Stressor Identification for Assessment Unit # ID17010104PN033_03

Lower Kootenai River Subbasin

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Table of Contents

List of Tables

List of Figures

Summary

Assessment Unit #ID17010104PN033_03 includes an upper portion of Boulder Creek from Rummy Creek to the East Fork Boulder Creek. Stressor identification for Assessment Unit #ID17010104PN033_03 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 #ID17010104PN033_03 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, this assessment unit was listed as impaired for reasons associated with combined biota/habitat bio-assessments. This stressor identification analysis was initiated to elucidate the causes of the bio-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.

The upper portion of Boulder Creek is a forested watershed that appears only lightly harvested. However, roads are common along the stream. There is minor evidence that Boulder Creek in this section has had habitat alterations leading to partial removal and replacement of natural tree/shrub riparian vegetation, and some loss of canopy. This is likely due to roads and primitive camping activities. Therefore, the most likely cause of low biological scores in upper Boulder Creek, if that condition even exists, is high water temperature.

Section 1.0 Scope of Investigation

Assessment Unit #ID17010104PN033_03 includes an upper portion of Boulder Creek from Rummy Creek to the confluence with the East Fork Boulder Creek (see Figures 1 & 2). This portion of the Boulder Creek watershed is entirely forested and within the Kaniksu National Forest.

The upper Boulder Creek watershed contains the Middle Fork Boulder Creek and numerous named and un-named tributaries to Boulder Creek (e.g. Clifty Creek, Pouch Creek, Black Creek, Cabin Creek, and Pinochle Creek). The watershed is south of Bonner's Ferry, Idaho and east of Naples, Idaho. Boulder Creek drains to the Kootenai River approximately 700 meters downstream from the border with the state of Montana.

Cumulative Watershed Effects (CWE) Assessments were conducted in the Upper and Lower Boulder Creek watersheds in 2003 by the Idaho Department of Lands (IDL, 2003a & IDL, 2003b). The CWE process divided the two watersheds at a different location then DEQ does with its assessment units. CWE divided upper from lower just upstream from Clifty Creek, thus a portion of assessment unit ID17010104PN033_03 is located in CWE's lower Boulder Creek assessment. The CWE report for Upper Boulder Creek described the watershed as follows:

"*Upper Boulder Creek is a 15,762 acre forested sub-section of the Boulder Creek Watershed in northern Idaho managed for multiple uses. For the purposes of this assessment, Upper Boulder Creek, along with major and minor tributaries, are referred to as Upper Boulder Creek. Upper Boulder Creek flows into flows into the Kootenai River. The lower end of Boulder Creek Watershed is generally accessed from Bonners Ferry by heading east on County Route 24 then to Primary Forest Route 314 and Forest Route 408 (totaling approximately twenty-two miles east of Bonners Ferry). Upper Boulder Creek is approximately six miles upstream from where Boulder Creek enters the Kootenai River. Land ownership is Unites States Forest Service. The watershed is located in Boundary County (Figure 1).*

Boulder Creek is a fourth order tributary, with a dendritic stream feeder pattern to the Kootenai River. The drainage is oriented in a northly direction with side tributaries flowing east and west. Elevation in the watershed ranges from 3,360 feet above sea level where Upper Boulder Creek enters Lower Boulder Creek to 6,426 feet above sea level on Iron Mountain.

The Upper Boulder Creek drainage is predominantly underlain by highly and weakly weathered Belt Supergroup Metasediments with glacial drift and till dominating the main stem flood plain and lower tributary flood plains. To a lesser extent the drainage is underlain in areas with Columbia River Basalt and weakly weathered granitics. The geologic types are typically divided, with the highly weathered material occurring along the lower elevations, and the weakly weathered material occupies the uplands and ridgelines.

The area is characterized by warm dry summers and cold wet winters with an average annual precipitation ranging from forty inches at the lower elevations to fifty inches at

the higher elevations. The majority of precipitation occurs as winter snowfall and spring rain. High-volume runoff occurs during spring snowmelt and major rain-on-snow events.

Vegetation varies with elevation and aspect. Strong south to west facing slopes at lower elevations support forbs, grasses, and ponderosa pine savannah. On north slopes, and with increasing elevation, forest stands become denser with a greater number of coniferous species. The presence of Douglas-fir, grand fir, western larch, lodgepole pine, western red cedar, western white pine, and western hemlock increases with increasing elevation and effective precipitation."

Stressor identification for Assessment Unit #ID17010104PN033_03 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 #ID17010104PN033_03.

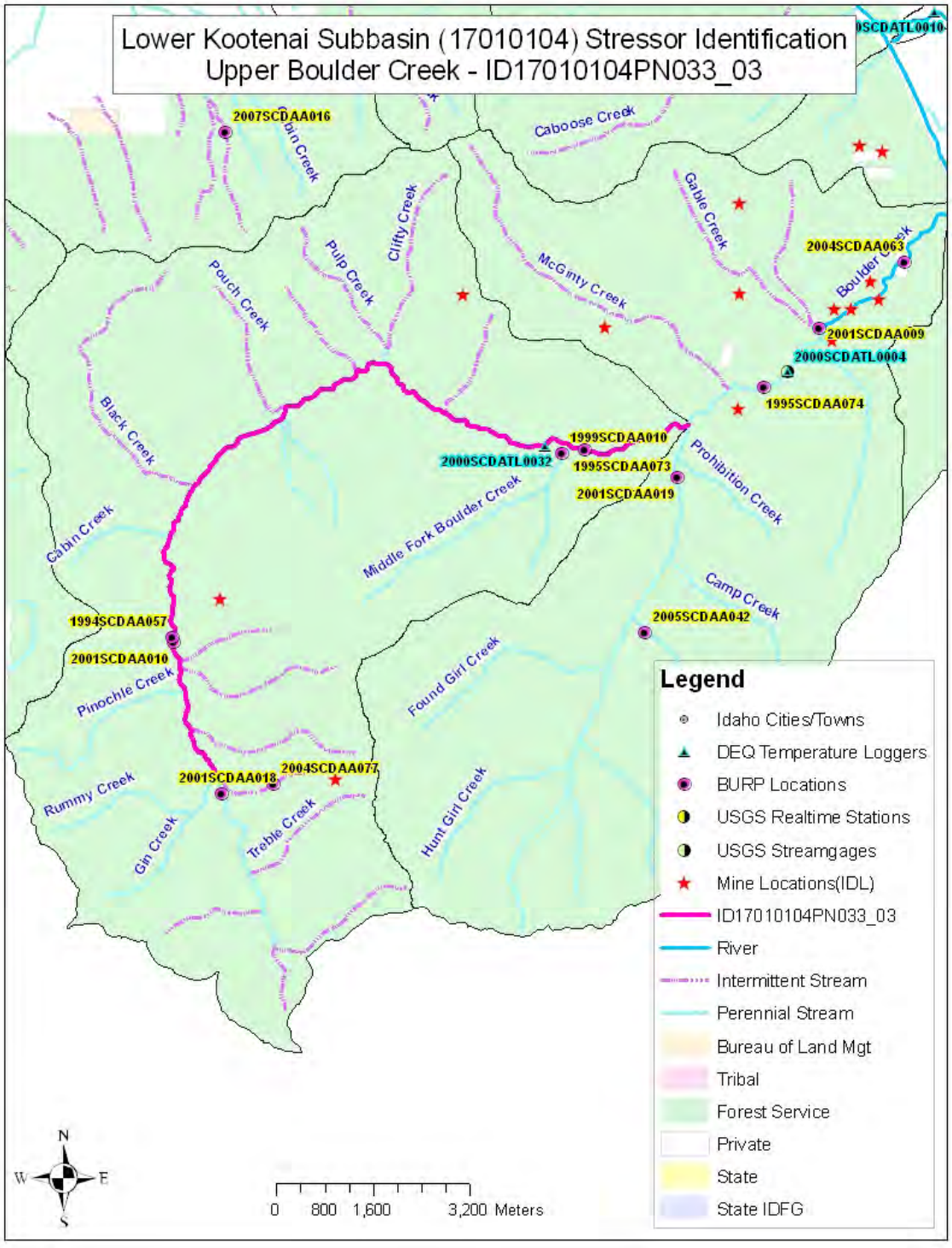
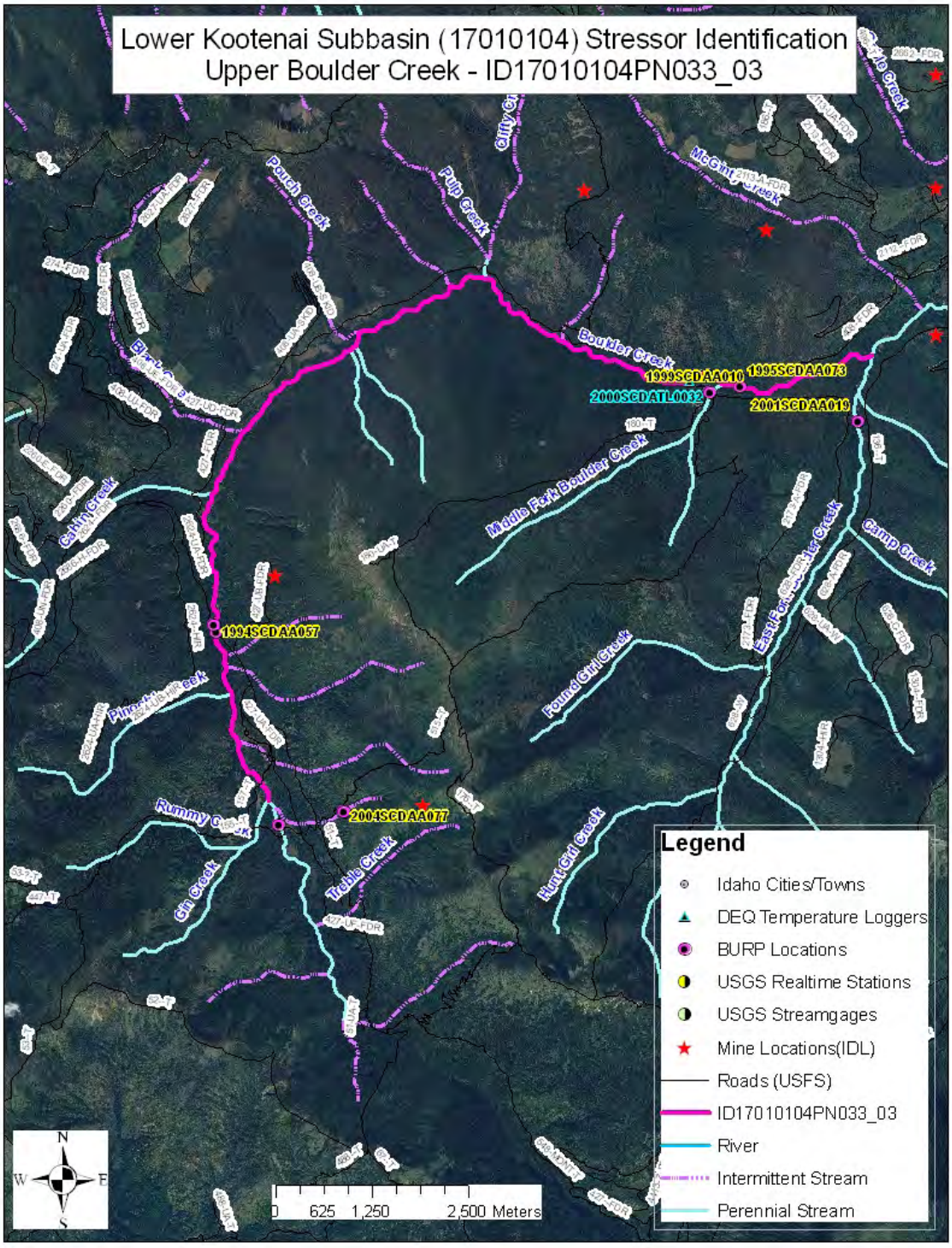


Figure 2. Aerial View of Assessment Unit #ID17010104PN033_03.



Section 2.0 Description of the Impairment

Assessment Unit #ID17010104PN033_03 was listed in the Idaho DEQ 2008 Integrated Report Section 5 as impaired for reasons associated with combined biota and habitat assessment scores. Essentially, this second listing indicates that BURP sampling in the assessment unit revealed that streams failed to pass assessment tests conducted on biological and stream habitat data.

Table 1 shows the index scores for the BURP sites in the assessment unit (2001SCDAA010, 1994SCDAA057, & 1995SCDAA073), as well as for several sites in the upstream assessment unit in the headwaters portion of the watershed. 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 #ID17010104PN033_03.

Assessment Unit	Stream	BURP ID	SMI (rating)	SFI (rating)	SHI (rating)	Overall Rating
ID17010104PN033_03	Boulder Creek	2001SCDAA010	61.33 (2)	66.74 (1)	68 (3)	2
ID17010104PN033_03	Boulder Creek	1994SCDAA057	80.27 (3)	82.14 (3)	45 (1)	2.33
ID17010104PN033_03	Boulder Creek	1995SCDAA073	35.47 (0)	N/A	59 (2)	0
ID17010104PN033_02	Boulder Creek	2001SCDAA018	60.58 (2)	N/A	67 (3)	2.5
ID17010104PN033_02	tributary	2004SCDAA077	N/A	N/A	N/A	dry
ID17010104PN033_02	MF Boulder Cr	1999SCDAA010	65.69 (3)	N/A	87 (3)	3

Note that in this assessment unit three BURP sites on Boulder Creek, two near the top of the assessment unit (2001SCDAA010, Photo 1 & 1994SCDAA057, Photo 2), and one near the bottom of the unit (1995SCDAA073), were involved in the assessment. Therefore, the ID17010104PN033_03 assessment unit's biological impairment rating was based on results obtained from the first three sites in Table 1, most of which had sufficient scores to pass the impairment test. Other BURP sites in the watershed are on Boulder Creek or its tributaries and are in a separate assessment unit. The 2001SCDAA018 BURP site on Boulder Creek (Photo 3) was just upstream from the assessment unit. The 1999SCDAA010 site is at the mouth of the Middle Fork Boulder Creek just upstream from the assessment unit under investigation. The 2004SCDAA077 site on a headwater tributary was dry and produced no scores.

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 2001SCDAA010. .Looking upstream through sampled reach.

Photo 2. BURP Site 1994SCDAA057. Looking downstream through sampled reach.

Photo 3. BURP Site 2001SCDAA018. Looking downstream through sampled reach.

Section 3.0 Candidate Causes

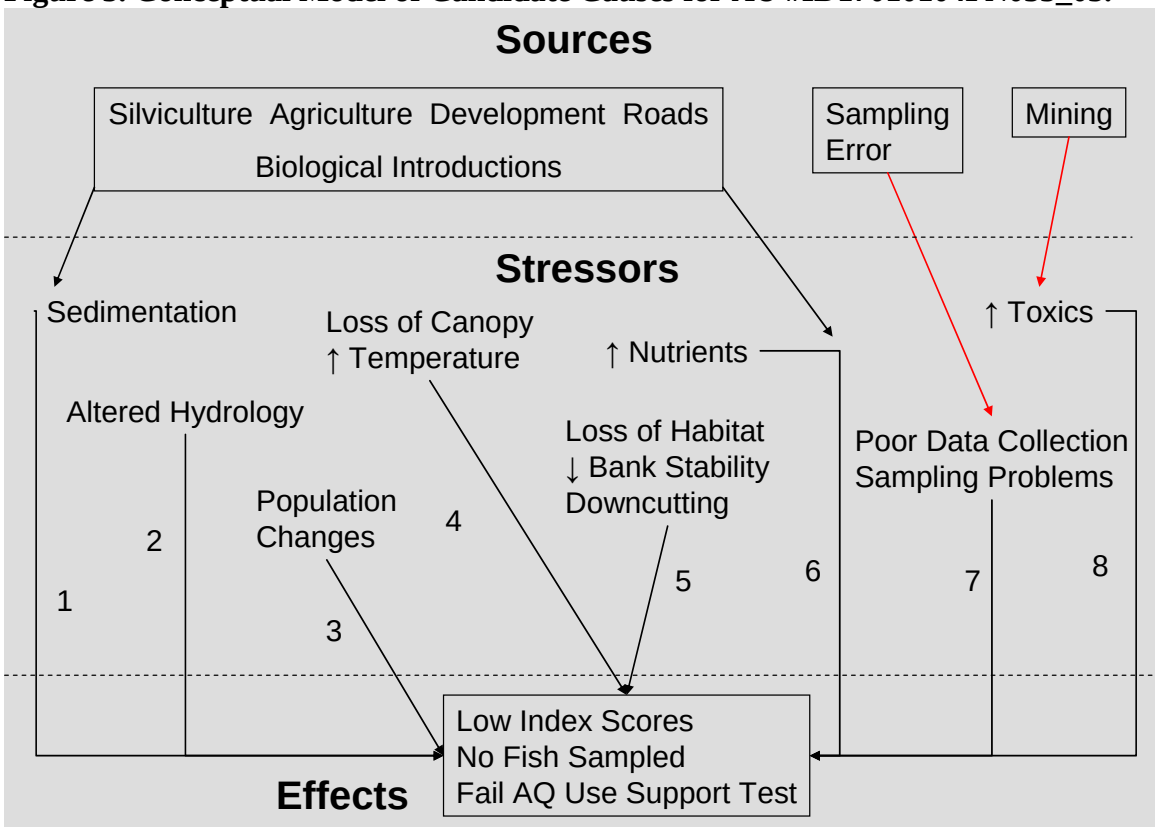
In order to suggest what may affect index scores for the assessment unit in question, a list of possible causes needs to be constructed. Figure 3 presents a simple conceptual model of candidate causes that may lead to poor biological/habitat scoring. The model presents eight candidate causes as stressors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

process where data were incorrectly interpreted or reported resulting in an incorrect assessment call.

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 #ID17010104PN033_03.



Section 4.0 Existing Data

Existing data for AU #ID17010104PN033_03 are somewhat limited. No data have been acquired from Idaho Fish and Game or U.S. Forest Service. However, IDL performed CWE assessments on the watershed in 2003 (IDL, 2003a & IDL, 2003b)

The CWE assessment for their upper Boulder Creek portion indicated that the watershed had moderate risk in surface erosion, mass failure hazards and channel stability, low risk in sediment delivery and hydrologic risk, and high risk in stream temperature ratings. Within the DEQ assessment unit in question, shade levels were not adequate to meet CWE targets and contributed to the high temperature risk rating. An important observation contained within the CWE report (IDL, 2003a) is as follows:

"*The 1998 303 (d) listing for Upper Boulder Creek identifies fine sediment as a pollutant inhibiting the stream from achieving its full range of beneficial uses. The 2003 CWE assessment determined that little additional sediment is being generated from forest roads, skid trails, and mass failures and delivered to the stream. Therefore, additional analysis may need to be done in order to better define the sediment sources within this watershed sub-section. Mining activity for at least the last one hundred years has impacted this watershed sub-section and may be the significant contributor of sediment pollution and channel stability.*"

The CWE assessment for their lower Boulder Creek portion again identified Boulder Creek as having a high temperature risk rating (IDL, 2003b). Channel stability was also rated high in this report, however, that was based on a sampled reach below the DEQ assessment unit #ID17010104PN033_03. All other risk ratings in the lower Boulder Creek CWE report were low.

These CWE assessments suggest that sedimentation is not an issue within the assessment unit, but there is a lack of canopy coverage which may indicate potential problems with stream temperature.

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 three BURP sites in the assessment unit. Note that only the 1994 site had SHI scores insufficient to pass the assessment test. All sites tended to have metric values that showed low bank cover and stability, low canopy cover, low pool/riffle ratios, and high width/depth ratios when compared to the average of all BURP sites in the Lower Kootenai subbasin with passing SHI scores (Ave Supporting). Scores for the 1995 site are suspect as the analysis lacked data for wetted depth and discharge. All sites had reasonably good percent fines data and good embeddedness scores suggesting that sedimentation was not an issue here.

Table 3. Habitat Metrics for BURP Sites in AU #ID17010104PN033_03.

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
2001SCDAA010	85.1	71.6	31.5	10.8	15	4	0.32	8.5	0.12	68.9	4.87	68
1994SCDAA057	47.5	45	8	11.2	18	0	0.54	4.5	0.06	71.1	2.38	45
1995SCDAA073	32.5	90	0	10	18	7	0.008	10.7	0	10.7	0	59
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

Two sites in the assessment unit were electrofished in the upper Boulder Creek watershed by BURP crews (Table 4). Rainbow trout, brook trout, cutthroat trout, and rainbow x cutthroat hybrids were sampled at these sites, thus percent cold water taxa and salmonid age class metrics look good. Macroinvertebrate metrics (Table 5) for the three sites in the assessment unit were variable among sites. The 1995 site in the lower part of the unit showed a lack of species especially mayfly, stonefly and caddis fly (EPT) taxa when compared to the subbasin average supporting scores. The site also lacked clinger and scraper functional groups. The upper two sites did not show such low metrics, although the 2001 site did lack caddis fly (Trichoptera) taxa and a low percentage of Plecoptera. The loss of EPT taxa suggests that impacts have occurred on upper Boulder Creek and are the driving mechanism inflicting macroinvertebrate impairment.

Table 4. Fish Metrics for BURP Sites in AU #ID17010104PN033_03.

BURP ID	Cold Water Taxa	% Cold Water	% Sensitive	Sculpin Age Classes	Salmonid Age Classes	CPUE	SFI
2001SCDAA010	1	91.4	51.4	0	4	4.4	66.7
1994SCDAA057	2	100	58	0	4	12.5	82.1
Ave Supporting	1.97	93.9	59.3	1.1	3.1	8.7	81.1

Table 5. Macroinvertebrate Metrics for BURP Sites in AU #ID17010104PN033_03.

BURP ID	Total Taxa	Ephemeroptera Taxa	Plecoptera Taxa	Trichoptera Taxa	% Plecoptera	HBI	% Dominance of top 5 taxa	% Scraper	% Clinger	SMI
2001SCDAA010	30	10	7	3	4.9	4.63	69.5	35	51	61.3
1994SCDAA057	45	10	10	7	30.8	5.11	62	29.5	58.1	80.3
1995SCDAA073	20	5	6	3	3.2	5.67	88.2	4.8	18.7	35.5
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 upper Boulder Creek watershed are limited to temperature and coliform bacteria sampling. E. coli sample results for upper Boulder Creek are low, thus below Idaho WQS action levels. Some instantaneous temperature measurements are unremarkable. A temperature logger was placed in the MF Boulder Creek outside of the assessment unit in question. To our knowledge no temperature loggers have been deployed in upper Boulder Creek, thus little is known about the temperature regime in this system.

Table 6. Water Chemistry Data Collected in AU #ID17010104PN033_03.

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)
8/30/1994	Boulder Creek									2.38
7/19/2001	Boulder Creek	10.5 (9:30am)								4.87
8/1/2001	Boulder Creek							5	370	
8/1/2001	Boulder Cr (033_02)	11.5 (11am)						5	120	14.3

*Temperatures are instantaneous readings unless otherwise noted.

Although there is abundant mining activity in the lower Boulder Creek watershed, there is evidence of only three mines in the upper watershed (see Red Stars in Figures 1 & 2). The Idamont mine was a lead and zinc interest in the Treble Creek watershed just above the assessment unit in question. Boulder Gold is in the upper Boulder Creek watershed near the upper BURP sites, and Golden Hope was a lead, silver and copper interest in the Clifty Creek watershed. None of these operations appear to have any workings and may have been only prospects. However, to our knowledge no water quality sampling for heavy metals has taken place in streams near them.

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 little evidence that sedimentation is occurring in the upper reaches of Boulder Creek. Habitat metrics such as percent fines and embeddedness scores suggest that the assessment unit has not been affected directly. The loss of EPT taxa that are generally sensitive to excess sediment may have resulted form sedimentation in the assessment reach sometime in the past or from some other cause (toxics, temperature, etc.). Low macroinvertebrate scores at the 1995 BURP site may indicate some pollutant has moved through this system and eliminated sensitive taxa. However, CWE assessments indicate that risk of sedimentation is low and there is only minor evidence of timber harvest activities in the watershed.
2. Hydrological alteration is not likely, but cannot be ruled out. Roads may influence runoff and hydrology, and there are numerous roads in the watershed including one that parallels the stream throughout the most of the assessment unit.
3. Although it is a possible cause, there is no evidence of biological invasions that maybe affecting macroinvertebrate populations. Fish species include rainbow trout and brook trout, both of which may have been introduced.
4. It is not known if water temperature is a problem in the upper portion of the Boulder Creek watershed. CWE assessments suggest that lack of canopy cover is a potential risk to stream temperatures. Habitat metrics did show a lack of canopy cover, however there has been insufficient measurements of water temperature to determine if a problem exists.
5. There is evidence of loss of habitat through riparian alteration in the vicinity of the BURP sites. BURP site comments indicate that primitive recreational camping has occurred near these sites. Such activities can cause local habitat destruction. It has been noted that low canopy cover has occurred in these reaches, and photographs of the sites suggest a general lack of riparian vegetation. These changes can lead to loss of habitat and a reduction in biological communities.
6. There is little evidence that nutrients are in excess in this assessment unit. Although algae was reported as sited in at least one BURP site, 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, but there has been some loss of data at earlier sites which is common with BURP data from the early to mid 1990s. The 2001 BURP site in the assessment unit, which is likely the most reliable of the BURP site information, has scores that are sufficient to pass the assessment test.
8. To our knowledge, there are few current or legacy mining activities in the assessment unit. There are three mines or prospects that are located in the watershed. The operations do not appear to be large enough or close enough to a stream to produce any mine related discharge. However, no water chemistry sampling has taken place to confirm a lack of toxic pollutants. The introduction of accidental spills to upper Boulder Creek watershed 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, sedimentation, biological invasion, and toxic pollutants are not causing the problems associated with low biological scores in this assessment unit. It is not known if water temperature is a problem in the upper Boulder Creek watershed, although evidence suggests that is a major risk. There is some evidence that habitat alteration has occurred, at least locally. There is no evidence of a general lack of flow that can influence biological communities. Thus, water temperature as a result of a lack of riparian shade is the most likely stressor affecting the biological community in upper Boulder Creek.

Section 6.0 Conclusions

It is difficult to draw conclusions about the Assessment Unit # ID17010104PN033_03. Most of what we know about upper Boulder Creek is from three BURP sites, two of which were measured over fourteen years ago that revealed low macroinvertebrate scores to fail assessment tests. The assessment unit should be re-examined to determine if conditions have improved since that time.

The upper portion of Boulder Creek is a forested watershed that appears only lightly harvested. However, roads are common along the stream. There is minor evidence that Boulder Creek in this section has had habitat alterations leading to partial removal and replacement of natural tree/shrub riparian vegetation, and some loss of canopy. This is likely due to roads and primitive camping activities. Therefore, the most likely cause of low biological scores in upper Boulder Creek, if that condition even exists, is high water temperature.

Section 7.0 References

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