline—the north end of this unassessed reach appears to be in better condition than BG_08, but near the house and below the driveway the channel is straightened, willows totally removed, and in poor condition.

BG_09: NRCS Score (2005): 58% "Sustainable at Risk," Fish Habitat Score: N/A
There is a large irrigation diversion and headgate upstream of the Brothers Ranch (lower end of Webb's property). This is a concrete structure with boards checks water 2-3' into RB ditch. Pipe flume (12" CMP) crosses the creek just downstream of the Brothers Ranch north boundary.

The stream appears to have been channelized sometime in the past. B5/E5 channel type.

Off-channel pond constructed on Left Bank terrace; diversion immediately upstream. Small rip-rap/junk above and below private road crossing downstream.

BG_10 and BG_11: NRCS Scores (2005): 38% to 58% "Not Sustainable" to "Sustainable at Risk" Fish Habitat Score: N/A
These reaches were mostly channelized in the past, forming straight channels with low sinuosity. This created conditions promoting higher slopes, higher velocities, bank instability and a deeply incised channel. Evidence is present of past efforts to armor banks with rock, grade controls to prevent headcuts, and to maintain the channel location. Return flows and saturation of banks from adjacent flood irrigation also causes bank failure and increased frequency of eroding banks. Woody shrubs are represented by occasional mature willows along the channel, but the growth is far from continuous. Woody plant diversity and regeneration are both low. Channel physical conditions may have worsened between 2005 and 2011 in Reach BG_10, but the property owner did not allow a second visit to the property for closer inspection after the first reconnaissance in 2011. Reach BG_10 had a "Sustainable at Risk" and Reach BG_11 a "Not Sustainable" rating in 2005.

Potential restoration projects could include improvement of irrigation and crossing structures, riparian grazing management, localized bank stabilization or re-naturalizing/re-vegetating straightened channel segments. Agricultural use of this corridor is intensive, with hay production nearly up to the stream banks, followed by fall and winter grazing, making restoration a challenge.

BG_12 and BG_13: NRCS Score (2005): 50% to 63% "Sustainable at Risk (low)," Fish Habitat Score: N/A
Both of these reaches are similar to Reach BG_11. Historic channelization is evident in the short reach just upstream of Hail Columbia Gulch, and below the Murphy driveway bridge. Bank erosion is not as prevalent as in BG_11, however significant channel incisement, lack of woody vegetation, and prevalent bank saturation creates conditions that contribute to the low end of "Sustainable at Risk" ratings.

Potential restoration projects could include upgrading irrigation structures for passage, riparian grazing management, removal of an undersized culvert on Malyevac, localized stabilization of eroding banks (if protected from grazing).

BG_14: NRCS Score (2005); "Sustainable," 82%. Fish Habitat Score: N/A
The channel appears to have been moved to one side of the valley, especially on the north end near Browns Gulch Road. However, due to the bedrock in the channel bottom, the degree of channel incisement and resulting bank erosion is less than the preceding reaches. Eroding banks are primarily on outside bends. Riparian vegetation is more diverse and robust with several species present, including geyer, booth, Sandbar and peachleaf willow. Noxious weeds include spotted knapweed in the uplands and Canada thistle within the riparian corridor. Garrison creeping foxtail is the dominant hay grass in the irrigated meadows, creating a near mono-culture. Overall this reach's score placed it in the lower end of the "Sustainable" category.

Potential restoration projects could include riparian grazing management.

BG_15: NRCS Score (2005): "Sustainable at Risk," 78%. Fish Habitat Score: N/A
This reach is similar to the BG_14 reach, except that the riparian woody vegetation is less vigorous and diverse and the weed species are more prevalent here. Russian knapweed is prevalent in the uplands adjacent to the channel. Irrigation diversion with 2 turnouts diverting water to both sides (Liva and Ueland). Checks water ~ 2'. Concrete structure (built in 1960s) has settled and is in relatively bad condition. There is rock rip-rap (RB) for about 40'.There are

some added concerns associated with the animal waste from corrals and livestock crossings/watering sites contributing to potential water quality concerns. The overall rating is at the high end of "Sustainable at Risk."

Potential restoration projects could include development of off-stream livestock water supplies and grazing management along the riparian corridor to eliminate heavy use of the stream by concentrated livestock, and channel renaturalization in the lowest end of the property (see below).

**Below BG_15 there is an unassessed reach on the lower end of Liva property. This short reach approximately 0.35 miles in length has had essentially all riparian woody vegetation removed and the channel straightened against the west valley wall. Channel is incised and would likely rank "not sustainable."*

BG_16: Prevost Rd. meadow

NRCS Score (2013): "Not sustainable," 37%. Fish Habitat Score: Fair (70).

The sub-reach BG_16 is about 0.11 miles in length and was visually classified as a Rosgen G channel type located within a type VIII Rosgen valley type. This classification is based on a bankfull width- to-depth ratio estimate of 2.2, a sinuosity of <1.5, a gravel, cobble, sand/silt dominated channel bed, and an estimated channel gradient of <2%. Geomorphically this channel is highly unstable, with active incisement (little to no stream access to the floodplain), extensive lateral erosion along a large proportion of banks. Bank slumping appears to be due to fluvial erosion undercutting saturated banks (photo BG_16_01), It appears that this reach was historically relocated and straightened on the perimeter of the valley for hay and pasture production purposes, hence the stream's morphology is highly altered.

During the time of this assessment (late June, 2013) stream flow appeared adequate, with an estimated discharge of 5-10 cfs. Density of woody riparian vegetation within this sub-reach is low and dominated by nonnative grasses (BG_16_02) with few willow, alder, and rose present (Nez Perce Code: SR2). Noxious weeds (thistle, leafy spurge, and whitetop) are beginning to establish in recently exposed erosional areas. There is moderate livestock browsing/rubbing on mature willows. There is very little woody plant regeneration at this time. Evidence includes umbrella shaped willows and alders and the absence of seedling, sapling, and young age classes.

The primary problems noted within this sub-reach consist of incision, lateral erosion (25 percent of banks were eroding), and poor regeneration of younger willows. Additionally, there is evidence of excessive sedimentation resulting from local erosion within the reach.

These issues result in fair fish habitat, as evident in the number of deep run and pool habitat elements, with medium substrate quality, and a small amount of cover/shading from lack of riparian vegetation and overhanging banks. Additionally, there is a poor percentage of large woody debris and potentially deficient flow in later summer months.

Potential restoration projects include bank stabilization/channel re-naturalization, improved grazing management, and weed management. The WRC has some funding for a pilot channel re-naturalization project in this reach.

BG_17: Prevost Rd.

NRCS Score (2013) = 30%, Unsustainable, Fish Habitat = Fair (50)

The sub-reach BG_17 is about 0.62 miles in length, and was visually classified as a Rosgen G channel type located within a type VIII Rosgen valley type. This classification is based on a bankfull width- to-depth ratio estimate of 6, a sinuosity of <1.5, a sand/silt dominated channel bed, and an estimated channel gradient of <2%.Geomorphically the top 2/3 of channel is unstable, with large portions of the reach having active down-cutting (Photo BG_17_01) resulting in deep incision and a lack of stream access to its floodplain (no physical evidence that stream water had access to the floodplain over the last few years). Additionally, there is extensive human-induced erosion along a large proportion of the banks (30%) related to irrigation over-saturation, fluvial undercutting and lack of root-binding riparian vegetation (Photo BG_17_02). This erosion is resulting in areas of major in-stream sedimentation/deposition including mid-stream bars (Photo BG_17_02). Sedimentation is mainly coming from local, in-reach sources, and from the upstream reach, BG-16. The lower 1/3 of the channel reach is in a state of recovery, with visible rebuilding of a new floodplain (Photo BG_17_03 and BG_17_04). This reach is not sustainable.

Reach BG_17 was historically relocated to the valley perimeter and straightened to facilitate agricultural use of the meadow, resulting in the continuing channel adjustment processes which are currently driving major down-cutting and channel bank collapse in the upper sub-reaches. The Prevost Rd. culvert is controlling downstream grade and causing major sediment deposition and re-meandering of the stream plan form. The density of woody riparian vegetation within this sub-reach is low and is dominated by grasses (Garrison foxtail), with few willows and sedges (Nez Perce Code: SR2). There is moderate browse occurring via cattle, with no to minimal woody plant regeneration, and a poor distribution of age classes, mainly mature and decadent willows.

The issues discussed result in fair fish habitat score, as evident in sedimented pools, with low substrate quality, minimal amounts of cover/shading from riparian vegetation and overhanging banks, and a low percentage of large woody debris.

Potential restoration projects include re-naturalization of the stream channel to re-establish connectivity with the floodplain, increased sinuosity, reduced shear stress on banks, and re-vegetation of banks. Improved grazing regime, with installation of riparian fencing for the top 2/3 of the reach would be necessary in a re-naturalization project. The property owner has already done experimental bank and rock grade controls reduce downcutting (Photo BG_17_03) which has slowed erosion and acts as temporary sediment traps.

BG_18: below Prevost Road
NRCS Score (2013) =48%, Not Sustainable (2005—may be improving). Fish Habitat= N/A
Sub-reach BG_18 is 0.88 miles in length, and is classified as a Rosgen G channel in its upper end and E channel in its lower end. The upper end of the reach is located in a narrow canyon with a large irrigation diversion (High Ditch) on the right bank at the top of the reach near Prevost Rd. The middle of the reach is marked by the Reservoir Ditch headgate, a large wooden diversion/bridge structure which controls channel grade upstream for several hundred feet. This section of the reach shows sinuosity and width-depth characteristics of a Rosgen E channel, and good access to its floodplain. There has had an active beaver colony with dams and ponds in this reachfor a number of years. There also may be bedrock grade control in this reach. Bank erosion is markedly lower than in BG_16 and Bg_17 (7%). There is a drop in channel elevation below Reservoir diversion, and the stream resumes a semi-natural form Rosgen E form (although may have been mechanically manipulated in past) in a riparian corridor between hayfields.

This reach land use is rangeland in the upper end and irrigated pastures/hayfields in lower end. Riparian woody vegetation includes dense alder, willow and juniper in the upper end of reach, with sparse willows lower. Weeds include houndstongue, hensbane, spotted knapweed, and leafy spurge. The riparian zone in the upper end of reach was burned in either 2004 or 2005, but regeneration was rather rapid.

Problems include channel incision (localized in upper end), moderate bank erosion, and areas of poor riparian woody vegetation. Although this reach scored low in 2005, it is in fair condition in its lower end with some areas of fairly healthy woody riparian vegetation and good floodplain connectivity, partly due to the arrested downcutting at Reservoir Ditch diversion and the other diversions downstream.

Potential projects include weed control, fish passage at High Ditch and Reservoir Ditch, and improved diversion/headgate at Reservoir Ditch.

BG_19: NRCS Score (2013) = 58%, Sustainable At Risk, Fish Habitat = Fair (70)
The sub-reach BG_19 is 0.82 miles in length and was visually classified as a Rosgen E channel type located within a broad (type VIII Rosgen) valley. This classification is based on a bankfull width- to-depth ratio estimate of 3.7, a sinuosity >1.5, a gravel/sand/silt dominated channel bed, and an estimated channel gradient of <2%. Geomorphically the top 1/3 and bottom 1/3 (totaling 2/3 of reach) of the channel is stabilizing (old downcutting, but channel is re-establishing its floodplain), with minimal lateral erosion, and small areas of widening or shallowing, resulting in enlarged point bars (Photo BG_19_01). The middle 1/3 of the channel reach is unstable with moderate to extensive lateral erosion and major widening/loss of pool depth due to cattle crossings, cattle trampling (hoof shear), and lack of riparian vegetation reducing bank strength (Photo BG_19_02).

The channel passes through hayfields throughout this reach. During the time of this assessment (June 2013) there was sediment deposition on the floodplain in the upper and lower 2/3 of reach indicating that the stream has access to its floodplain (Photo BG_19_01). Stream flow appeared low, with an estimated discharge of <2 cfs at the top of the reach (due to diversion- Photo BG_19_03) and increased to ~2-5 cfs downstream when irrigation water returned in several locations. Density of woody riparian vegetation within this sub-reach is low to moderate and dominated by willows and alder, over sedges and grasses (Nez Perce Code:SR2). There is

moderate livestock browsing, with minimal to moderate regeneration at this time. There is a poor distribution of woody plant age classes in the middle 1/3 of the reach (mainly mature and decadent- Photo BG_19_02), the same age classes dominate the upper and lower 2/3 of the reach but with some seedling and samplings present.

The primary problems noted within this sub-reach are cattle trampling of the bed/banks, over-widening of channel, and lack of root-binding riparian vegetation. Bank erosion and sedimentation are issues in the lower half of the reach. Additionally, there appear to be water quality degradation issues such as low-warm water conditions, and excessive nutrients (cattle manure) causing large blooms of algae on the channel substrate.

The issues discussed result in fair fish habitat score, as evident in the good riffle, run, and glide features, but poor pool habitat elements (shallow with high sedimentation), moderate amounts of cover/shading due to poor riparian woody vegetation and overhanging banks, moderate percentage of large woody debris, and an impassable fish barrier at the top of the reach—Reservoir Ditch (Photo BG_19_03) and impassable rock grade control at bottom of reach (Photo BG_19_04). The NRCS score for this reach is 58%, sustainable at risk.

The reach has had mechanical channel modifications such as bank stabilization through rip-rrap, hardening of bed at cattle crossings, and the addition of LWD on outside bends. Thus, potential restoration projects include improved grazing management, localized channel renaturalization, and re-vegetation.

BG_20: NRCS Score (2013) = 50%, "Not Sustainable," Fish Habitat = Fair (65)

The sub-reach BG_20 is 0.20 miles in length, and was visually classified as a Rosgen G channel degraded from an E channel type located within a wide type VIII Rosgen valley. This classification is based on a bankfull width- to-depth ratio estimate of 2.5, a sinuosity <1.5, a gravel dominated channel bed, and an estimated channel gradient of <2%. Geomorphically this channel is stabilizing, but has several locations which are fairly unstable with noticeable incisement (Photo BG_20_01). In turn this incisement is causing a moderate amount of lateral erosion propagating as slumping/cleavage of the inner and outer banks into the steam channel. This excess erosion results in excessively large point bars, formation of midstream bars, and almost complete loss of pool elements.

During the time of this assessment (June, 2013) flow appeared low with an estimated discharge of <2 cfs and a wetted width of <3 ft. This deficient flow is due to the series of diversion dams located in the two prior reaches. There were point locations where sediment was found on the floodplain indicating that the stream does has access to its floodplain during high flow events. Density of woody riparian vegetation within this sub-reach is moderate and dominated primarily by grasses with few willow and sedge (Nez Perce Code:SR2). There is moderate browse occurring via cattle, with no to minimal woody plant regeneration at this time, and a poor distribution of age classes of woody species (mature and decadent-Photo BG_20_02).

The primary problems noted within this sub-reach consist of bank and bed form alterations caused by livestock such as trampling of the bed/banks and lack of riparian woody vegetation which acts to stabilize the banks and reduce sediment inputs. In addition, the diversion dam

located at the top of the reach has caused dewatering issues (low flow and warmer temperatures), with the channel readjusting through incision. These issues result in fair fish habitat, as evident in the low number of shallow pool habitat elements, high substrate quality, low amount of cover/shading due to riparian vegetation and overhanging banks, moderate percentage of large woody debris, deficient flow, and impassable fish barrier.

Potential restoration projects include an improved grazing management plan and re-vegetation. It is also recommended to redesign the diversion dam or retro-fit with fish ladder (WRC has funding available for a fish ladder on this diversion).

BG_21: NRCS Score (2013) = 53%, At Risk, Fish Habitat = Good (85)

The sub-reach BG_21 is about 0.28 miles in length, and was visually classified as a Rosgen E channel type located within a type VIII Rosgen valley type. This classification is based on a bankfull width- to-depth ratio estimate of ~3, a sinuosity >1.5, minor to moderate incisement, gravel dominated channel bed, and an estimated channel gradient of <2%. Geomorphically this channel is semi-stable, having old downcutting that is now stabilizing through the rebuilding of its floodplain, and a moderate amount of human-induced erosion of outside and inside banks (Photo BG_21_01). Erosion is primary due to hoof shear, trampling, and lack of riparian vegetation. Additionally, there are areas of channel widening and shallowing, as a result of excessive cattle crossing locations.

During the time of this assessment the reach had an estimated discharge of 2-4 cfs and a wetted width of 4 ft. Density of woody riparian vegetation within this sub-reach is low and dominated by grasses with few willow and sedge (Photo BG_21_02). There is intensive browsing occurring via cattle, with no to minimal regeneration at this time, and a poor distribution of age classes of woody species (mainly mature and decadent). The primary problems noted within this sub-reach consist of bank and bed form alterations caused by livestock such as: 1) trampling of the bed and banks, 2) over-widening of channel at cattle crossings, and 3) lack of deep root binding riparian vegetation. The lack or riparian vegetation has also caused a reduction in fish habitat and minimal covering/shading. Fish habitat is also reduced in summer months due to deficient flow, dewatering by irrigation systems.

Overall the fish habitat can be classified as good, as this area retains some natural channel form elements, and there are a number of deep pool and run habitat elements, high substrate quality, and low-moderate LWD.

Potential restoration projects options, include improving grazing management with the option to re-vegetate the riparian area.

BG_22: NRCS Score (2013) = 45%, "Not Sustainable." Fish Habitat = Good (85)

The sub-reach BG_22 is about 0.97 miles in length, and was visually classified as a Rosgen E channel type located within a type VIII Rosgen valley type. This classification is based on a bankfull width- to-depth ratio estimate of 3, a sinuosity >1.5, a gravel dominated channel bed, and an estimated channel gradient of <2%. The upper (eastern) part of this channel reach has

been historically manipulated (moved north and straightened), but geomorphically that reach is beginning to stabilize, and the lower end of the reach appears more natural. Old down-cutting is quite evident, but it is in a stage of rebuilding a new floodplain (BG_22_01). With this said, the stream has little to moderate access to its floodplain. The reach exhibits a moderate amount of human-induced erosion to the inner and outer banks as a result of cattle trampling, hoof shear, and lack of riparian vegetation. There is evidence of point widening and shallowing due to excessive cattle crossings (Photo BG_22_02).

At the time of the assessment there were a few floodplain locations with sediment deposits, indicating that during high flow events some sites have access to its floodplain. There are some historical mechanical channel modifications such as the stabilization of outside banks and bridge crossings with rip-rap/boulders (BG_22_03). At the time of this assessment stream flow appeared low to normal with an estimated discharge of 2-5cfs. Density of woody riparian vegetation within this sub-reach is low. The vegetative community is dominated by grasses with willow and sedge. (Nez Perce Code: SR2/GD1). There is intensive browsing occurring via cattle, with no to minimal regeneration at this time, and a poor distribution of age classes of woody species, mainly mature and decadent (BG_22_01).

The primary problems noted within this sub-reach consist of trampling of the banks, over-widening of the channel at numerous cattle crossings, and hoof shear. The hoof shear is exacerbated by the lack or deep-root binding riparian vegetation. The sedimentation of the channel becomes a larger issue as you move downstream within the reach. There are indicators of water quality degradation, due to brick-red/copper colored irrigation water re-entering the mainstem of the channel.

The issues discussed result in a fair-good fish habitat score, as evident in the moderate number of deep pool habitat elements, high substrate quality, minimal amounts of cover/shading from riparian vegetation and overhanging banks, low percentage of large woody debris, and potentially deficient flow.

Possible restoration projects include improving grazing management, with the option to re-vegetate the riparian area, and monitoring of noxious weeds.

BG_23A: NRCS Score (2013) = 57%, At Risk, Fish Habitat = Poor (30)

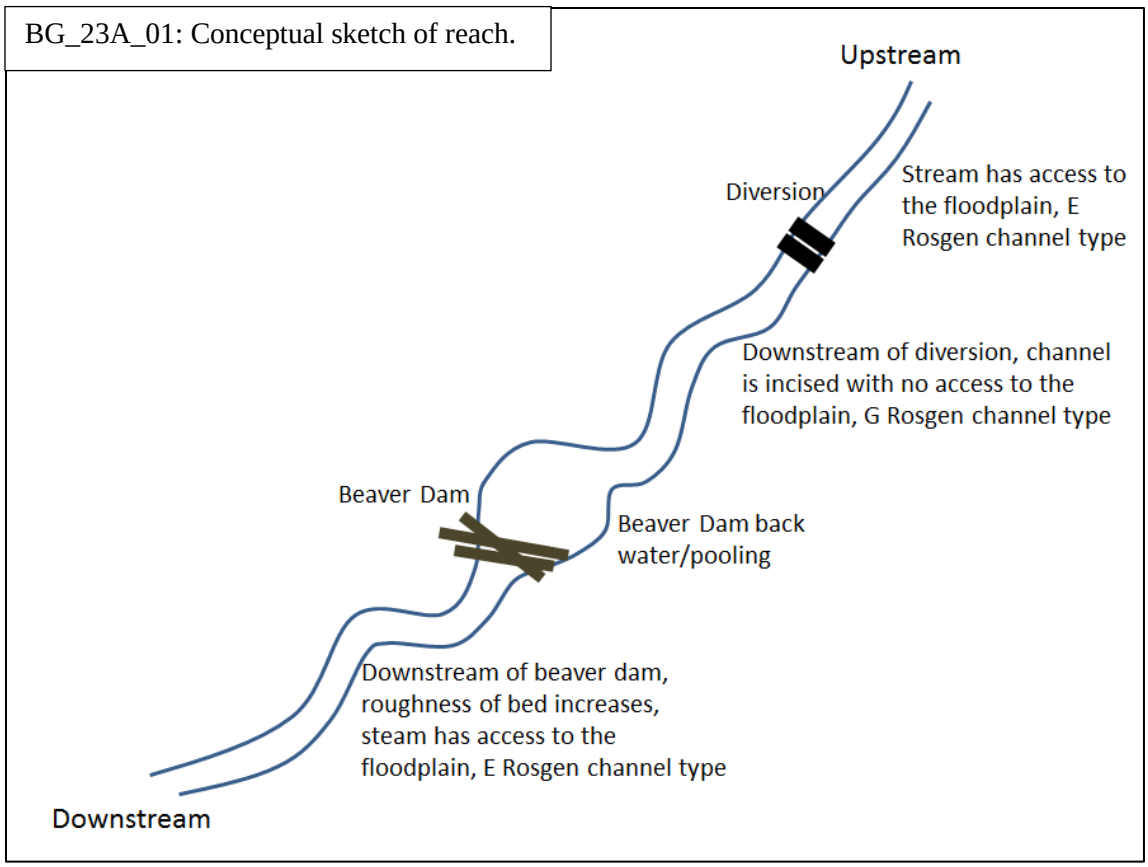
The sub-reach BG_23A is about 1.09 miles in length, and was visually classified as a Rosgen E/G channel type located within a type VIII Rosgen valley type. This classification is based on a bankfull width- to-depth ratio estimate of 3.5, a sinuosity >1.5, a sand/silt/small gravel dominated channel bed, and an estimated channel gradient of <2%. Refer to Figure BG_23A_01 as a resource throughout this discussion, which depicts the complexity of the reach and the changing problems/issues from upstream to downstream. Geomorphically the upper and lower sections of this reach are stabilizing, with old downcutting, but with the rebuilding of a new floodplain (Photo BG_23A_02). The center of this reach is fairly unstable with active and noticeable incisement (BG_23A_03). There is human-induced erosion of the inner and outer banks though the entirety of the reach, but tends to be more prevalent mid-reach (BG_23_04). There is some evidence of areas of widening and shallowing, resulting in enlarged point bars and loss of pool depth.

There was evidence that the stream has access to its floodplain above the diversion dam and below the beaver dam. During the time of this assessment (June 2013) stream flow appeared low with an estimated discharge of <2 cfs and a wetted width of 5-12 ft. Density of woody riparian vegetation within this sub-reach is low to moderate and dominated by mature willows over grasses and sporadic sedges. There is intensive browsing occurring via cattle, with minimal woody plant regeneration at this time, and a poor distribution of age classes of woody species (mature and decadent dominate).

There are several problems noted within this sub-reach, mostly pertaining to the center of the reach. Firstly, there is historical/mechanical channel straightening, with rip-rapped/hardening of channel walls. The channel is attempting to regain its sinuosity from this straightening, which in turn is inducing incisement and lateral erosion. There is additional erosion from cattle trampling, crossing, hoof shear, and lack of deep-root binding riparian vegetation (both from browse and rubbing/physical impact). Furthermore, there appears to be water quality degradation issues such as excess fine-grained sediment and high nutrient load from cattle manure, along with evident low flows.

The issues discussed result in a NRCS score for this reach of 57%, “sustainable at risk” and a poor fish habitat score, evidenced by the low number of shallow pool habitat elements (very few deep pools), low substrate quality, moderate amounts of cover/shading (riparian vegetation and overhanging banks), and moderate percentage of large woody debris. There beaver dam located near the downstream end of the reach may act as a natural fish barrier during low flow months.

Potential restoration projects include improved grazing management, and further restoration assessments to explore renaturalization and/or grade control projects. Rewatering would benefit this reach, but potential for projects is low according to the assessment done by WRC in 2010.



BG_23B: Palmer St to Ramsey Rd/I-90
NRCS Score (2013) = 55%, At Risk, Fish Habitat = Poor (30)
The sub-reach BG_23B is about 0.63 miles long, and was visually classified as a Rosgen E channel type located within a type VIII Rosgen valley type. This classification is based on a bankfull width- to-depth ratio estimate of 5.6, a sinuosity >1.5, a sand/silt dominated channel bed, and an estimated channel gradient of <2%.Geomorphically this channel is stabilizing, having old downcutting, but with active building of a new floodplain. There is a moderate amount of human-induced erosion of the inner and outer banks, due to hoof shear, trampling, numerous cattle crossings, and lack of riparian vegetation due to browse/livestock impact (Photo BG_23B_01 and BG_23B_02). Additionally, there is moderate sedimentation found on the bed of the channel.

During the time of this assessment stream flow appeared low-normal with an estimated discharge of 2-5 cfs. Also, there was evidence that the stream has access to its floodplain, due to several sediment and debris piles found in the floodplain zone. Density of woody riparian vegetation within this sub-reach is low to moderate and dominated by willow and grasses (Nez Perce Code: SR2/GD1). There is moderate browse and rubbing occurring via cattle, with minimal to moderate regeneration (regeneration increases downstream) at this time. There is and a moderate distribution of age classes, primarily mature and decadent, with a few young/sapling willows.

The primary problems noted within this sub-reach are cattle related, and consist of trampling of the bed and banks, over-widening through cattle crossings, loss of banks due to lack of deep-root binding riparian vegetation. This cattle related erosion results in a stream bed high in fines and a muddy water column. Additionally, the stream has cut a new channel through the adjacent grass-land pasture/field, after abandoning its historical channel bed due to plugging from beaver dams.

The issues discussed result in a NRCS score for this reach of 55% "low sustainable at risk", and poor fish habitat score, as evident in the moderate number of shallow to deep pool habitat elements, poor substrate quality, moderate amounts of cover/shading due to riparian vegetation and overhanging banks, moderate percentage of large woody debris, and deficient flow.

Potential restoration projects include improved grazing management, bank stabilization, and re-vegetation of the riparian area. Additionally, the historical diversion dam, which is no longer is use, could be removed, although it is currently not causing a fish passage issue (Photo BG_23B_03).

BG_24: I-90 to Railroad Tracks
NRCS Score (2013) = 23%, "Not Sustainable." Fish Habitat = Poor (30)

This is a complex reach about 0.92 miles long, with distinct problems in its upstream and downstream sectors; please see Figure BG_24_01 which has been provided as a reference for elements of this reach. This figure depicts the complexity of the reach and its major features from upstream to downstream. The upstream section between the frontage road/I-90 and the fence line is marked by a beaver pond complex and is a Rosgen E channel type in a highly sustainable state (Photo BG_24_02, Photo BG_24_03), with significant beaver influence. It is an example of the high potential habitat quality of lower Browns Gulch. Because the upper section has had minimal to no human or cattle impacts for some time, the remainder of this sub-reach narrative will describe the geomorphology, riparian health, fish habitat, problems, and restoration projects for BG_24 below the marked fence line.

The lower sub-reach BG-24 was visually classified as a Rosgen G channel type located within a type VIII Rosgen valley type. This classification is based on a bankfull width- to-depth ratio estimate of 5.7, a sinuosity >1.2, a silt/sand/gravel dominated channel bed, and an estimated channel gradient of <2%. Downstream of the fence line current and historical beaver complexes cause a flooded/ponded stream channel (Photo BG_24_04). This ponding abruptly ends where the stream abandoned its original channel bed at some point in recent history, and cut a new channel through the adjacent pasture to the west (signified by willow tree-line and old low elevation cobble channel bed-see Figure BG_24_01). It is unknown what caused this major avulsion, but beaver dams are suspected to be a major factor. The prior channel location was likely the result of historical manipulation, so avulsion to the west may be a natural process.

Geomorphically this channel is extremely unstable, with deep incision, and no stream access to the floodplain (Photo BG_24_05, BG_24_06). There is extensive human-induced lateral erosion along a large proportion of channel banks (Photo BG_24_05). This lateral erosion is primarily due to lack of riparian vegetation owing to the new channel location through the grass-dominated landscape. This erosion is also exacerbated by cattle trampling, hoof shear, crossings, and

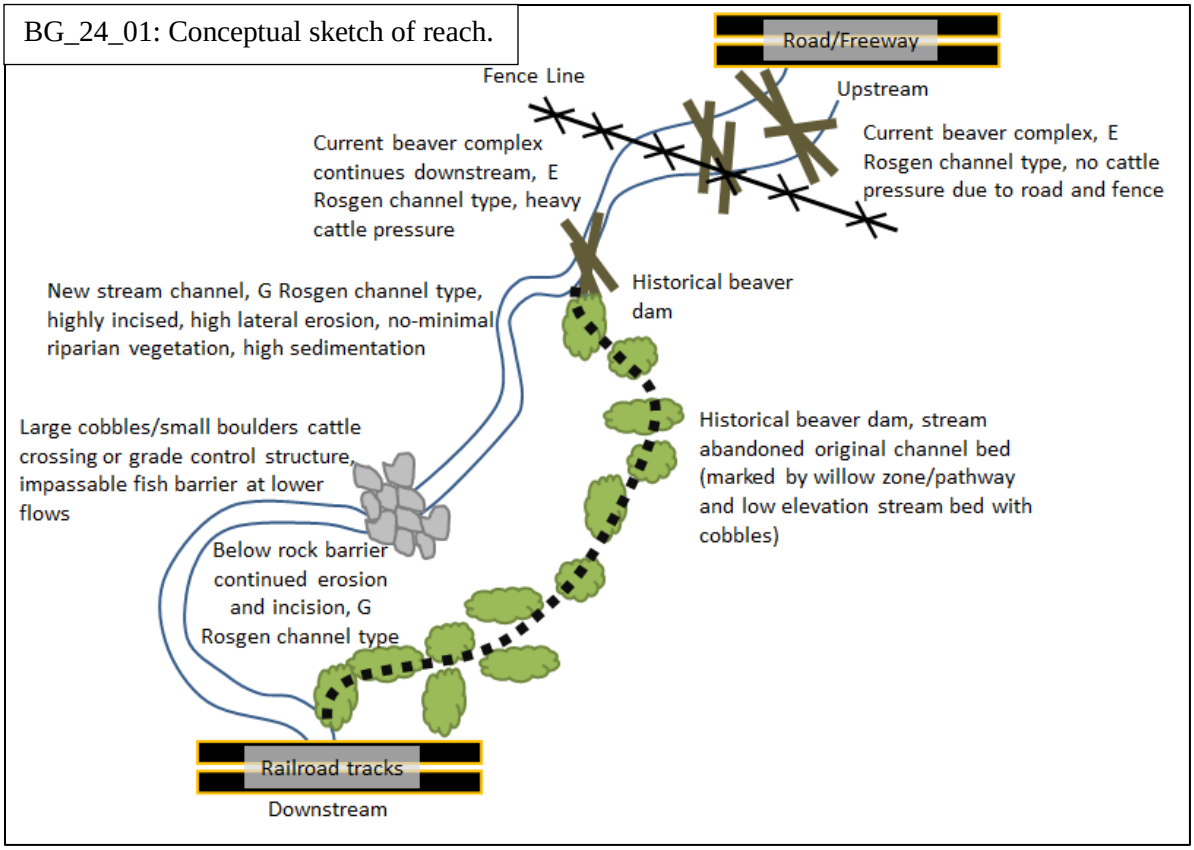
browse, resulting in areas of widening, shallowing, midstream islands, and loss of pool depth. During the time of this assessment stream flow appeared low with an estimated discharge of 2 cfs and a wetted width of 9 ft.

Density of woody riparian vegetation within this sub-reach is low and dominated by grasses with minimal willow and sedge (Nez Perce Code: SR2). There is intensive browse occurring via cattle, with no to minimal regeneration at this time, and a poor distribution of age classes of woody species (some mature and decadent willow). The primary problems noted within this sub-reach consist of the apparently natural beaver-caused channel avulsion, which is causing major erosion and incisement, and subsequent heavy livestock impact. This channel cannot stabilize within its new location due to cattle pressures, which further erode the stream banks and have halted any propagation of new deep-root binding riparian vegetation (via browse) that could strengthen the banks. This excessive bank erosion (measured at 10-30% of banks) is the primary cause for the high quantity of fine-grained sediment deposited on the stream bottom, which in places measures a foot in depth or more.

Additionally, a rock cattle crossing or grade control (gully plug) has been installed 2/3 of the way downstream within the reach in the last two years (Photo BG_24_07). It is comprised of large cobble and small boulders. The gully plug acts as a sieve for fine-grained sediment, resulting in a coarsening of bed substrate immediately downstream. The gully plug also acts as a fish barrier (water traveled under/though plug at time of assessment). There also appears to be nutrient water quality degradation issues, indicated by overgrowth of aquatic vascular plants and excessive algae on rocks. Other problems include minimal to moderate growth of noxious weeds like leafy spurge and thistle (species?).

The issues discussed above result in a NRCS score for this reach of 23%, unsustainable and poor fish habitat score, as evident in a moderate number of shallow to deep pool habitat elements, low substrate quality, minimal amounts of cover/shading due to overhanging banks and no shading from riparian vegetation. There is a low percentage of large woody debris.

There are two potential restoration project options. Option one is to relocate/reconstruct the channel into its original channel bed—it is likely that the original channel can be used for much of its length with little modification. A complementary measure is to improve grazing management. Trying to stabilize the existing avulsed channel in place will be quite difficult. Removal/re-design of the gully plug should be further investigated.



BG_25: NRCS Score (2013) = 65%, At Risk, Fish Habitat = Fair (65)

This reach was reconstructed in the last four years by the Superfund remediation/restoration project working on Silver Bow Creek. The sub-reach BG_25 was visually classified as approximating a Rosgen E channel type located within a type VIII Rosgen valley type. This classification is based on a bankfull width- to-depth ratio estimate of 8, a sinuosity >1.2, a cobble/gravel dominated channel bed, and an estimated channel gradient of <2%. This channel appears to be geomorphically stable, having little to no active/current downcutting, and minimal lateral erosion (Photo BG_25_01). There are a few locations where banks are exposed and coconut-fiber root mats are ripping and/or coming unpinned. The constructed channel design appears to be overly wide, for the amount of water flowing during the time of assessment (flow appear to be low-normal), and has excessively large point bars (Photo BG_25_02).

Density of woody riparian vegetation within this sub-reach is low to moderate, dominated by recently planted/transplanted (2-4 years) russian olive and willows, in addition to nonnative grasses (Nez Perce Code: SR2/GD1). There is little to no browse occurring via wildlife, with moderate regeneration at this time, and a moderate distribution of age classes of woody species (seedling, saplings, and few young). This reach has improved since 2005, when it was classified by a non-sustainable NRCS riparian assessment score (prior to its restoration). Presently, the reach has improved to an 65%, “sustainable at-risk” score.

The primary problems noted within this sub-reach appear to be related to the constructed channel, which is likely too wide, and likely to suffer from warm water temperatures and deposition of fines. There appears to be water quality degradation due to nutrients, indicated by overgrowth of aquatic vascular plants. Additionally, the planted riparian vegetation is minimal and needs additional time to grow tall enough to provide shade/cover. These issues result in fair fish habitat, as evident in the low number of shallow pool habitat elements, high substrate quality, low amounts of cover/shading due to riparian vegetation and overhanging banks, low percentage of large woody debris, and sufficient flow.

There are no recommended restoration projects at this time. The sub-reach should maintain the current land management, being a no grazing regime.

Appendix A: Additional Figures

Figure 9: 2005 NRCS Riparian Assessments by Reach

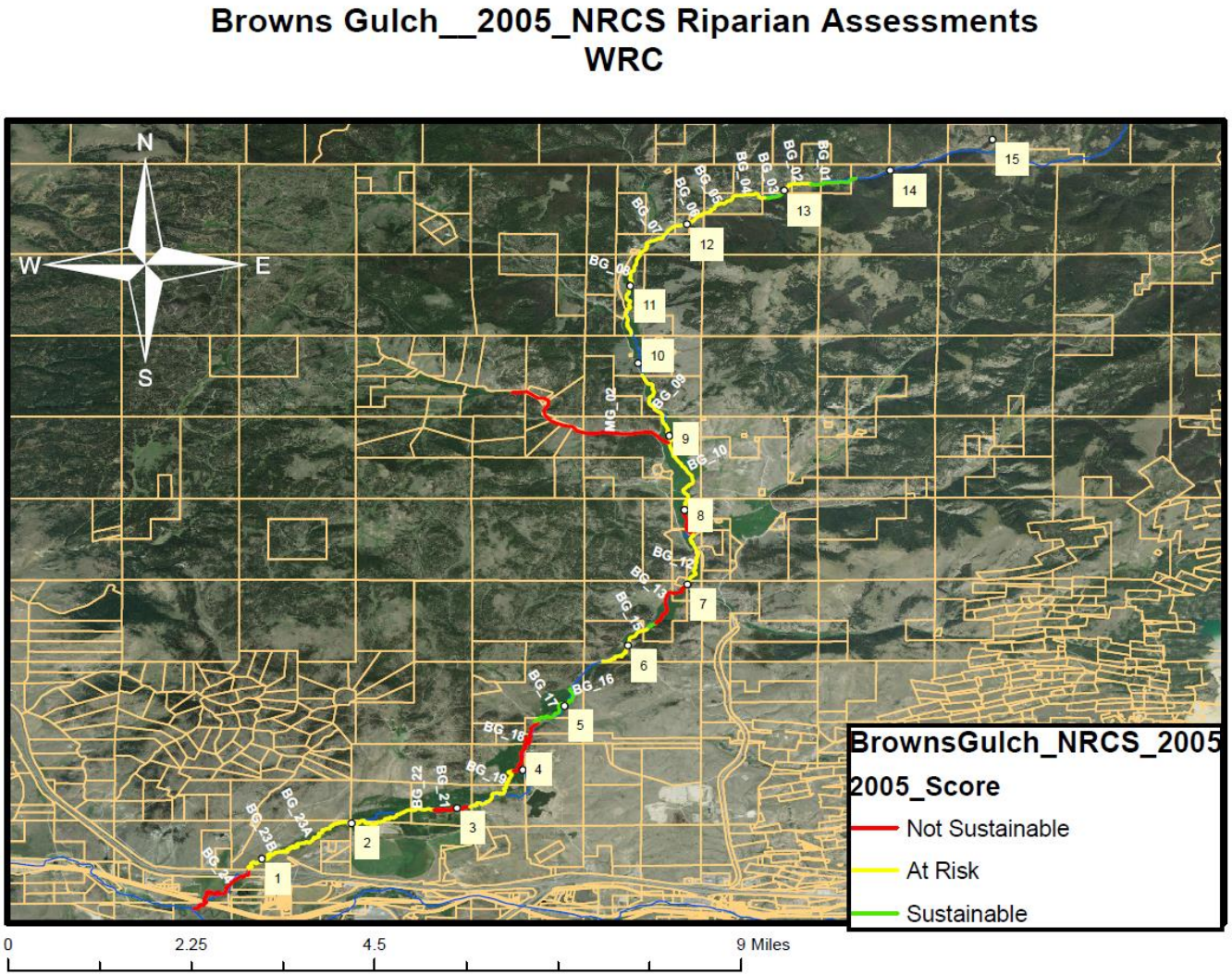


Figure 10: 2011 BEHI Sediment Load & DEQ Habitat Assessment score on Browns Gulch

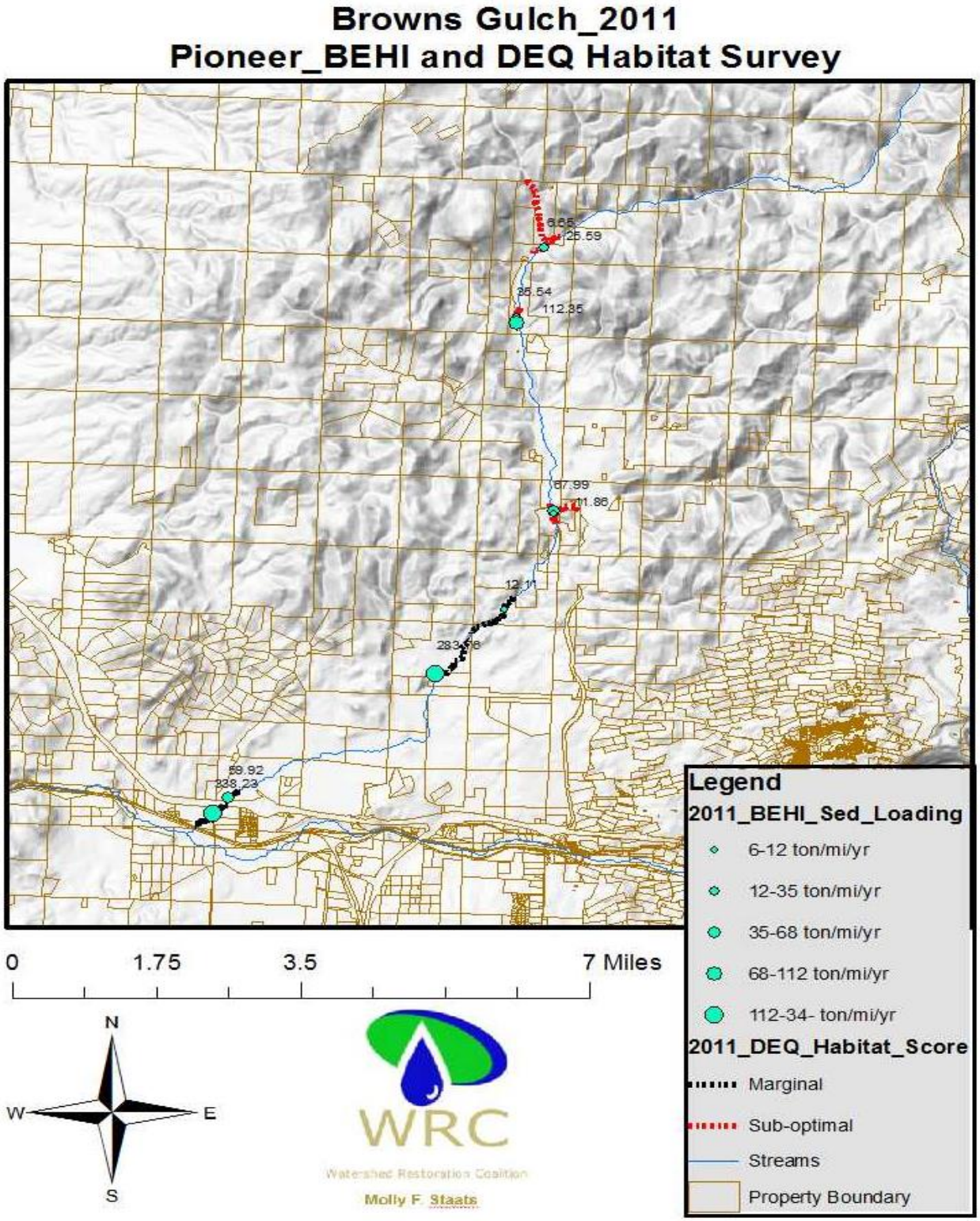


Figure 11: 2011 BEHI Sediment Load & DEQ Habitat Assessment score on Lower Browns Gulch

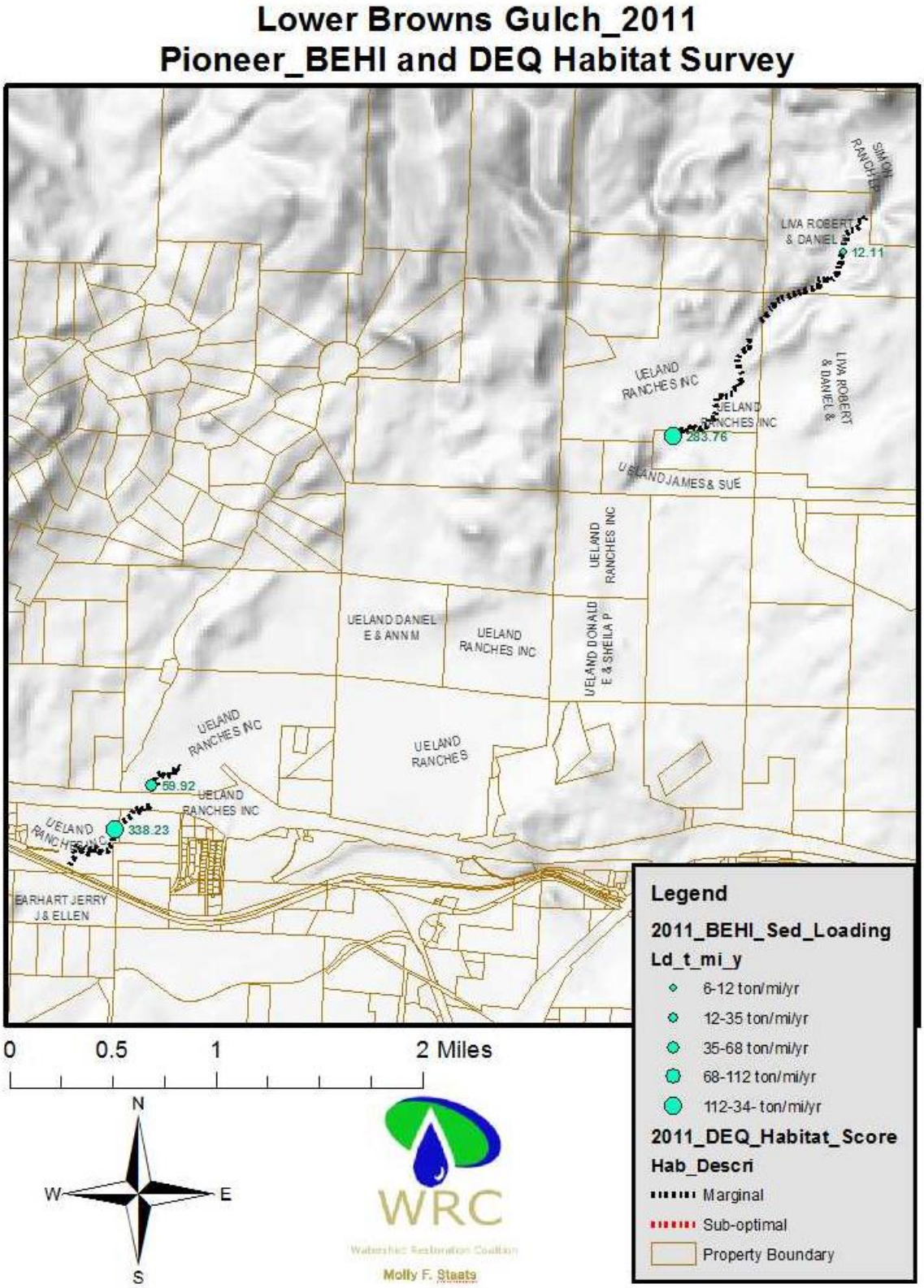


Figure 12: 2011 BEHI Sediment Load & BEQ Habitat Assessment score on Upper Browns Gulch

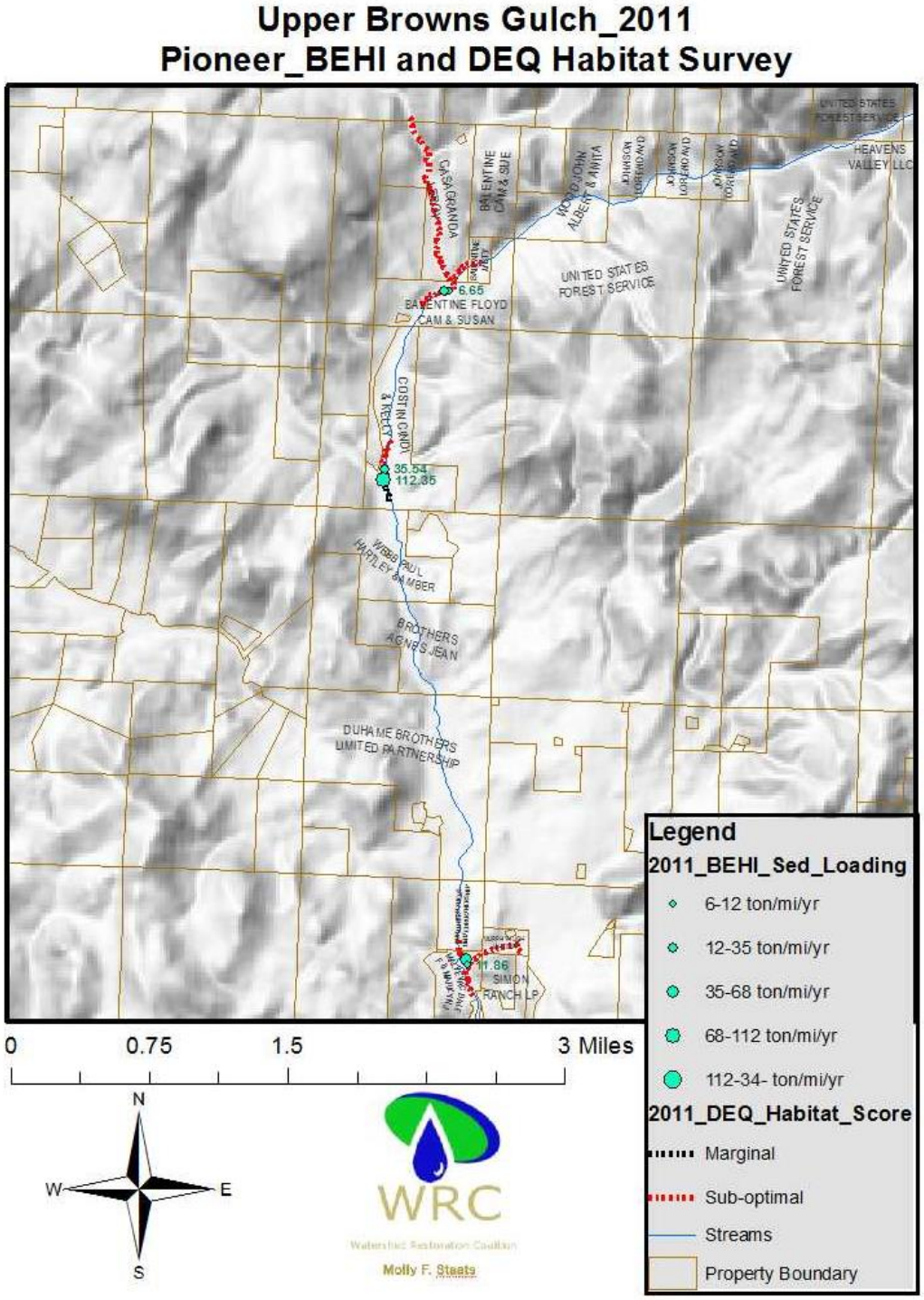
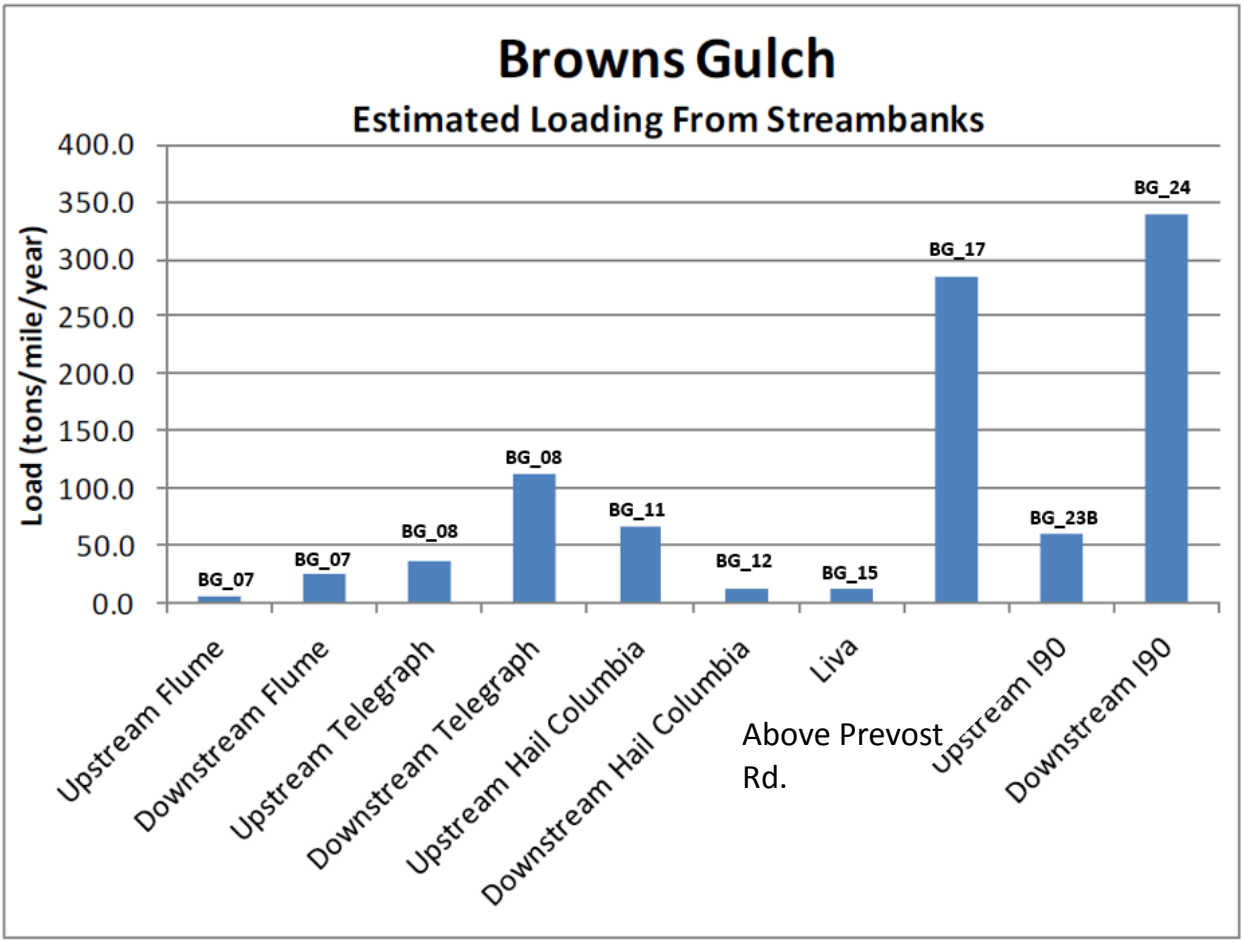


Figure 13: 2011 BEHI sediment loading rates from stream banks sources (Pioneer, 2011).



Appendix B: Additional Tables

Table 3: 2013 Detailed NRCS Riparian Assessment data by reach

Reach Code	Primary Land Use	Reach Length (mi)	Plant Community	Rosgen Channel Type	BF Depth (ft)	BF Width (ft)	BF Ratio	Channel Sub	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total Score
BG_00	grazing, forest	0.71	grass, willow, conifer, sedge	B/E	2	6	3	co, gr, veg	8	3	4	6	0	2	0	4	2	8	62
BG_16	grazing	0.11	willow, sedge, garrison	G	4.5	10	2.2	gr, sm co	2	0	4	6	0	0	0	4	2	4	37
BG_17	grazing	0.62	sedge, willow , alder	G	2	12	6	sa, si, sm gr	2	0	2	4	0	2	0	4	2	2	30
BG_19	grazing	0.82	willow, reed canary	C/E	1.9	5.5	2.9	sm gr, sa	6	5	2	6	2	2	0	4	2	6	58
BG_20	grazing	0.2	grass, willow	G/E	2	5	2.5	lg/sm gr	6	3	6	4	2	2	0	4	1	6	50
BG_21	grazing	0.28	willow, reed canary	E	1.9	5.8	3.1	lg/sm gr	6	3	4	4	0	2	0	6	1	6	53
BG_22	grazing	0.97	willow, garrison, canary	E	2	6	3	gr, sa, si	6	3	4	4	0	1	0	4	1	4	45
BG_23 A	grazing	1.09	sedge, willow, reed can	E/G	1.7	6	3.5	sa, si, sm gr	6	3	4	6	2	2	0	4	1	6	57
BG_23 B	grazing	0.63	sedge, willow, reed can	E	1.6	9	5.6	sa, si, gr	6	3	2	4	2	2	0	6	2	6	55
BG_24	grazing	0.92	herbaceous, willow	G/E	1.75	10	5.7	si, sa, gr	0	0	2	6	0	2	0	2	0	2	23
BG_25	reclamati on	0.15	russian olive, willow, grass	C	1.8	10	5.6	co, gr	8	8	4	6	0	2	0	4	3	4	65

Table 4: 2005 Detailed NRCS Riparian Assessment data by reach

Reach Code	Primary Land Use	Reach Length (m)	Plant Community	Rosgen Channel Type	BF Depth (ft)	BF Width (ft)	BF Ratio	Channel Sub	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total Score
BG_01	Forest	666	willow	B	2	10	5	co	8	8	6	6	4	2	2	6	4	6	87
BG_02	IrrPH	485	sedge, rush	E	2.5	8	3.75	gr	8	8	6	2	4	3	0	0	0	4	58
BG_03	Forest	345	willow	D	2.5	12	6	sa	8	8	6	6	6	2	2	8	4	8	97
BG_04	NIrrPH	520	willow, grass	B	2	7	3.5	sa	8	5	6	6	4	2	2	4	2	6	75
BG_05	IrrPH	651	sedge, herbaceous	B	1.5	9	6	gr	6	5	6	2	2	3	0	2	3	2	52
BG_06	Range	365	sedge, willow, alder	B	1	15	15	gr	6	8	0	6	2	0	1	4	3	6	60
BG_07	IrrPH	913	herbaceous, grass	B	2	7	3.5	co	6	5	4	4	2	2	1	4	2	4	57
BG_08	IrrPH	1850	willow, alder, sedge	B	1.5	10	7	gr	6	3	4	4	4	3	2	4	2	6	63
BG_09	IrrPH	1060	willow, sedge, grass	F	2.5	9	3.75	gr	4	5	4	6	2	2	2	4	2	4	58
BG_10	IrrPH	2293	sedge, willow	B	2	8	4	gr	4	5	4	6	2	3	2	4	1	4	58
BG_11	IrrPH	1796	sedge, grass	F	1.5	10	6.5	gr	4	3	4	2	2	3	1	0	0	4	38
BG_12	IrrPH	183	sedge, willow, grass	F	2.5	12	5.5	gr	4	5	4	6	4	1	1	4	3	6	63
BG_13	IrrPH	1093	willow, sedge, grass	F	2	8	4	gr	6	3	4	6	2	1	1	4	1	2	50
BG_14	IrrPH	155	willow, reed canary, al	F	2	10	5	sa	6	8	4	6	6	2	2	6	3	6	82
BG_15	IrrPH	1149	willow	F	1.5	12	8	co	6	8	0	6	6	3	2	6	4	6	78
BG_16	IrrPH	990	willow, sedge, garrison	E	2.2	8	3.75	sa	8	8	6	6	6	2	2	8	3	8	95
BG_17	Range	1421	sedge, willow , alder	E	3	15	5	sa	8	8	6	6	6	1	2	8	3	8	93
BG_18	IrrPH	1312	sedge, willow, garrison	F	1.5	8	5.2	sa	2	3	4	6	2	1	1	4	2	4	48
BG_19	IrrPH	314	willow, reed canary	F	2	8	4	sa	6	5	6	6	4	3	1	4	2	6	72
BG_20	IrrPH	447	grass, willow	C	2	9	4.5	sa	6	3	4	4	2	2	2	2	1	4	50

Reach Code	Primary Land Use	Reach Length (m)	Plant Community	Rosgen Channel Type	BF Depth (ft)	BF Width (ft)	BF Ratio	Channel Sub	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total Score
BG_21	IrrPH	1557	willow, reed canary	F	2.5	8	3.5	gr	2	3	4	4	2	2	1	4	1	4	45
BG_22	NIrrPH		willow, garrison, canary	-	-	-	-	-	4	3	4	4	4	1	1	4	3	4	53
BG_23	NIrrPH	2375	sedge, willow, reed can	F	2	10	5	gr	4	5	4	6	4	1	2	4	3	4	62
BG_24	NIrrPH	1481	herbaceous, willow	G	2	15	7.5	sa	0	0	2	2	0	0	1	2	2	0	15
BG_25	Indust	246	Sedge, willow, bulrush	C	1.5	7	5	sa	2	0	0	6	2	3	2	6	4	0	42

Table 5: 2011 Pioneer Sediment loading via stream banks by reach (note 500ft location within reach)

Site	Landowner	Reach (NRCS)	Reach (WRC)	Loading (tons/mile/year)	Average Height Eroding Bank	Percent Eroding Bank
Upstream Flume	Balentine	BG7	BG12	6.65	2.27	2%
Downstream Flume	Balentine	BG7	BF12	25.59	3.30	5%
Upstream Telegraph	Casagranda	BG8	BG13	35.54	3.62	8%
Downstream Telegraph	Casagranda	BG8	BG13	112.35	4.38	17%
Upstream Hail Columbia	Malyevac	BG11	BG18	67.99	5.17	9%
Downstream Hail Columbia	Malyevac	BG12	BG19	11.86	2.63	3%
Liva	Liva	BG15	BG22	12.11	2.50	3%
Ubove Ueland Road	Ueland	BG17	BG24	283.76	4.00	69%
Upstream I90	Ueland	BG23	BG29	59.92	2.83	19%
Downstream I90	Ueland	BG24	BG30	338.23	3.78	66%

Table 6: 2011 Pioneer DEQ Habitat Assessment scores and details by reach

		Reach Scores											
		Mainstem Browns Gulch										Tributaries	
	Reach	BG-07	BG-07	BG-8	BG-8	BG-11	BG-12	BG-15	BG-16 and 17	BG-23	BG-24	FG-3	HC-5
	Description	Above Flume Gulch	Below Flume Gulch	Above Telegraph Gulch	Below Telegraph Gulch	Above Hail Columbia	Below Hail Columbia	Liva	Between Upper Ueland Diversion and Ueland Road	Brown's Gulch above I-90	Brown's Gulch below I-90 (lowest most site)	Flume Gulch	Hail Columbia
Habitat Parameter	**Score Range [1]**												
Riffle Development	0-10	9	8	9	5	8	8	4	3	1	4	9	4
Benthic Substrate	0-10	8	7	7	5	4	5	2	1	1	3	7	3
Embeddedness	0-20	16	14	16	10	12	8	5	2	1	3	12	8
Channel Alteration	0-20	16	15	15	13	11	16	11	11	14	14	14	15
Sediment Deposition	0-20	15	14	16	6	7	8	8	3	2	2	10	3
Channel Flow Status	0-20	18	15	16	14	16	18	17	15	15	12	18	16
Bank Stability	0-20	16	10	14	10	10	18	14	6	10	0	16	16
Bank Vegetation	0-20	16	14	16	10	16	18	14	12	16	2	14	16
Vegetated Zone Width	0-20	4	4	4	4	6	10	4	4	6	2	4	8
Total [2]	0-160	118	101	113	77	90	109	79	57	66	42	104	89
Rating		Sub-optimal	Sub-optimal	Sub-optimal	Marginal	Sub-optimal	Sub-optimal	Marginal	Marginal	Marginal	Marginal	Sub-optimal	Sub-optimal
% of Maximum Score		73.8%	63.1%	70.6%	48.1%	56.3%	68.1%	49.4%	35.6%	41.3%	26.3%	65.0%	55.6%

[1] Low value "poor"; High Value "optimal"

[2] 130 -160 = Optimal
86 -129 = Sub-Optimal
44 – 85 = Marginal

Table 7: Detailed WRC 2011/2013 Rapid Bank Erosion Inventory by reach

Reach Code	Reach Length (mi)	Reach Length (ft)	Property Owner	Total Bank Erosion **2011** (ft2)	Total Bank Erosion **2013** (ft2)	Percentage of Linear Bank Erosion **2011** %	Percentage of Linear Bank Erosion **2013** %
BG_00	0.71	3743	Heavens Valley LLC	-	1237.5	-	6
BG_01	0.41	2185	Johnson David	-	-	-	-
BG_02	0.30	1591	Johnson David	-	-	-	-
BG_03	0.21	1132	US Forest Service	-	-	-	-
BG_04	0.32	1706	Wood Albert	495	-	5	-
BG_05	0.40	2136	Wood Albert	497	-	4	-
BG_06	0.27	1404	Balentine	455	-	4	-
BG_07	0.55	2881	Balentine_Casagranda	755	-	5	-
BG_08	1.15	6070	Casagranda	2324	-	6	-
BG_09	0.66	3478	Brothers Jean	520	-	4	-
BG_10	1.42	7523	Brothers Duhame	5875	-	12	-
BG_11	0.36	1926	Brothers Duhame	1772	-	10	-
BG_12	0.73	3862	Simon_Malyevac	210	-	1	-
BG_13	0.68	3586	Simon	1429	-	7	-
BG_14	0.10	509	Simon	44	-	11	-
BG_15	0.71	3770	Liva	1133	-	10	-
BG_16	0.11	607	Ueland	830	-	25	-
BG_17	0.62	3248	Ueland	5035	-	30	-
BG_18	0.88	4662	Ueland	1166	-	7	-
BG_19	0.82	4304	Ueland	-	755	-	6
BG_20	0.20	1030	Ueland	-	256	-	7
BG_21	0.28	1467	Ueland	-	680	-	14
BG_22	0.97	5108	Ueland	-	1359.5	-	7
BG_23A	1.09	5751	Ueland	-	780	-	5
BG_23B	0.63	3337	Ueland	-	1102	-	13
BG_24	0.92	4859	Ueland	-	1335	-	10
BG_25	0.15	807	Earhart Jerry	-	0	-	0

Appendix C: Field Forms

Rapid Bank Erosion Inventory Reference Codes:

Notes/Code	Description
RD	Road Erosion
BR	Bridge Erosion
CR	Cropland Encroachment: Lack of Riparian Veg
LS-P	Physical Livestock Erosion
LS-B	Livestock Browse: Lack of Riparian Veg
TP	Trampled by livestock, no real height of erosion
I	Geomorphic incisement
NC	New channel has formed (channel has left original stream channel due to humans, beavers, etc.) in area that lack riparian vegetation
C	Corrals
HS	Hillside erosion, channel cutting into valley walls

Rapid Bank Erosion Inventory Field Form:

Bank Erosion Inventory							
LEW				**REW**			
Height (ft)	Length (ft)	LEW Total (ft2)	Notes	Height (ft)	Length (ft)	REW Total (ft2)	Notes
TOTAL				TOTAL			

Notes/Codes	Description
RD	Road Erosion
BR	Bridge Erosion
CR	Cropland Encroachment: Lack of Riparian Veg
LS-P	Physical Livestock Erosion
LS-B	Livestock Browse: Lack of Riparian Veg
TP	Trampled by livestock, no height of erosion
I	Geomorph Incisement
NC	New channel
HS	Hillside erosion, cutting into valley walls

Reach Narrative Field Form:

Browns Gulch Narrative: Paragraph Description of Reach

Part 1: General Classification of Reach

1) This sub-reach was visually classified as a _____ Rosgen channel type located within a _____Rosgen valley type. This classification is based on a bankfull width- to-depth ratio estimate of _____, a sinuosity of _____, a _____dominated channel bed, and an estimated channel gradient of _____.

Part 2: Geomorphology

1) Geomorphically this channel is…
    a. Stream Incisement (circle one)
        i. Appears stable, having little to no active/current downcutting,
        ii. stabilizing, having old downcutting that is now stabilizing through regeneration of vegetation,
        iii. in the early stages of downcutting, with small headcuts present,
        iv. fairly unstable, with active and noticeable incisement,
        v. extremely unstable, with deep incision/little to no stream access to the floodplain,
    b. Lateral Cutting (circle one)
        i. and minimal lateral erosion (balanced: erosion of outside/cut banks equal the deposition at point bars)
        ii. and some human induced erosion of outside banks
        iii. and a moderate amount of human induced erosion of inner and outer banks
        iv. and extensive human induced erosion along a large proportion of banks.
    c. Water and Sediment Balance
        i. In general there is no evidence of widening or shallowing of the stream channel—there are and numerous pools of good depth.
        ii. There is some evidence of widening or shallowing, resulting in enlarged point bars.
        iii. There is excessively large point bars, formation of midstream bars, and loss of pool depth.
        iv. There is heavy sedimentation causing a braided channel formation, with few to no pools.

Part 3: Flow and Floodplain Function (Circle both, one, or none)

1) During the time of this assessment there were several indicators, such as:
    _____
    _____ that the stream has access to its floodplain.
2) During the time of this assessment stream flow appeared (Circle One: low, high, or normal), with an estimated discharge of _____cfs and a wetted width of _____ ft.

Part 4: Riparian Vegetation and Browse

1) Density of woody riparian vegetation within this sub-reach is (Circle One: low, moderate, or high) and dominated by
    (genera)_____

_____
_____ (Nez Perce Code:_____).

2) There is (Circle One: little to no, little, moderate, intensive) browsing occurring via (Circle One: cattle, horses, sheep, other:_____), with (Circle One: no, minimal, moderate) regeneration at this time, and a _____(poor, mod., good) distribution of age classes of woody species like_____.

Part 5: Impacts to Reach (Circle all that apply)

1) The primary problems noted within this sub-reach consist of …….
    a. Historical mechanical channel modifications such as: channel straightening/channelization, or other_____
    b. Bank and bed form alterations caused by livestock:
        i. trampling of the bed and banks
        ii. over-widening channel
        iii. other
    c. Erosion/sedimentation due to:
        i. road encroachment into riparian corridor
        ii. bridges/culverts/crossing
        iii. agricultural encroachment into riparian (or other removal of vegetation)
        iv. upstream land use sediment sources
        v. historic mining
        vi. other causes (_____)
    d. Water quality degradation due to nutrients or other contamination
        i. Indicated by overgrowth of aquatic vascular plants
        ii. Excessive algae on rocks
        iii. Other water quality indicators_____
    e. Removal, damage or degradation of riparian vegetation reducing habitat, cover and shade:
        i. indicated by vegetation type/land use:_____
        ii. weeds:_____
        iii. other: _____
    f. Low flows or dewatering:
        i._____
2) There are no apparent problems with this reach

Part 6: Fish Habitat

1) These issues result in (Circle One: poor, fair, good) fish habitat, as evident in…
    a. (Low/High) number of (Shallow/Deep) pool habitat elements
    b. (Low, medium, high) Substrate quality
    c. (Small/Large) amounts of cover/shading due to riparian vegetation and overhanging banks
    d. (Low/Medium/High) percentage of large woody debris
    e. (Sufficient/Deficient) flow
    f. Impassable fish barriers
    g. _____
    h. _____
    i. _____

Part 7: Potential Projects (Circle all that apply)

1) There are no recommended restoration projects at this time
2) Potential restoration projects include
    a. Change of grazing regime (water/fencing/etc.)
    b. Weed management
    c. Road/bridge/culvert improvement or maintenance
    d. Removal or re-design of fish barriers (irrigation diversions or other)
    e. Channel or bank stabilization_____
    f. Channel re-naturalization:_____
    g. Other: _____

Part 8: Other Notes

_____
_____
_____
_____
_____

General/Photo Documentation Field From:

Brown's Gulch Assessment Survey June 2013

Reach ID:	

Date:	
Substrate:	
Rosgen Channel:	

Primary Land Use:	
Nez Perce Veg Code:	
Plant Community:	

Lead Observer:	
BF Width (ft):	
BF Depth(ft):	
W/D Ratio (ft2):	

Begin Lat:	
Begin Long:	
Ending Lat:	
Ending Long:	

Photo 1 (top of reach) Description	
Photo 2 Description	
Photo 3 Description	
Photo 4 Description	
Photo 5 Description	

NRCS Assessment Summary:

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Riparian Health Score (%)	S1	S2, Fish Habitat Notes

Narrative/Notes:

Nez Perce Riparian Community Type Codes

CM1 Upland grand fir/cedar community with midshrub/forb understory
CM2 Riparian grand fir/cedar community with wetland shrub/forb understory
CM3 Upland grand fir/cedar community with upland forb understory
CM4 Riparian grand fir/cedar community with wetland forb understory
CC1 Upland subalpine fir/lodgepole community with upland midshrub/forb understory
CC2 Riparian subalpine fir/lodgepole community with wetland midshrub/forb understory
CC3 Upland subalpine fir/lodgepole community with upland forb understory
CCR Riparian subalpine fir/lodgepole community with riparian/wetland forb or graminoid understory
CD1 Douglas-fir/ponderosa pine with midshrub/forb understory
CD3 Douglas-fir/ponderosa pine with forb/graminoid understory
BB2 Broadleaf deciduous with shrub/forb understory
BB4 Broadleaf deciduous with forb understory
SR2 Riparian willow/alder (and so forth) with wet site grasses and sedges
SR4 Riparian willow/alder (and so forth) with wet site forbs/grasses/sedges
SD1 Upland shrub species
GR2 Grass and forb cover dominated by riparian sedges
GR4 Riparian grasses/forbs
GRD Riparian grasses/forbs with grazing indicators
GD1 Upland grass dominated
HD1 Upland forb/grass dominated
XX1 Plant cover less than 10 percent (unvegetated)

Appendix E: Detailed Field Data

Rapid Bank Erosion Inventory by Site:

BG_00	Stream Length (m)	Stream Length (ft)	Total Erosion (ft^2)	Percent Erosion (%)			
Heavens Valley	1141	3744	1237.5	6.16			
LEW				REW			
Height (ft)	Length (ft)	LEW Total (ft^2)	Notes	Height (ft)	Length (ft)	REW Total (ft^2)	Notes
1	5	5	LS-P	1	2	2	TP
1	2	2	LS-B/TP	2.5	15	37.5	LS-B/HS
2	20	40	LS-B	3	10	30	LS-B
3	10	30	LS-B	3	10	30	LS-B
3	10	30	LS-B	3	5	15	LS-B
3	10	30	LS-B	4	30	120	LS-B
3	5	15	LS-B	1	5	5	TP
3	5	15	LS-B	1	10	10	HS
4	10	40	LS-B	1	5	5	LS-B
2	15	30	LS-B	3	3	9	LS-B
1	5	5	TP	3	10	30	LS-B
2	25	50	LS-B	3	15	45	LS-B
1	15	15	LS-B	1	20	20	HS
4	20	80	LS-B	1	20	20	LS-B/HS
2	5	10	LS-B	4	25	100	LS-B
1	10	10	LS-P	1	5	5	LS-B/HS
3	5	15	LS-B				
2	5	10	LS-B				
2	20	40	LS-B				
12	12	144	HS				
3	5	15	HS				
1.5	10	15	LS-B				
4	2	8	LS-B				
4	10	40	LS-B				
2	30	60	LS-B				
TOTALS:	271	754		TOTALS:	190	483.5	

BG_19	Stream Length (m)	Stream Length (ft)	Total Erosion (ft^2)	Percent Erosion (%)			
Ueland	1312	4305	755	6.10			
LEW				REW			
Height (ft)	Length (ft)	LEW Total (ft^2)	Notes	Height (ft)	Length (ft)	REW Total (ft^2)	Notes
1	5	5	TP	2	5	10	LS-B
1	2	2	TP	1	2	2	TP
1	10	10	TP	1	7	7	TP
1	5	5	TP	1	5	5	TP
1	2	2	LS-B	1	10	10	TP
1	5	5	TP	1	15	15	TP
1	25	25	LS-B	1	25	25	LS-B
1	2	2	TP	3	3	9	LS-B
4	15	60	LS-B	1	5	5	TP
1	10	10	TP	2	20	40	LS-B
3	30	90	LS-B	1	5	5	TP
1	2	2	TP	1	4	4	TP
1	15	15	LS-B	1	5	5	TP
4	5	20	LS-B	1	3	3	TP
4	15	60	LS-B	1	10	10	TP
3	5	15	LS-B	1	5	5	TP
1	10	10	TP	1	10	10	TP
2	6	12	LS-B	1	5	5	LS-B/TP
1	2	2	TP	2	3	6	LS-B
1	2	2	TP	1	100	100	C
4	5	20	LS-B				
1	100	100	C				
TOTALS:	278	474		TOTALS:	247	281	

BG_20	Stream Length (m)	Stream Length (ft)	Total Erosion (ft^2)	Percent Erosion (%)			
Ueland	314	1030	256	7.33			
LEW				REW			
Height (ft)	Length (ft)	LEW Total (ft^2)	Notes	Height (ft)	Length (ft)	REW Total (ft^2)	Notes
1	3	3	LS-B	1	5	5	TP/LS-B
1	20	20	LS-B	1	8	8	TP
1	10	10	LS-B	1	5	5	LS-B
4	20	80	LS-B	4	15	60	LS-B
1	10	10	TP	1	15	15	TP
1	5	5	TP	1	15	15	TP
1	20	20	TP				
TOTALS:	88	148		TOTALS:	63	108	

BG_21	Stream Length (m)	Stream Length (ft)	Total Erosion (ft2)	Percent Erosion (%)			
Ueland	447	1467	680	14.22			
LEW				REW			
Height (ft)	Length (ft)	LEW Total (ft2)	Notes	Height (ft)	Length (ft)	REW Total (ft2)	Notes
1	15	15	TP	1	3	3	TP
2	23	46	TP/LS-B	1.5	10	15	LS-B
1	5	5	TP	1	16	16	TP
1	10	10	TP	1	30	30	TP/LS-B
1	25	25	TP	2	25	50	TP/LS-B
1	10	10	TP	1	10	10	TP
1	30	30	TP	4	40	160	LS-B
2	30	60	TP/LS-B	1	10	10	TP
1	20	20	TP	2	5	10	LS-B
1	10	10	TP			0	
1	25	25	TP/LS-B			0	
1	10	10	LS-B			0	
2	55	110	TP/LS-B			0	
TOTALS:	268	376		TOTALS:	149	304	

BG_22	Stream Length (m)	Stream Length (ft)	Total Erosion (ft2)	Percent Erosion (%)			
Ueland	1557	5109	1359.5	7.41			
LEW				REW			
Height (ft)	Length (ft)	LEW Total (ft2)	Notes	Height (ft)	Length (ft)	REW Total (ft2)	Notes
1	8	8	TP	0.5	5	2.5	TP
1	5	5	TP	5	20	100	LS-B
1	10	10	LS-B	1	20	20	TP
1	5	5	TP	1	10	10	LS-B
1	5	5	TP	1	10	10	TP
1	35	35	LS-B	2	5	10	LS-B
2	15	30	LS-B	1	12	12	TP
1	35	35	TP	1	20	20	LS-B/TP
1.5	70	105	TP/LS-B	1	3	3	TP
1	20	20	LS-B	4	15	60	LS-B
3	20	60	LS-B	1	10	10	TP
1	12	12	TP	1	10	10	TP
2	8	16	LS-B	1	6	6	TP
1	10	10	LS-B	2.5	20	50	LS-B/TP
3	40	120	LS-B	1	20	20	LS-B
1	10	10	TP	2	15	30	LS-B
1	3	3	TP	1	2	2	TP
3	45	135	LS-B	1	10	10	TP
1	10	10	TP	1	3	3	TP
1	5	5	TP	1	10	10	TP
2	45	90	LS-B	2	30	60	TP
2	12	24	LS-B	3	10	30	LS-B
2	55	110	LS-B/TP	1	8	8	TP
TOTALS:	483	863		TOTALS:	274	496.5	

BG_23A	Stream Length (m)	Stream Length (ft)	Total Erosion (ft^2)	Percent Erosion (%)			
Ueland	1753	5752	780	5.49			
LEW				REW			
Height (ft)	Length (ft)	LEW Total (ft^2)	Notes	Height (ft)	Length (ft)	REW Total (ft^2)	Notes
1	15	15	LS-P	1	5	5	LS-P
1	15	15	LS-P	1	17	17	LS-P
1	4	4	TP	1	8	8	TP
1	7	7	TP	1	2	2	TP
1	4	4	TP	1	2	2	TP
1	45	45	LS-P	1	6	6	TP
1	5	5	TP	1	10	10	TP
1	3	3	LS-P	1	4	4	TP
1	15	15	TP	1	5	5	TP
2	18	36	LS-B	1	2	2	TP
1	5	5	TP	2	4	8	LS-B
1	2	2	TP	2	5	10	TP
1	10	10	TP	2	5	10	LS-B
1	20	20	TP	1	16	16	LS-B
1	10	10	TP	1	3	3	TP
1	10	10	TP	1	4	4	TP
1	10	10	TP	1	25	25	TP
1	4	4	TP	1	4	4	TP
1	60	60	TP	2	12	24	LS-B & I
1	12	12	TP	2	27	54	LS-B
3	5	15	LS-B	2	6	12	LS-B
2	6	12	LS-B	2	24	48	LS-B & I
2	4	8	TP	1	35	35	TP
1	8	8	TP	1	30	30	TP
1	12	12	TP	1	35	35	LS-B
2	12	24	LS-B				
2	15	30	TP				
TOTALS:	336	401		TOTALS:	296	379	

BG_23B	Stream Length (m)	Stream Length (ft)	Total Erosion (ft^2)	Percent Erosion (%)			
Ueland	1017	3337	1102	12.95			
LEW				REW			
Height (ft)	Length (ft)	LEW Total (ft^2)	Notes	Height (ft)	Length (ft)	REW Total (ft^2)	Notes
1	35	35	TP	1	48	48	LS-B/I
2	10	20	LS-B	1	32	32	TP/VEHICLE X
1	8	8	LS-B	2	32	64	LS-B
3	20	60	LS-B	2	34	68	LS-B
1	40	40	TP	1	20	20	TP
2	74	148	LS-B	1	4	4	LS-B
1	20	20	TP	1	16	16	TP
1	30	30	TP	2	20	40	LS-B
1	60	60	TP/LS-B	1	8	8	LS-B
1	15	15	TP	1	24	24	TP
1	30	30	TP	2	28	56	LS-B/TP
1	20	20	TP/LS-B	1	28	28	LS-B/TP
1	20	20	TP	1	26	26	LS-B/TP
1	25	25	TP	1	20	20	TP
1	60	60	TP	1	12	12	LS-B
1	4	4	TP	1	22	22	TP
				1	5	5	TP
				1	10	10	TP
				1	4	4	TP
TOTALS:	471	595		TOTALS:	393	507	

BG_24	Stream Length (m)	Stream Length (ft)	Total Erosion (ft^2)	Percent Erosion (%)			
Ueland	1481	4859	1335	10.09			
LEW				REW			
Height (ft)	Length (ft)	LEW Total (ft^2)	Notes	Height (ft)	Length (ft)	REW Total (ft^2)	Notes
2	16	32	LS-B/TP	2	4	8	LS-B
1	9	9	TP	1	35	35	TP
1	6	6	TP	1	4	4	TP
1	10	10	TP	4	24	96	LS-B
1	55	55	TP	1	6	6	TP
1	15	15	TP	1	74	74	TP
2	40	80	NC	4	5	20	NC
1	7	7	TP	3	10	30	NC
1	30	30	TP	1	10	10	TP
1	3	3	TP	2	56	112	NC
1.5	22	33	NC	2	24	48	NC
1	10	10	TP	1	22	22	TP
1	30	30	NC	1	16	16	TP
1	21	21	TP/NC	2	10	20	NC
1	10	10	TP	1	24	24	TP
1	24	24	TP	2	12	24	NC
2	20	40	NC	2	24	48	NC
1	75	75	TP	1	48	48	TP
2	10	20	NC	1	23	23	TP
1	42	42	TP	2	20	40	I
1	65	65	TP				
1	10	10	TP				
TOTALS:	530	627		TOTALS:	451	708	

BG_25	Stream Length (m)	Stream Length (ft)	Total Erosion (ft^2)	Percent Erosion (%)			
Earhart	246	807	0	0.00			
LEW				REW			
Height (ft)	Length (ft)	LEW Total (ft^2)	Notes	Height (ft)	Length (ft)	REW Total (ft^2)	Notes
0	0	0		0	0	0	
TOTALS:	0	0		TOTALS:	0	0	

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