

Stressor Identification for Assessment Unit # ID17010104PN024_03
Lower Kootenai River Subbasin



March 9, 2009

Prepared for:

Idaho Department of Environmental Quality
Coeur d'Alene Regional Office
2110 Ironwood Parkway
Coeur d'Alene, ID 83814

Prepared by:

State Technical Services Office
Idaho Department of Environmental Quality
1410 N. Hilton St.
Boise, ID 83706



Table of Contents

Summary..... 3
Section 1.0 Scope of Investigation..... 4
Section 2.0 Description of the Impairment..... 8
Section 3.0 Candidate Causes 10
Section 4.0 Existing Data..... 12
 4.1 Physical Habitat Data..... 12
 4.2 Biological Data 12
 4.3 Water Chemistry 13
Section 5.0 Analysis..... 14
 5.1 Stressor Refinement 14
 5.2 Candidate Cause Elimination..... 15
Section 6.0 Conclusions 15
Section 7.0 References 16

List of Tables

Table 1. Assessment Scores and Rating for AU #ID17010104PN024_03..... 8
 Table 2. Index Rating for Northern Idaho Streams..... 8
 Table 3. Habitat Metrics for BURP Sites in AU #ID17010104PN024_03. 12
 Table 4. Fish Metrics for BURP Sites in AU #ID17010104PN024_03. 13
 Table 5. Macroinvertebrate Metrics for BURP Sites in AU #ID17010104PN024_03..... 13
 Table 6. Water Chemistry Data Collected in AU #ID17010104PN024_03..... 13

List of Figures

Figure 1. Land Status Map for Assessment Unit #ID17010104PN024_03..... 6
 Figure 2. Aerial View of Assessment Unit #ID17010104PN024_03..... 7
 Figure 3. Conceptual Model of Candidate Causes for AU #ID17010104PN024_03..... 11

Summary

Assessment Unit #ID17010104PN024_03 includes the lowest portion of Dodge Creek from the confluence with the South Fork Dodge Creek to McArthur Lake. Stressor identification for Assessment Unit #ID17010104PN024_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 Units #ID17010104PN024_02 and 024_04 were 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, these assessment units were no longer listed in Section 5, however, assessment unit #ID17010104PN024_03 was listed as impaired for reasons associated with benthic macroinvertebrate bio-assessments and temperature. 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 lowland portion of Dodge 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 may be misleading. However, there is evidence that Dodge Creek in this lowland section has had channel alterations leading to bank instability, partial removal and replacement of natural tree/shrub riparian vegetation with grasses, and some sedimentation issues. Therefore, the most likely causes of low biological/habitat scores in lower Dodge Creek are habitat alteration and excess sediment.

Section 1.0 Scope of Investigation

Assessment Unit #ID17010104PN024_03 includes the lowest portion of Dodge Creek from the South Fork Dodge Creek confluence to McArthur Lake (see Figures 1 & 2). This portion of the Dodge Creek watershed is largely agricultural, pasture land and hay crops.

The Dodge Creek watershed is a forested watershed that is mostly state and privately owned, although a small portion of the headwaters areas are within Kaniksu National Forest (see Figure 1). Assessment Unit #ID17010104PN024_03 is entirely on state land surrounding McArthur Lake.

A Cumulative Watershed Effects (CWE) Assessment was conducted in the Dodge Creek watershed in 2003 by the Idaho Department of Lands (IDL, 2003). That report described the watershed as follows:

“Dodge Creek is a 7,382 acre forested watershed in northern Idaho managed for agriculture, rural development, and timber production. For the purposes of this assessment, Dodge Creek, along with major and minor tributaries, are referred to as Dodge Creek. Dodge Creek flows into McArthur Lake. McArthur Lake is accessed two and a half miles north of Elmira, Idaho, on Highway 95. Land ownership is private, Idaho State, Forest Capital, and United States Forest Service. The watershed is located in Boundary County (Figure 1).

Dodge Creek is a third order tributary, with a dendritic stream feeder pattern to McArthur Lake. The drainage is oriented in a southeasterly direction with side tributaries flowing east. Elevation in the watershed ranges from 2,000 feet above sea level where Dodge Creek empties into McArthur Lake to 5,027 feet above sea level in the headwaters on Dodge Peak.

The Dodge Creek drainage is underlain with glacial drift and till in the lower elevations and weakly and highly weathered granitics in the higher elevations. To a lesser extent, highly weathered Belt Supergroup Metasediments are located in the southern portion of the watershed.

The area is characterized by warm dry summers and cold wet winters with an average annual precipitation of thirty inches. 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 #ID17010104PN024_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 #ID17010104PN024_03.

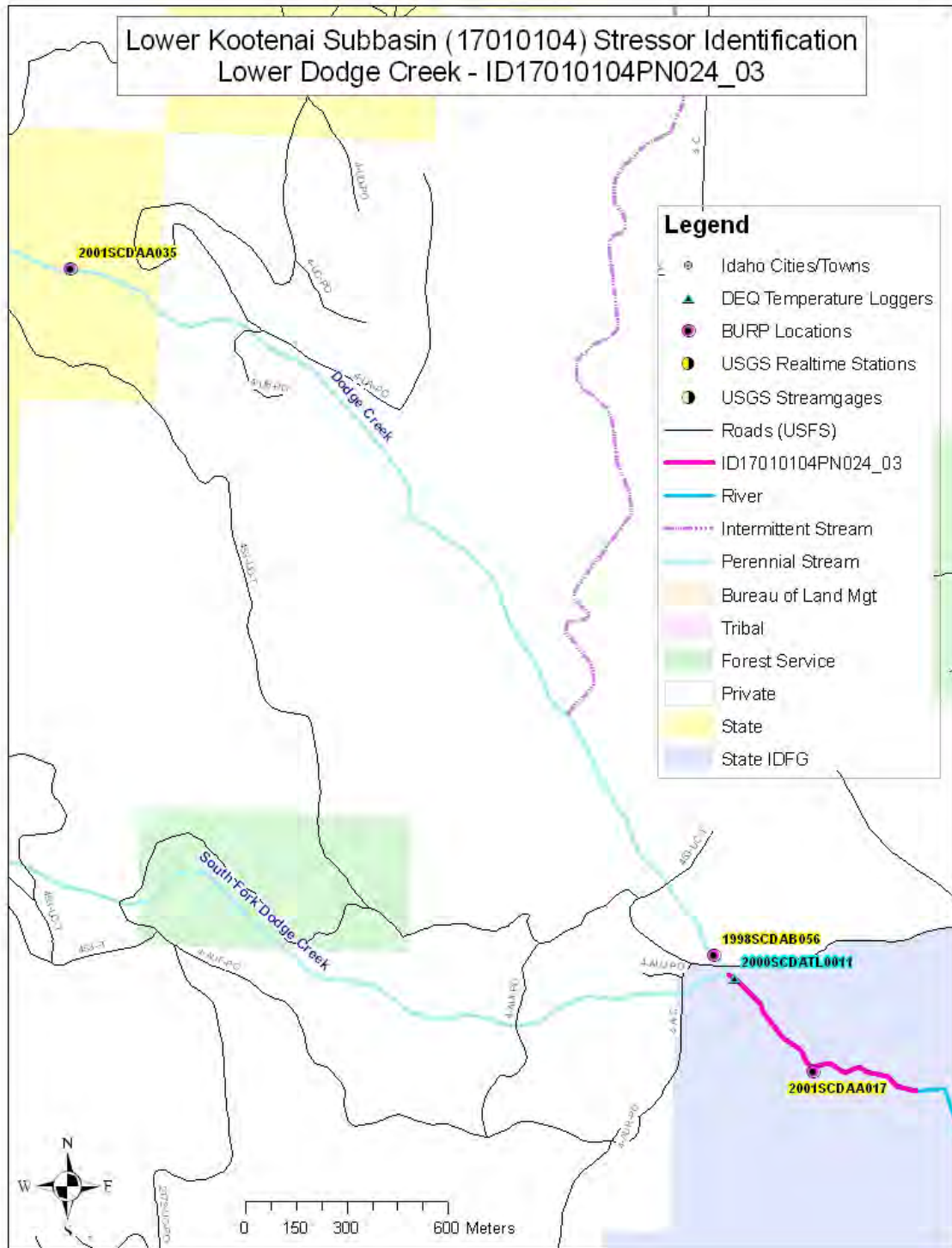
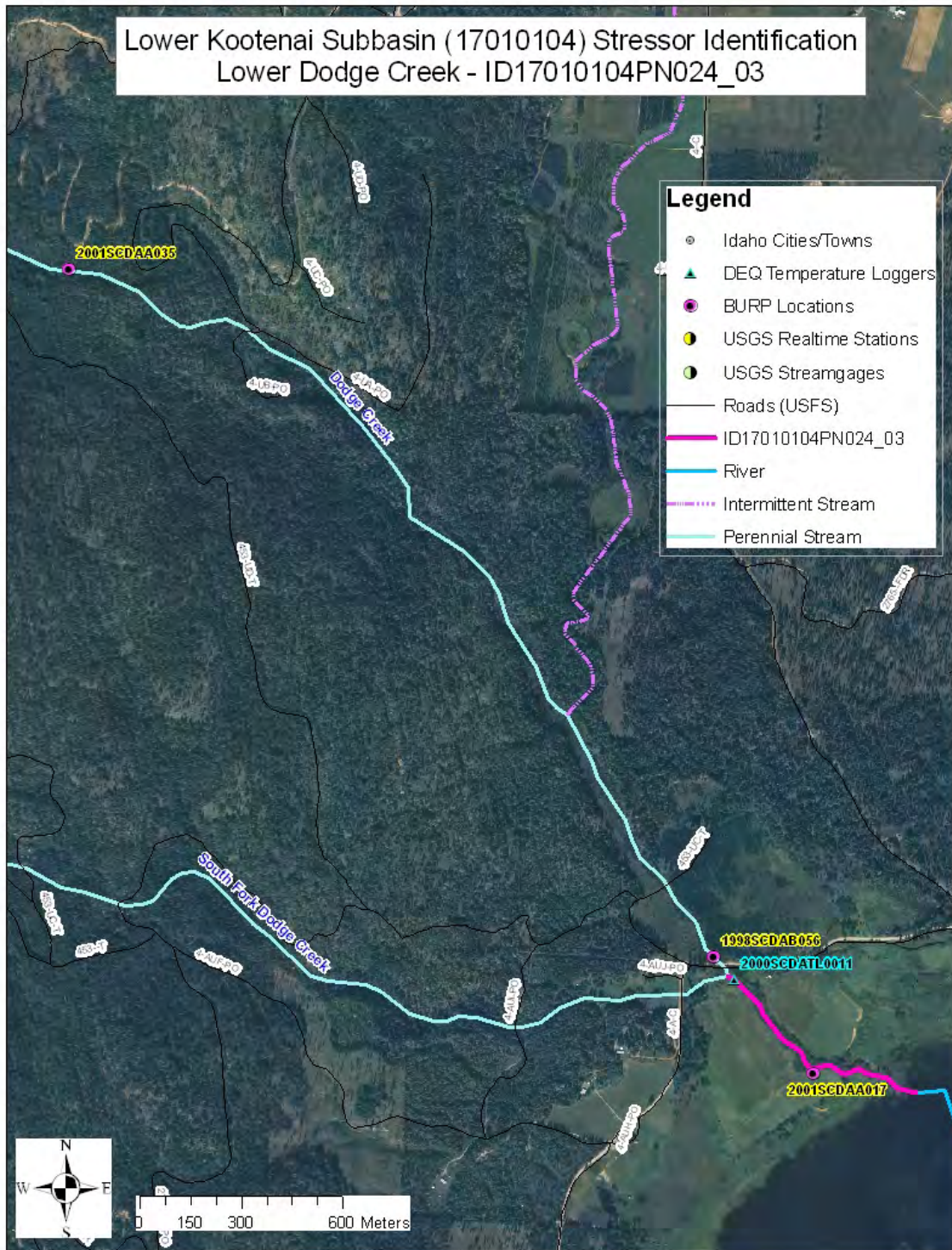


Figure 2. Aerial View of Assessment Unit #ID17010104PN024_03.



Section 2.0 Description of the Impairment

Assessment Unit #ID17010104PN024_03 was listed in the Idaho DEQ 2008 Integrated Report Section 5 as impaired for temperature and for reasons associated with benthic macroinvertebrate 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 data.

Table 1 shows the index scores for the BURP site in the assessment unit (2001SCDAA017), as well as for several sites in the upper 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 #ID17010104PN024_03.

Assessment Unit	Stream	BURP ID	SMI (rating)	SFI (rating)	SHI (rating)	Overall Rating
ID17010104PN024_03	Dodge Creek	2001SCDAA017	45.45 (1)	66.05 (1)	48 (1)	1
ID17010104PN024_02	Dodge Creek	1998SCDAB056	N/A	N/A	N/A	N/A
ID17010104PN024_02	Dodge Creek	2001SCDAA035	58.64 (2)	N/A	52 (2)	2

Note that in this assessment unit only one BURP site, on Dodge Creek near McArthur Lake (Photo 1), was involved in the assessment. Other BURP sites in the watershed are on Dodge Creek and are in a separate assessment unit. The 2001SCDAA035 BURP site (Photo 2) was in the middle of the watershed on state endowment land. The other BURP site (1998SCDAB056) was to be located just above the confluence with the South Fork, however, this site was inaccessible and produced no data. Therefore, the assessment unit's biological impairment rating is solely based on results obtained from the first site in Table 1. The lower Dodge Creek site had insufficient scores to pass the impairment test. The upper Dodge Creek site in the next assessment unit did have sufficient scores, however was listed for temperature impairment based on criteria exceedances. Electrofishing did not take place at upper site, thus there are no fish (SFI) scores available.

Table 2. Index Rating for Northern Idaho Streams.

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

Photo 1. BURP Site 2001SCDAA017. Looking upstream through sampled reach.



Photo 2. BURP Site 2001SCDAA035. Looking downstream from sampled reach.



Section 3.0 Candidate Causes

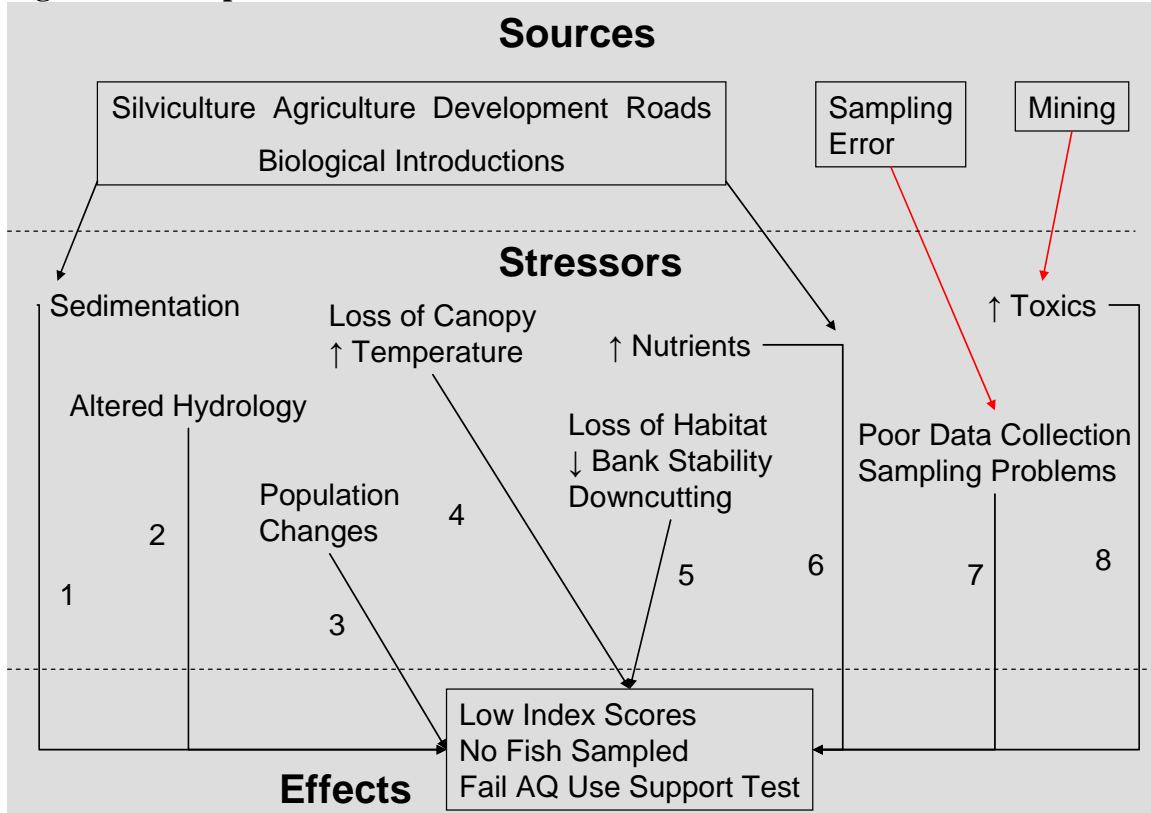
In order to suggest what may affect index scores for the assessment unit in question, a list of possible causes needs to be constructed. Figure 3 presents a simple conceptual model of candidate causes that may lead to poor biological/habitat scoring. The model presents eight candidate causes as stressors 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. 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 #ID17010104PN024_03.



Section 4.0 Existing Data

Existing data for AU #ID17010104PN024_03 are very limited. No data have been acquired from USGS, Idaho Fish and Game or U.S. Forest Service. However, IDL performed a CWE assessment on the watershed in 2003 (IDL, 2003)

The CWE assessment indicated that the watershed moderate risk in surface erosion and mass failure hazards, low risk in sediment delivery and hydrologic risk, and high risk in channel stability and stream temperature ratings. Within the assessment unit in question, shade levels were not adequate to meet CWE targets and contributed to the high temperature risk rating. Additionally, the reach of Dodge Creek immediately above this assessment unit (immediately above the South Fork confluence) was the reach identified as having a high channel stability risk. An important observation contained within the CWE report (IDL, 2003) is as follows:

“The highest Channel Stability Index (CSI) score, 60.0 recorded in reach number three, correlates to a high CSI rating for the Dodge Creek Watershed. The reach with the highest score is used for the CWE channel stability rating since this area is the most susceptible to disturbance from potential increases in peak flows. The assessment identified little to no bank rock content, some bank cutting, a lack of large organic debris, and a loosely packed sand and gravel channel bottom which contribute to a high CSI Rating. Reach number three is located within agriculture and grazing lands where local land use may have impacted stream banks leading to the relatively high rating.”

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 one BURP site (2001SCDAA017) in the assessment unit and the one site (2001SCDAA035) further upstream in another assessment unit. Note that only the upper site had an SHI score high enough to pass the assessment test. The lower site had metric values that were in general slightly different from the average of all BURP sites in the Lower Kootenai subbasin with passing SHI scores (Ave Supporting). Percent fines were especially high (65%) at the lower site.

Table 3. Habitat Metrics for BURP Sites in AU #ID17010104PN024_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
2001SCDAA017	82.5	82.5	56	65	4	5	0.67	3.35	0.22	15	0.6	48
2001SCDAA035	49	85.5	97.5	22.2	3	3	0.18	2.37	0.06	41.8	0.2	58
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 lower site in the assessment unit was the only site to be electrofished on Dodge Creek by BURP crews (Table 4). Only rainbow trout were sampled at that site, thus fish metrics reflect the lack of additional cold water species, especially sculpins.

Macroinvertebrate metrics (Table 5) for the upper site was generally similar to the average of all BURP sites in the Lower Kootenai subbasin with passing SMI scores (Ave

Supporting), although percent scrappers and clingers were low. The lower site (2001SCDAA017) in the assessment unit showed a lack of species especially mayfly, stonefly and caddisfly (EPT) taxa when compared to the subbasin average supporting scores. Hilsenhoff Biotic Index (HBI) was also higher than the average supporting sites in the subbasin suggesting that pollution tolerant organisms were dominating the lower system. The loss of EPT taxa suggests that impacts have occurred on the lower portion of Dodge Creek and are the driving mechanism inflicting macroinvertebrate impairment.

Table 4. Fish Metrics for BURP Sites in AU #ID17010104PN024_03.

BURP ID	Cold Water Taxa	% Cold Water	% Sensitive	Sculpin Age Classes	Salmonid Age Classes	CPUE	SFI
2001SCDAA017	1	100	86.7	0	2	5.7	66.05
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 #ID17010104PN024_03.

BURP ID	Total Taxa	Ephemeroptera Taxa	Plecoptera Taxa	Trichoptera Taxa	% Plecoptera	HBI	% Dominance of top 5 taxa	% Scraper	% Clinger	SMI
2001SCDAA017	33	6	6	0	5.2	6.78	71.6	15.6	38.8	45.45
2001SCDAA035	31	10	5	7	2.2	4.71	79.7	7.6	32.3	58.6
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 Dodge Creek within and above the assessment unit are limited to temperature and one coliform bacteria sampling event. E. coli sample results are well below Idaho WQS action levels. A temperature logger deployed near the lower Dodge Creek site in 2000 showed numerous violations of the fall salmonid spawning criteria as temperatures exceeded 13 °C from August 1st to September 21st. General cold water aquatic life criteria were never exceeded at this site.

Table 6. Water Chemistry Data Collected in AU #ID17010104PN024_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)	Suspended Sediment (mg/L)	Turbidity (JTU)
8/11/2000	Dodge Creek	20.2 (MDMT)										
7/31/2001	Dodge Creek (L)	16								0.6		
8/29/2001	Dodge Creek (U)	13								0.2		
9/17/2001	Dodge Creek (L)							12	1300			
9/17/2001	Dodge Creek (U)							<1	390			

*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 Dodge Creek. Habitat metrics such as percent fines, bank cover and bank stability suggest that the assessment unit has been affected directly. The loss of EPT taxa that are generally sensitive to excess sediment may have resulted from bank erosion and sedimentation in the assessment reach. Low macroinvertebrate scores at the lower BURP site may indicate excess sediment has moved through this system and eliminated sensitive taxa.
2. Hydrological alteration cannot be ruled out. There was evidence of timber harvest activities in aerial photo (Figure 2) that could have led to changes in runoff characteristics and increased hydrologic loading. Changes in land use in the lower portion of the watershed that result from agricultural activities may also influence hydrologic characteristics.
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 lower portion of the Dodge Creek watershed. The IDL CWE assessment process showed that Dodge Creek above and within this assessment unit is at risk of high stream temperatures due to a lack of shade. Measured temperature was not extremely high but 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 early September, then water temperature in this assessment unit may not be impairing uses.
5. There is evidence of loss of habitat through riparian alteration and possibly channel morphological changes. It has been noted that bank instability has occurred in the lower reaches and photographs suggest a loss of riparian habitat due to agricultural activities. 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 this assessment unit. 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. There were problems with the assessment process as originally the lack of fish data may have been interpreted as a lack of fish in the stream. However, after review of the assessment data, it was discovered that the impairment call would likely result from a low macroinvertebrate score at one of the two BURP sites.
8. To our knowledge, there are not current or legacy mining activities in the assessment unit. However, no water chemistry sampling has taken place to confirm a lack of toxic pollutants. The introduction of 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 and toxic pollutants are not causing the problems associated with low biological scores in this assessment unit. It is likely that biological invasion by alien species is not prominent enough to cause low scores either. Temperature does appear to be playing a role in Dodge Creek watershed as recognized by the CWE assessment process and DEQ temperature data. It is more likely that excess sediment and channel/habitat alteration are the leading causes of macroinvertebrate loss.

Section 6.0 Conclusions

It is difficult to draw conclusions about the Assessment Unit # ID17010104PN024_03. Most of what we know about lower Dodge Creek is from one BURP site that revealed low macroinvertebrate, fish and habitat scores to fail assessment tests, and from a CWE analysis of the entire watershed.

The lowland portion of Dodge 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 Dodge Creek in this lowland section has had channel alterations leading to bank instability, partial removal and replacement of natural tree/shrub riparian vegetation with grasses, and some sedimentation issues. Therefore, the most likely causes of low biological/habitat scores in lower Dodge Creek are habitat alteration and excess sediment.

Section 7.0 References

- EPA. 2000. Stressor Identification Guidance Document. Office of Water and Office of Research and Development, U.S. Environmental Protection Agency. Washington, D.C. EPA/822/B-00/025.
- Grafe, C.S., C.A. Mebane, M.J. McIntyre, D.A. Essig, D.H. Brandt, and D.T. Mosier. 2002. The Idaho Department of Environmental Quality Water Body Assessment Guidance, Second Edition-Final. Idaho Department of Environmental Quality; Boise, Idaho.
- IDL. 2003. Dodge Creek (HUC Nos. 17010104 – 0807) WQLS 3155 Cumulative Watershed Effects Assessment. November 17, 2003. Idaho Department of Lands, Coeur d'Alene, Idaho. 26p.