Stressor Identification for Assessment Unit # ID17010104PN011_02a
Lower Kootenai River Subbasin

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Summary

Assessment Unit #ID17010104PN011_02a includes the lower portion of Ball Creek from the national forest boundary, across the valley floor, to the Kootenai River. Stressor identification for Assessment Unit #ID17010104PN011_02a was completed with aid from CADDIS (Causal Analysis/Diagnosis Decision Information System), EPA's *Stressor Identification Guidance Document* (EPA, 2000), and from physical, chemical and biological data collected in the unit.

Assessment Unit #ID17010104PN011_02 (Ball Creek - source to mouth) was listed in the Idaho DEQ 2002 Integrated Report Section 5 as impaired for reasons associated with temperature. In the Idaho DEQ 2008 Integrated Report Section 5 assessment unit #ID17010104PN011_02a (Ball Creek - lower portion, forest to Kootenai River) continued to be listed for temperature and benthic macroinvertebrate bio-assessments. This stressor identification analysis was initiated to elucidate the causes of the biological assessment test failure.

Eight candidate causes were identified and were analyzed based on the available data. Those causes that are unlikely to be involved in the habitat/biological impairments of the assessment unit will be eliminated from consideration. This analysis brings forth likely candidate causes for further in depth investigation.

Section 1.0 Scope of Investigation

Assessment Unit #ID17010104PN011_02a includes the lower portion of Ball Creek that extend approximately 1000 meters across the lowland agricultural area of the Kootenai River valley (see Figures 1 & 2). The assessment unit extends part way through forested landscape from the Kaniksu National Forest boundary to the main road along the river valley. From the road to the river, the landscape is primarily agricultural used for grazing pasture and possibly hay or row crops. The assessment unit is entirely on private ground.

The Kootenai River from Shorty's Island to the Canadian border is in a broad agricultural valley and is very sinuous throughout (see Figure 2). The Ball Creek watershed is located on the west side of the valley between Burton Creek to the south and Trout Creek to the north. Ball Creek above this assessment unit is primarily forested and in the Kaniksu National Forest (Figure 1).

Upper portions of watersheds in forested lands can experience impacts from roads and timber harvest activities on slopes (sedimentation from erosion and runoff, road crossings, landslide and slumps, etc.). Whereas lower portions of Ball Creek will be depositional and exposed to a variety of agricultural related impacts (channelization, diversions, removal of vegetative cover, field runoff, etc.).

Stressor identification for Assessment Unit #ID17010104PN011_02a was completed with aid from the CADDIS (Causal Analysis/Diagnosis Decision Information System) program (http://cfpub.epa.gov/caddis/), EPA's *Stressor Identification Guidance Document* (EPA, 2000), and from physical, chemical and biological data collected by Idaho DEQ, Idaho Department of Lands (IDL), U.S. Forest Service (USFS) and others.

A map and an aerial photo view of the Assessment Unit are found in Figures 1 and 2.

Figure 1. Land Status Map for Assessment Unit #ID17010104PN011_02a.

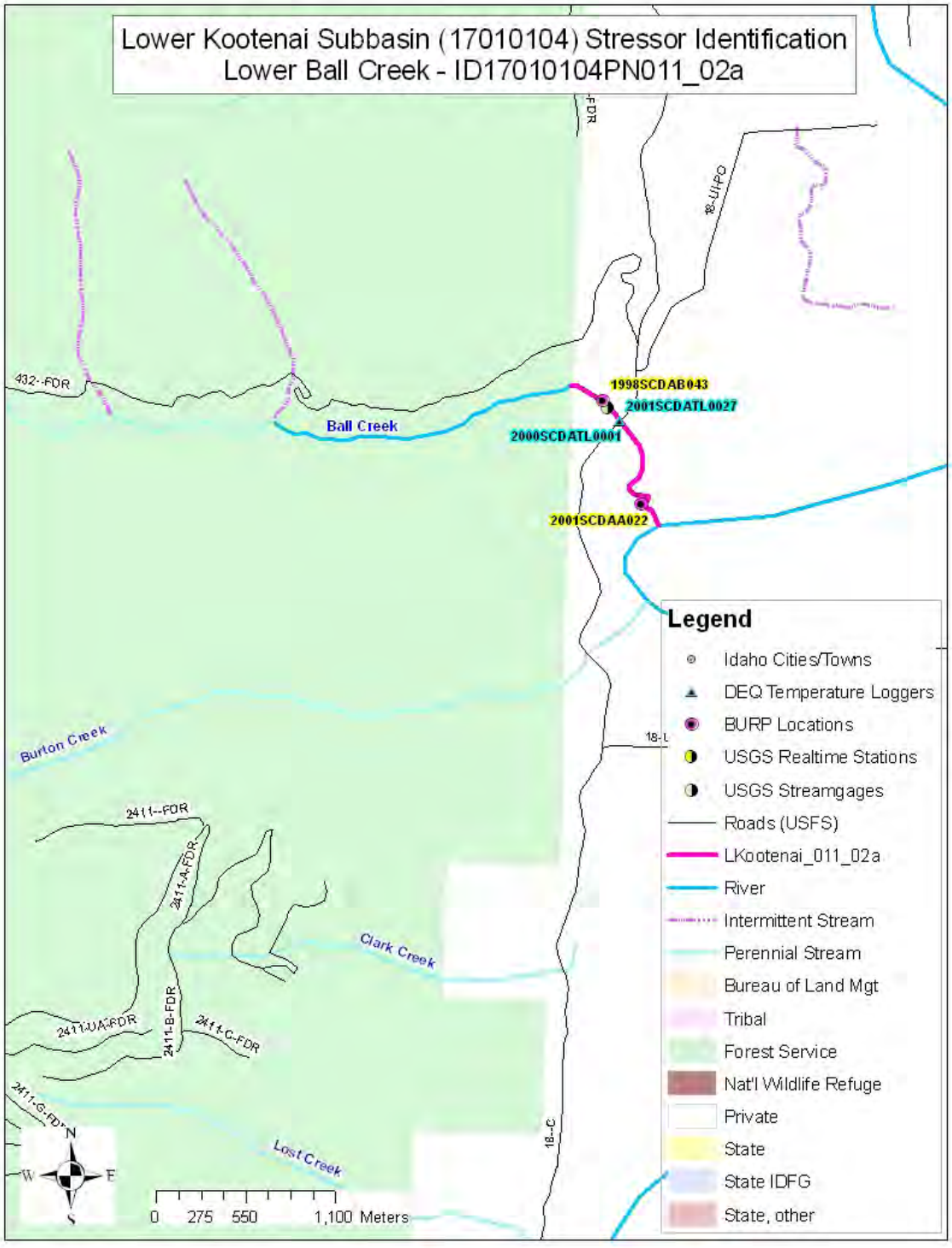
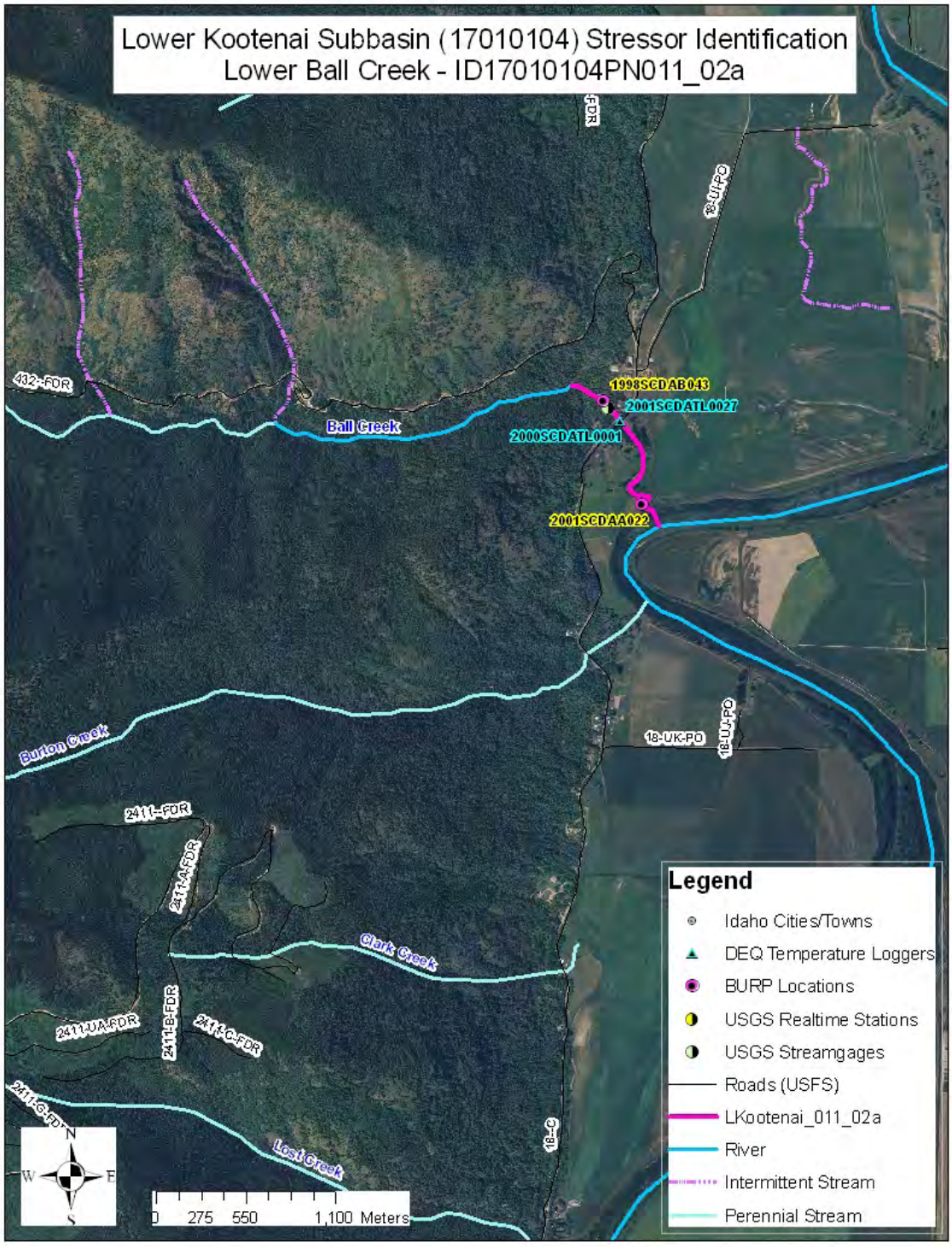


Figure 2. Aerial View of Assessment Unit #ID17010104PN011_02a.



Section 2.0 Description of the Impairment

Assessment Unit #ID17010104PN011_02a was listed in the Idaho DEQ 2008 Integrated Report Section 5 as impaired for reasons associated with temperature and benthic macroinvertebrate bio-assessments. Essentially, this second listing indicates that BURP sampling in the assessment unit revealed that streams failed to pass assessment tests conducted on biological data.

Table 1 shows the index scores for the BURP site in the assessment unit. These scores were generated using the Idaho DEQ Water Body Assessment Guidance (WBAG) protocols (Grafe et al., 2002). Multimetric indices were generated from macroinvertebrate, fish and stream habitat data collected at BURP sites. These indices are then rated based on their values relative to bio-regional values calculated for least disturbed sites (Table 2). Ratings (0 to 3) for the macroinvertebrate index (SMI), the fish index (SFI), and the habitat index (SHI) are then combined to form an overall rating (also 0 to 3). In order to pass an assessment test the overall rating needs to be 2 or greater.

Table 1. Assessment Scores and Rating for AU #ID17010104PN011_02a.

Assessment Unit	Stream	BURP ID	SMI (rating)	SFI (rating)	SHI (rating)	Overall Rating
ID17010104PN011_02a	Ball Creek	2001SCDAA022	64.45 (2)	79.17 (2)	31 (1)	1.66
ID17010104PN011_02a	Ball Creek	1998SCDAB043	64.72 (2)	64.8 (1)	83 (3)	2

Although there are two sites listed in Table 1, the older site (1998SCDAB043) was not used in the latest assessment of this assessment unit. Therefore, the assessment unit's biological/habitat impairment rating is solely based on results obtained from the one location on Ball Creek. The BURP site on the lower portion of Ball Creek near its mouth (2001SCDAA022, see Photo 1) failed as a result of poor habitat (SHI) scores. Macroinvertebrate (SMI) and fish (SFI) scores were sufficient to pass the assessment test.

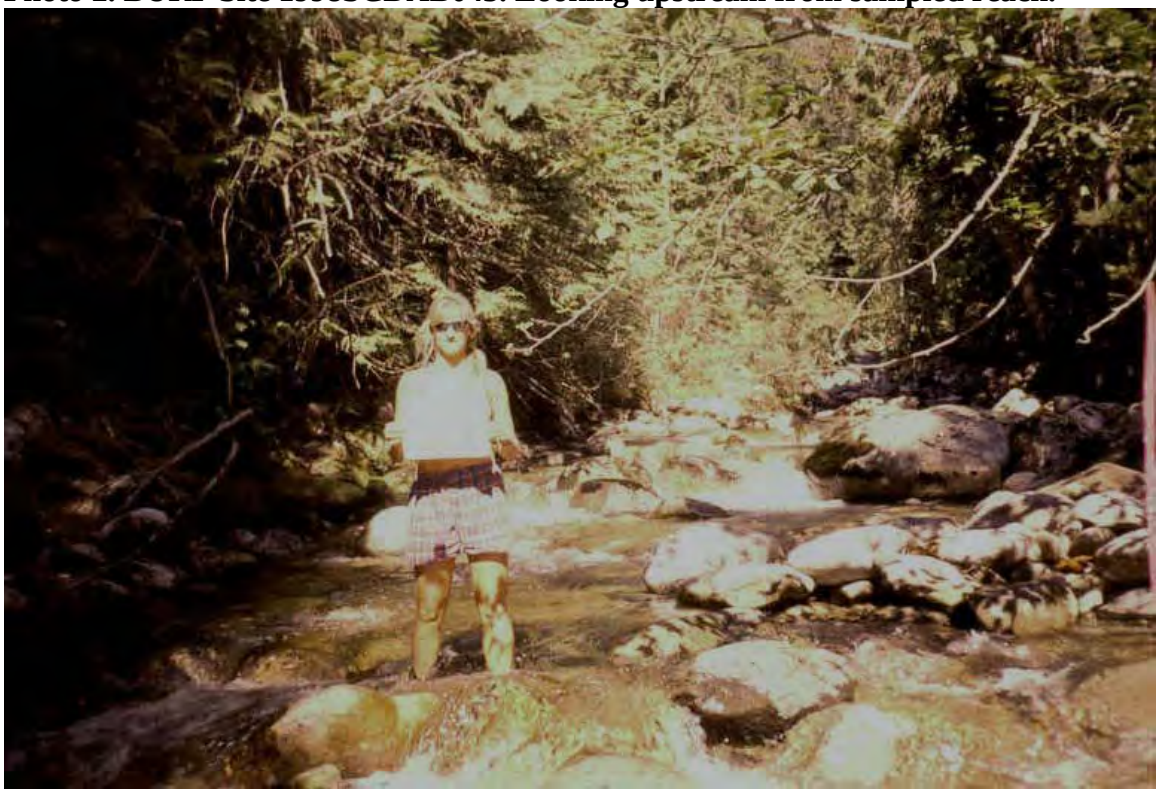
In 1998, a BURP location on the upper portion of the assessment unit near the Kaniksu National Forest produced relatively high value index scores with an overall rating of 2, although the fish index rating was low. That site was considerably more forested then the 2001 site (see Photo 2).

Table 2. Index Rating for Northern Idaho Streams.

Condition Category	SMI (Northern Mountains)	SFI (Forest)	SHI (Northern Rockies)	Condition Rating
Above 25th percentile of reference condition	≥65	≥81	≥66	3
10th to 25th percentile of reference condition	57-64	67-80	58-65	2
Minimum to 10th percentile of reference condition	39-56	34-66	<58	1
Below minimum of reference condition	<39	<34	N/A	0

Photo 1. BURP Site 2001SCDAA022. Looking upstream through sampled reach.

Photo 2. BURP Site 1998SCDAB043. Looking upstream from sampled reach.



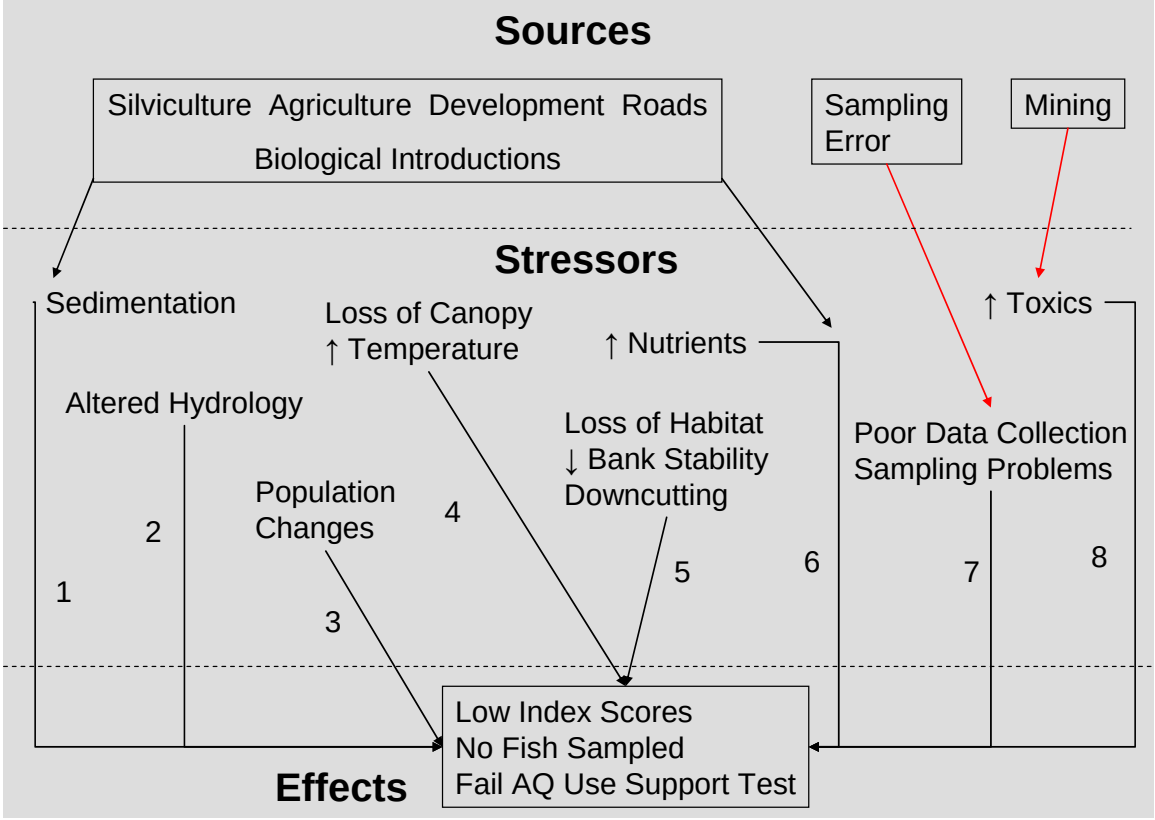
Section 3.0 Candidate Causes

In order to suggest what may affect index scores for the assessment unit in question, a list of possible causes needs to be constructed. Figure 3 presents a simple conceptual model of candidate causes that may lead to poor biological/habitat scoring. The model presents eight candidate causes as stressors that include:

1. Increased **sedimentation** (bedload and suspended) from many of the activities that could occur in the watershed (silviculture, agriculture, rural development, and roads) may result from field and trail runoff, mass failures, road cuts and fills, etc. Excess sediment leads to loss of habitat for macroinvertebrates and fish by the filling of gravel spaces with sand and silt. An over-abundance of sediment can decrease intergravel dissolved oxygen needed for fry development and drive sensitive macroinvertebrates out of the system to be replaced by more tolerant species.
2. Many activities that change the face of the land and increase runoff can alter the hydrology. An **altered hydrology** affects the streams ability to maintain flow and prevent bank erosion and downcutting. Streams can lose baseflow resulting in insufficient water during dry season for aquatic life. Streams can over-widen and increase width/depth ratios resulting in decreased shade and increased water temperatures resulting in loss of cold water species.
3. **Population changes** can result from a variety of interspecies conflicts that result from introductions of alien species including competition, parasitism and predation. Additionally, population changes can result from complications due to small populations (genetic loss, inbreeding, genetic alteration, etc.). Small populations result from habitat loss and loss of connectivity to regional populations.
4. Many activities and natural wildfire can cause a **loss of canopy** shade through direct removal of riparian vegetation. Again, this can result in increased water temperatures that affect biological communities.
5. **Loss of instream habitat** and bank stability can result from modifications to the channel (channelization, trenching and field draining, dikes, berms, instream structures) and changes to the hydrology of the system (see #2). This in turn affects the ability of some species to remain in the system due to loss of habitat, sedimentation, temperature increases, etc.
6. Certain kinds of activities may lead to **increased nutrients** (phosphorus and nitrogen) in the water column. Increased nutrients can cause algae blooms and other un-wanted plant growth instream, the decomposition of which uses up valuable dissolved oxygen, cause warming and can eliminate habitat.
7. Poor macroinvertebrate and fish scores may result from **sampling errors** where field methods are not followed correctly resulting in poor collection events. Sample containers may leak or be inadvertently destroyed resulting in a loss of data.
8. **Toxic pollutants** that are heavy metals may be introduced into the system from mining operations or legacy mine problems should they exist in the watershed. Other toxic pollutants may occur but are unlikely given the rural setting, unless

they are localized introductions of farm chemicals. Increased concentrations of metals and other toxic pollutants can lead to reduction or elimination of sensitive species.

Figure 3. Conceptual Model of Candidate Causes for AU #ID17010104PN011_02a.



Section 4.0 Existing Data

Existing data for AU #ID17010104PN011_02a are very limited. No data have been acquired from Idaho Department of Lands, Idaho Fish and Game, or U.S. Forest Service. Other than some water chemistry data collected on Ball Creeks in the 1970s by USGS, all the data are from the lower reach of Ball Creek collected by DEQ.

4.1 Physical Habitat Data

The habitat metrics that go into the formulation of the Stream Habitat Index (SHI) are presented in Table 3 for the BURP sites on lower Ball Creek. Metric values for the 2001 site are relatively inconsistent with the average of all BURP sites in the Lower Kootenai subbasin with passing SHI scores (Ave Supporting). The lower BURP site (2001SCDAA022) had poor scores for bank cover and stability, canopy, percent fines, embeddedness and width/depth ratio. These data suggest that sediment from bank erosion and temperature are likely to be impacting the lower segment of Ball Creek. The 1998 site had much better bank and canopy cover, and percent fines were not as high as the 2001 site. Pool/riffle ratio was of lower quality at this upper site as well.

Table 3. Habitat Metrics for BURP Sites in AU #ID17010104PN011_02a.

BURP ID	Bank Cover (%)	Bank Stability (%)	Canopy (%)	Fines (%)	Embedded Score	Channel Shape Score	Pool/Riffle Ratio	Ave Wetted Width (m)	Ave Wetted Depth (m)	Width/ Depth Ratio	Discharge (cfs)	SHI
2001SCDAA022	7.5	7.5	3	21.5	0	6	2.1	5.7	0.21	27.2	4.05	31
1998SCDAB043	100	96.5	70.5	10	20	5	0.17	6.4	0.31	20.9	13.8	83
Ave Supporting	98.2	99.3	65.7	5.6	14.6	5.3	0.75	6.6	0.04	18.7	5.9	78.4

4.2 Biological Data

The 2001 BURP site on lower Ball Creek produced cutthroat trout when electrofished (Table 4). The site's scores were relatively good compared to the average of all BURP sites in the Lower Kootenai subbasin with passing SFI scores (Ave Supporting). However, because there was only one taxon the sculpin age classes and the cold water taxa number suffered as a result. Electrofishing at the 1998 site yielded similar results, however, there were more less-sensitive species present.

Table 4. Fish Metrics for BURP Sites in AU #ID17010104PN011_02a.

BURP ID	Cold Water Taxa	% Cold Water	% Sensitive	Sculpin Age Classes	Salmonid Age Classes	CPUE	SFI
2001SCDAA022	1	100	100	0	2	6.85	79.17
1998SCDAB043	2	89.7	69	0	3	1.05	64.8
Ave Supporting	1.97	93.9	59.3	1.1	3.1	8.7	81.1

Macroinvertebrate metrics (Table 5) for the sites on lower Ball Creek showed index values similar to the average of all BURP sites in the Lower Kootenai subbasin with passing SMI scores (Ave Supporting). The 2001 site had abundant taxa including EPT taxa, however their scores were somewhat diluted by an apparent abundance of less sensitive taxa. Thus, percent Plecoptera, percent scrapers, percent clinger values were

lower than expected, and HBI and percent dominance by the top five taxa increased as a result. The 1994 site was slightly more consistent with average supporting values than the 2001 site. The lack of scrapper and clinger abundance at the 2001 site suggests that sedimentation and loss of habitat are having a slight affect on macroinvertebrate populations.

Table 5. Macroinvertebrate Metrics for BURP Sites in AU #ID17010104PN011_02a.

BURP ID	Total Taxa	Ephemeroptera Taxa	Plecoptera Taxa	Trichoptera Taxa	% Plecoptera	HBI	% Dominance of top 5 taxa	% Scraper	% Clinger	SMI
2001SCDAA022	37	13	7	7	5.4	5.94	79.5	6.3	40	64.4
1998SCDAB043	30	8	8	6	12	4.9	66.8	47.1	74.5	64.7
Ave Supporting	34.3	9.2	6.9	7.5	13.3	4.97	67.2	25.3	58.3	68.1

4.3 Water Chemistry

Water chemistry data for the assessment unit are extremely limited. Most data points in Table 6 were taken at USGS temporary gage stations in the 1970s in the upper portion of this assessment unit. Data are not remarkable and no specific problems are suggested (other than temperature). There were several suspended sediment measurements including one turbidity measurement in Jackson Turbidity Units (JTU) which are no longer used today and are not directly comparable to the Nephelometric Turbidity Units (NTU) used today. These data are insufficient to suggest any water quality problems from suspended sediment.

The E. coli count measured on August 9, 2001 did not exceed the single value action levels (406 or 576 per 100mL) to suggest potential violation of recreation criteria.

There were two temperature loggers placed in Ball Creek in this assessment unit, one in 2000 and the other in 2001. The 19 °C and 18.7 °C maximum daily maximum temperatures (MDMT) are the highest of a series of temperatures recorded with temperature loggers by DEQ in this assessment unit. Both loggers showed 16 or more consecutive days of exceedance of the 13 °C fall salmonid spawning maximum temperature criterion applied to the default time period starting on August 1st. Neither logger showed any exceedances of cold water aquatic life criteria.

Table 6. Water Chemistry Data Collected in AU #ID17010104PN011_02a.

Date	Stream	Temperature* (°C)	pH	Dissolved Oxygen (mg/L)	Specific Conductance (µs/cm)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	E. coli (#/100mL)	Total Coliform (#/100mL)	Discharge (cfs)	Suspended Sediment (mg/L)	Turbidity (JTU)
2/22/1973	Ball Creek	0.5			43					9.8		
4/17/1973	Ball Creek	3			32					33		
6/14/1973	Ball Creek	6.5			16					106		
7/23/1973	Ball Creek	13			39					11		
8/17/1973	Ball Creek	12			35					3.4		
10/24/1973	Ball Creek	8			26					21		
11/19/1973	Ball Creek	3.5			19					53		
12/10/1973	Ball Creek	1			31					31		
1/29/1974	Ball Creek	3			30					51		
3/20/1974	Ball Creek	2.5			33					38		
4/24/1974	Ball Creek	5.5			25					126		
5/15/1974	Ball Creek	15			26					149		
6/13/1974	Ball Creek	8.5			14					553		
7/26/1974	Ball Creek	11			19					53		
8/21/1974	Ball Creek	13			24					18		
9/19/1974	Ball Creek	9.5			33					5.4		
10/24/1974	Ball Creek	3			36					3.2		
1/23/1975	Ball Creek	1			16					19		
1/24/1975	Ball Creek	1			1					19		
3/6/1975	Ball Creek	1			45					12		
4/9/1975	Ball Creek	2.5			43					9.4		
5/20/1975	Ball Creek	5.5			19					186		
6/3/1975	Ball Creek	6			15					518		
6/3/1975	Ball Creek										40	3
6/30/1975	Ball Creek	8.5			18					130		
8/21/1975	Ball Creek	14								9.4		
10/6/1975	Ball Creek	8			28					27		
11/25/1975	Ball Creek	0			25					29		
12/4/1975	Ball Creek										132	
12/4/1975	Ball Creek				22					395		
1/8/1976	Ball Creek	1								22		
2/17/1976	Ball Creek	2			31					13		
4/5/1976	Ball Creek	3			41					31		
6/2/1976	Ball Creek	4			19					129		
7/12/1976	Ball Creek	12			14					68		
9/9/1976	Ball Creek	8			29					18		
10/6/1976	Ball Creek	6			25					8.7		
11/30/1976	Ball Creek	0			32					6.4		
1/27/1977	Ball Creek	0.5								4.5		
3/7/1977	Ball Creek	1			34					5.6		
4/28/1977	Ball Creek	5			20					80		
6/1/1977	Ball Creek	10			17					73		
7/13/1977	Ball Creek	13.5			25					9.8		
9/6/1977	Ball Creek	11.5			20					7.8		
10/3/1977	Ball Creek	6.5			29					9.9		
12/1/1977	Ball Creek	1			24					20		
1/17/1978	Ball Creek	1			50					8.9		
4/13/1978	Ball Creek	3.5			30					54		
5/18/1978	Ball Creek	6			29					220		
7/27/1978	Ball Creek	15.5			24					25		
9/11/1978	Ball Creek	11			30					6.3		
10/13/1978	Ball Creek	4			29					6.1		
11/21/1978	Ball Creek	0.5			35					13		
1/3/1979	Ball Creek	0			24					5.6		
3/2/1979	Ball Creek	0.5			36					3.8		
3/30/1979	Ball Creek	2.5			86					9.8		
5/1/1979	Ball Creek	3.5			19					134		
6/13/1979	Ball Creek	8.5			14					110		
9/5/1979	Ball Creek	11			30					8		
9/18/2000	Ball Creek	19 (MDMT)										
8/16/2001	Ball Creek	18.7 (MDMT)										
7/29/1998	Ball Creek	17								13.8		
8/7/2001	Ball Creek	16								4.05		
8/9/2001	Ball Creek							18	300			

*Temperatures are instantaneous readings unless otherwise noted.

Section 5.0 Analysis

The eight candidate causes identified in Section 3.0 are analyzed here based on the available data. Those causes that are unlikely to be involved in the habitat/biological impairments of the assessment unit will be eliminated from consideration. This analysis brings forth likely candidate causes for further in depth investigation.

5.1 Stressor Refinement

1. There is some evidence that sedimentation is occurring in the lower reaches of Ball Creek that are likely to result in poor habitat scores. Habitat metrics such as percent fines, bank cover and bank stability suggest that excess sediment maybe in place and erosion maybe occurring, which would in turn could cause a loss of taxa that are generally sensitive to excess sediment. There are no BURP sites in the upper part of the watershed to determine if it is impacted or contributing excess sediment to the system. However, there is some timber harvest activity within the watershed. Additionally, the lower portion of Ball Creek is a low gradient depositional area that one would expect to find sediment deposition occurring. To what degree land uses are exacerbating sedimentation has not been determined. Regarding habitat and biological index scores, the lowland depositional areas are being held to the same test as the higher gradient forested portion of these streams, which may not be appropriate.
2. Hydrological alteration cannot be ruled out. There was evidence from the site photos that this section of Ball Creek has been channelized or downcut. Whether or not flow diversion or field draining has taken place to affect hydrology is unknown. The high banks and lack of bank stability suggest that the stream has downcut considerably in the lowland section and there is likely a loss of connection with its flood plain.
3. Although it is a possible cause, there is no evidence of biological invasions that maybe affecting macroinvertebrate populations.
4. Water temperature maybe a problem in the Ball Creek watershed. Habitat metrics suggest that the lower reach lacks adequate canopy cover. Measured temperature did exceed salmonid spawning criteria in early fall. If it can be demonstrated that early fall spawning does not occur in these waters and is not appropriate to evaluate in August and September, then water temperature in Ball Creek may not be impairing uses.
5. We have indicated that bank instability and channelization are likely occurring in the lower portion of the Ball Creek watershed. Channelization, dikes or berms, and downcutting may have occurred as suggested by photographs. These activities can lead to loss of habitat and a reduction in biological communities.
6. There is no evidence that nutrients are in excess in the Ball Creek watershed. To our knowledge visible slime growth, excess algae and other macrophytes have not been reported for streams in the assessment unit. However, no data have been collected on water chemistry to confirm normal nutrient status.

7. To our knowledge, BURP sampling occurred in an appropriate manner and there were no problems, sample mishandling nor loss of data.
8. To our knowledge, there are not current or legacy mining activities in the assessment unit other than sand and gravel. However, no water chemistry sampling has taken place to confirm a lack of toxic pollutants. The introduction of agricultural chemicals or other accidental spills cannot be ruled out.

5.2 Candidate Cause Elimination

There is a lack of information and data about this assessment unit, so ruling out candidate causes is difficult. We feel somewhat confident that excess nutrients, sampling error, biological invasion by alien species, and toxic pollutants are not causing the problems associated with low habitat scores in lower Ball Creek. Temperature could play a role in affecting species distributions in Ball Creek. Habitat data suggest that there is a lack of adequate riparian cover to prevent excess heat loading. There are some fall salmonid spawning criteria issues, however this may result from improper application of spawning time intervals. It is more likely that excess sediment and channel/habitat alteration are leading causes of low habitat scores.

Section 6.0 Conclusions

Assessment Unit # ID17010104PN011_02a is a small 1000 meter stretch of Ball Creek in the Kootenai River valley. One BURP site represents the condition and the majority of the data about this stretch of creek.

The lowland portion of Ball Creek to some extent would be expected to be a depositional area with high sediment bedload. The lower BURP site has index scores that are held to the same test as higher gradient, forested sites which maybe misleading. However, there is evidence that Ball Creek in this lowland section has had channel alterations leading to downcutting, removal and replacement of natural tree/shrub riparian vegetation with grasses, and some bank stability issues. Therefore, the most likely causes of low habitat scores in lower Ball Creek are habitat alteration and possibly excess sediment.

Section 7.0 References

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