Bedrock Creek Water Quality Assessment

2012

Nez Perce Soil and Water Conservation District

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Introduction

This water quality assessment document follows the five steps outlined in Section VIII of the *Oregon Watershed Assessment Manual*, 1999 (Oregon Watershed Enhancement Board, 1999) . Where necessary, nomenclature consistent with the State of Idaho Water Quality Standards and Nez Perce Tribe water quality documents are used.

Watershed Description

Bedrock Creek is a third order tributary of the lower Clearwater River. The Bedrock Creek watershed drains 25,353 acres, originating in Clearwater County, near the town of Cavendish, Idaho and flowing west/southwest to its confluence with the Clearwater River, just downstream of Lenore, Idaho in Nez Perce County. The headwaters drain a rolling plateau consisting of agricultural, pasture and hay lands before the creek drops into a steep bedrock canyon with mixed timber and shrublands on the canyon walls. In total, the stream drops more than 3,000 feet from its headwaters to its mouth. The watershed is sparsely populated, with no major industrial or municipal point sources of pollutant discharge to the creek.

Step 1: Identify Designated and Existing Beneficial Uses

The State of Idaho's Water Quality Standards contain no officially designated beneficial uses for Bedrock Creek, although a 1985 water quality status report written by the Lewiston Regional Office of the Department of Environmental Quality (IDEQ) recommends:

> Inclusion of Bedrock Creek into the Idaho Water Quality Standards will provide a means for protecting future designated beneficial uses of the stream. The designated uses should include agricultural water supply, cold water biota, salmonid spawning and secondary contact recreation (Latham & Moeller, 1985).

The majority of the creek flows through the Nez Perce Tribe indian reservation. Through agreements with the State of Idaho (State) and the Environmental Protection Agency (EPA), the Nez Perce Tribe (NPT) has primary jurisdiction over the streams and stream segments occurring on the reservation. The NPT designates the following beneficial uses for Bedrock Creek: salmonid spawning, cold water biota, primary contact recreation, secondary contact recreation and wildlife habitat (Harris, 2009).

By gathering water quality and habitat condition data and utilizing their own assessment methodology, the NPT determined that Bedrock Creek is not supporting its beneficial uses. The NPT found that Bedrock Creek is impaired by the following pollutants: bacteria, dissolved oxygen (lack of), flow alteration, habitat alteration, ammonia, nutrients, oil and grease, sediment and temperature (Harris, 2009). Based on the data gathered and the assessment results, Bedrock Creek has been included in the Lower Clearwater TMDL the NPT is currently developing.

Step 2: Identify Water Quality Criteria Necessary to Support Beneficial Uses

Temperature: Cool water temperatures are necessary to support many types of aquatic life, from salmon, trout and other fishes to amphibians and insects. Cooler water contains more dissolved oxygen, on which all of these creatures depend. All streams in Idaho are considered to have cold water aquatic life as an existing beneficial use, protected by temperature criteria put forth in Idaho's Water Quality Standards. Salmonid spawning is considered the most sensitive of those uses covered by the cold water aquatic life designation and corresponding temperature

criteria. Historical fisheries study data, collected by Kucera et. al in 1983, shows that the NPT salmonid spawning beneficial use designation for Bedrock Creek is necessary to protect the remnant Snake River Steelhead trout (O. mykiss) population existing there. Bedrock Creek still has the intrinsic potential to provide spawning and rearing habitat for threatened Snake River Steelhead trout. State temperature criteria necessary to support both cold water aquatic life and a healthy population of Steelhead trout are as follows:

> Cold Water Aquatic Life: 22° C (72° F) maximum daily maximum temperature, 19° C (66° F) maximum daily average temperature. (State of Idaho, 2012)
>
> Salmonid Spawning: 13° C (55° F) maximum daily maximum temperature, 9°C (48° F) maximum daily average temperature (Idaho Department of Environmental Quality, 2012).

Dissolved Oxygen: Like temperature, dissolved oxygen is a requirement of fresh water organisms, and has codified numeric criteria set at a level to protect these organisms. The amount of dissolved oxygen found in a stream can be affected by other pollutants, like temperature and nutrients. Warm water cannot hold as much oxygen as cold water. Excess nutrients can cause algae and aquatic plants to grow, and when these plants respire they can deplete the oxygen in the stream. The Idaho Water Quality Standards contain the following criteria for dissolved oxygen in streams designated for salmonid spawning:

> Intergravel Dissolved Oxygen: A one day minimum of not less than 5.0 mg/L, and a seven day average mean of not less than 6.0 mg/L.
>
> Water Column Dissolved Oxygen: A one day minimum of not less than 6.0 mg/L or ninety percent saturation, whichever is greater (State of Idaho, 2012).

Nutrients: As mentioned earlier, excess nutrients can cause excessive plant growth, which in turn can cause a lack of dissolved oxygen in the stream. These nutrients can also promote algae growth that can interfere with recreation and create waste products that are toxic to livestock and wildlife. The Idaho Water Quality Standards contain narrative criteria for nutrients that read as follows: “Surface waters of the State shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing beneficial uses (Idaho Department of Environmental Quality, 2012).” Most Idaho TMDL documents set numeric indicators of impairment for two main nutrients, phosphorous and nitrogen. These indicator criteria are often set at levels gleaned from scientific literature, like the Environmental Protection Agency’s Ecoregional Criteria Recommendations or Gold Book Standards, which are set below levels at which impairment is likely to occur. Other TMDLs use dissolved oxygen as a surrogate indicator because of the direct relationship between low DO concentrations and nutrient cycling.

Bacteria: The State of Idaho uses *E.coli* bacteria as an indicator of the sanitary condition of surface water in order to protect beneficial uses like primary and secondary contact recreation and public drinking water (source water) withdrawal. Idaho’s criterion for *E. coli* is that bacteria are not to exceed 126 colony forming units per 100 milliliters of solution (cfu/100 ml) as a 30-day geometric mean. Also, there are single sample maximum limits of 406 cfu/100 ml for primary contact recreation (PCR) uses and 576 cfu/100 ml for secondary contact recreation (SCR) uses. Depending on the use, if either single sample maximum is exceeded, five additional samples must be taken every 3 to 7 days over a month’s time to determine the geometric mean concentration and compare it to the standard (Idaho Department of Environmental Quality, 2012).

Primary contact use applies when the ingestion of small quantities of water is likely to occur. Such activities include, but are not restricted to, swimming, water skiing, or skin diving. Secondary contact applies for recreation uses not included in the primary contact category. These activities may include fishing, boating, wading, infrequent swimming, and other activities where ingestion of raw water is not likely to occur.

Sediment: Sediment criteria found in Idaho Water Quality Standards is narrative, meaning there is not a numeric value to assess whether a water body is in compliance with standards; instead, Idaho has a requirement that states sediment shall be limited to a quantity that does not impair beneficial uses (State of Idaho, 2012). The Idaho Department of Environmental Quality *Guide to Selection of Sediment Targets for use in Idaho TMDLs* presents a range for sediment concentrations based on research and available literature. Most Idaho TMDLs for sediment set desired sediment concentrations at a range found to support either a "moderate fishery" or a "good fishery." Sediment targets expressed in mg/L of Total Suspended Sediment for lower Clearwater TMDLs like the Potlatch River TMDL use a monthly average of 50 mg/L TSS with a one day episodic limit of 80 mg/L TSS as targets (Idaho Departmet of Envionmental Quality, 2006).

Flow and Habitat Alteration: Both flow and habitat alteration are considered forms of pollution by the State of Idaho, but not pollutants. Therefore, the State does not write TMDL documents for these forms of pollution. Flow and habitat alteration contribute to impairment by other pollutants, like temperature and sediment. Often, flow alteration leads to a loss of habitat. Several streams in Nez Perce County--like Catholic Creek, Big Canyon Creek, and Hatwai Creek--that have had their headwaters drained and channelized to ease agricultural processes exhibit increased flashiness, where flows are excessively high in late spring and excessively low in late summer. The draining and channelizing of the headwaters reduces or eliminates the holding capacity of these streams. In addition, increased volume and velocity of spring flows can lead to the deposition of large substrate in the stream channel that causes the stream flow sub-surface in the late summer.

Step 3: Assemble Available Water Quality Data

NPSWCD Stream Temperature Data: NPSWCD technicians deployed HOBO temperature data loggers in nearly every watershed in Nez Perce County to establish baseline (pre-implementation) stream temperature data, identify stream reaches impaired by high temperatures, and prioritize streams for the implementation of treatment actions aimed at reducing stream temperatures and restoring habitat. Temperature data was collected near the mouth of Bedrock Creek, where stream temperatures show the cumulative effects of land use practices in the watershed. Data was collected during the critical time period, April through October, when stream flows diminish and solar heat loading to streams increases. Data was collected during the following years: 2000, 2002, 2003, 2004, 2005, 2007, 2008, 2011. State agencies consider data five years old or less to be most relevant for comparison to Water Quality Standards criteria. Data from 2007-2011 are presented below (Tables 1 and 2).

Table 1. Salmonid Spawning Data Summary

Criteria	2007		2008		2011	
	Exceedance Counts		Exceedance Counts		Exceedance Counts	
	Number	%	Number	%	Number	%
SPRING						
13 °C Instantaneous	72	97%	69	96%	0	0%
9 °C Average	74	100%	72	100%	0	0%
Days Evaluated & Date Range	74	4/15-7/31/07	72	4/15-7/31/08	0	Not Deployed
FALL						
13 °C Instantaneous	72	95%	71	93%	58	100%
9 °C Average	76	100%	76	100%	58	100%
Days Evaluated & Date Range	76	8/1-10/15/07	76	8/1-10/15/08	58	8/1-10/15/11
TOTAL						
13 °C Instantaneous	144	96%	140	95%	58	100%
9 °C Average	150	100%	148	100%	58	100%
Days Evaluated & Date Range	150	4/15-10/15/07	148	4/15-10/15/08	58	8/1-10/15/11

Table 2. Cold Water Aquatic Life Data Summary

Criteria	2007		2008		2011	
	Exceedance Counts		Exceedance Counts		Exceedance Counts	
	Number	%	Number	%	Number	%
22 °C Instantaneous	60	65%	30	33%	9	26%
19 °C Average	35	38%	17	18%	5	15%
Days Evaluated & Date Range	92	6/22-9/21/07	92	6/22-9/21/08	34	6/22-9/21/11

NPT Dissolved Oxygen Data: NPT field technicians collected water quality data sporadically from 2000-2005 on Bedrock Creek. Only a handful of readings were recorded during mid to late summer, when flows decrease, temperatures rise and DO is most likely to sag. Available DO data are instantaneous measurements. 24 hour diurnal DO measurements have not been conducted on Bedrock Creek.

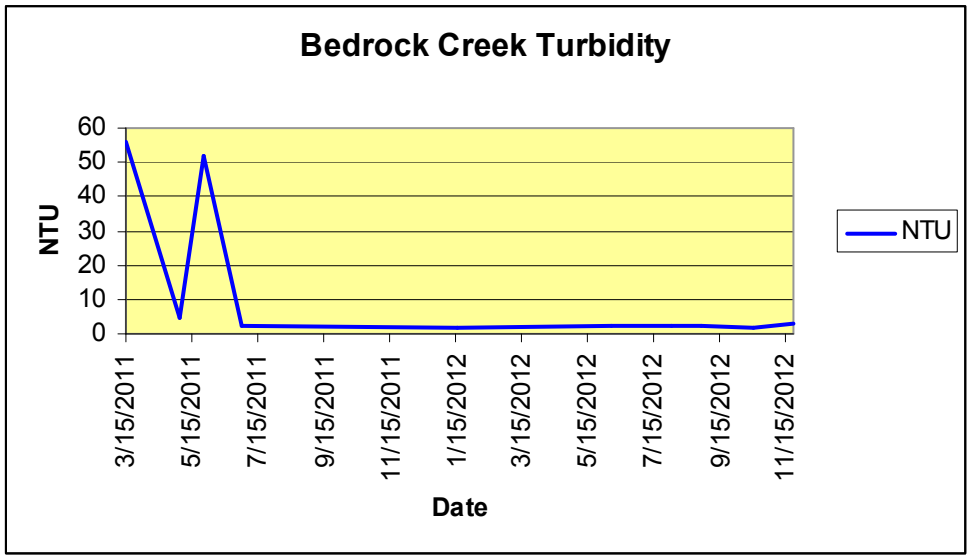
NPT Nutrient Data: NPT field technicians also collected nutrient concentration data on Bedrock Creek from 2000-2002, and then again from 2004-2005. Samplers using accepted methods and protocols collected nitrite plus nitrate nitrogen (NO_2+NO_3=N), ortho-phosphorous (PO_4), total phosphorous (TP), total Kjeldahl nitrogen (TKN) and ammonia (NH_3) samples.

NPT Bacteria Data: NPT field technicians collected both fecal coliform and *E. coli* bacteria samples from Bedrock Creek from 2000-2002 and then again from 2004-2005. Dip samples were collected according to accepted protocols. 14 total samples were collected from 2000-02, and 18 were collected from 2004-05.

Suspended Sediment Data: NPT field technicians collected both turbidity and total suspended sediment (TSS) samples from Bedrock Creek from 2000-2002 and then again from 2004-2005. Dip samples were collected according to accepted protocols. 12 TSS and 16 turbidity samples were collected from 2000-02, while 17 TSS and 15 turbidity samples were collected from 2004-05.

NPSWCD technicians collected turbidity data, reported in Nephalomic Turbidity Units (NTU) from several Nez Perce County streams from 2011-2012. Instantaneous turbidity measurements collected from 2011-2012 on Bedrock Creek are presented in Figure 1.

Figure 1. Bedrock Creek Turbidity 2011-2012.



Step 4: Evaluate Water Quality Data

Temperature: Temperatures recorded in Bedrock Creek violated salmonid spawning criteria the majority of the critical time period, from 2007-2011. Temperature loggers recorded violations of the cold water aquatic life criteria from 2007-2011. 2007 had the most violations of both the instantaneous and average criteria, which can partially be attributed to the fact that 2007 was a

low water year, with very little precipitation during the critical time period. Criteria violations were less numerous in 2008 and 2011.

Dissolved Oxygen: Of the 20 instantaneous DO measurements taken by the NPT on Bedrock Creek from 2000-2005, none violated the DO standard of 6.0 mg/L. The average of these measurements over the 5 years of records is 10.5 mg/L, well above the standard. Of the 20 measurements, only 5 were recorded during the season when DO sags are the most likely to occur, and these 5 measurements were the lowest recorded.

Nutrients: The average NO_2+NO_3=N concentration from 2000-2002 was 1.13 mg/L, and the average from 2004-05 was 0.084 mg/L. TKN concentrations averaged 0.22 mg/L from 2000-02, and averaged 0.53 mg/L from 2004-05. NH_3 averaged 0.018 from 2000-02, and 0.053 from 2004-05. TP concentrations averaged 0.1 mg/L from 2000-02, and 0.07 mg/L from 2004-05. PO_4 concentrations averaged 0.065 mg/L from 2000-02, and 0.056 mg/L from 2004-05.

Most Idaho TMDL documents set numeric indicators of impairment for two main nutrients, phosphorous and nitrogen. Another Lower Clearwater tributary TMDL, the Hatwai Creek SBA/TMDL(s) approved by EPA in 2010, uses EPA Ecoregional Criteria Recommendations for TP and NO_2+NO_3=N. Average TP concentrations are not to exceed 0.03 mg/L, and NO_2+NO_3=N concentrations are not to exceed 0.072 mg/L in Hatwai Creek. If those indicators of impairment are compared to the concentrations measured by the NPT on Bedrock Creek, the concentrations measured from 2000-02 show a higher level of impairment than the concentrations measured from 2004-05. Concentrations from 2004-05 are still higher than the recommendations. The fact that the NH_3 concentrations are higher from 2004-05 indicate that the ammonia sampled had not yet oxidized to form nitrogen, and may have been recently contributed to the creek.

Bacteria: Because the Idaho Water Quality Standards contain numeric criteria for *E. coli* rather than fecal coliform bacteria, the NPT *E. coli* data will be compared to State standards. The average *E. coli* concentration for 2000-02 was 340 cfu/100 ml, while the average concentration for 2004-05 was 105 cfu/100 ml. During both the 2000-02 and 2004-05 sampling efforts, *E. coli* concentrations greater than the single sample maximum criteria for primary and secondary contact recreation were recorded. However, the NPT did not collect the additional samples necessary over the next month to calculate a geometric mean to compare to the State standard.

Suspended Sediment: Sediment targets expressed in mg/L of Total Suspended Sediment for lower Clearwater TMDLs, like the Potlatch River TMDL, use a monthly average of 50 mg/L TSS with a one day episodic limit of 80 mg/L TSS as targets (Idaho Departmet of Envionmental Quality, 2006). Only one TSS sample taken by the NPT from Bedrock Creek exceeds the episodic limit—a single sample concentration of 239 mg/L TSS taken in May 2005.

The Idaho Department of Environmental Quality *Guide to Selection of Sediment Targets for use in Idaho TMDLs* presents a range for turbidity concentrations based on research and available literature. Idaho Water Quality Standards state that turbidity concentrations are not to exceed 50 NTU instantaneous or 25 NTU continuous for 10 days above baseline background turbidity levels. The research shows that juvenile steelhead begin to exhibit altered behaviors like emigration/avoidance and even reduced growth rates in concentrations as low as 25 NTU.

Step 5: Conclusions Drawn from Water Quality Data

Temperature: Temperatures in the ranges recorded in Bedrock Creek from 2007-2011 show that the stream is impaired by temperature and does not support either its salmonid spawning or cold water aquatic life beneficial uses.

Dissolved Oxygen: Instantaneous DO readings taken on Bedrock Creek show that the creek contains enough DO to support aquatic life during daylight hours. If DO is likely to sag, it will do

so at night while aquatic plants respire. The lack of 24 hour diurnal DO measurements makes it impossible to know whether diurnal DO sags occur in Bedrock Creek.

Nutrients: TP and NO_2+NO_3=N concentrations at the levels found in Bedrock Creek during the 2000-02 sampling effort are high enough to indicate impairment and can cause visible slime growths, lack of DO, and lack of support of the creek's beneficial uses. Concentrations measured from 2004-05 are lower, with the notable exception of NH_3, which was higher on average from 2004-05. The data sets are not robust enough to conclude that nutrient concentrations are trending downward. However, these concentrations are high enough to warrant further installation of BMPs designed to reduce nutrient inputs to Bedrock Creek from fertilizer, septic tanks and grazing activities.

Bacteria: Although the available NPT bacteria data cannot be compared to the State geometric mean standard of 126 cfu/100 ml, single sample maximum limits were exceeded during both the 2000-02 and 2004-05 sampling efforts. Therefore, both the primary and secondary contact recreation beneficial uses are not fully supported by Bedrock Creek. BMPs designed to limit bacteria inputs should continue to be installed and used in the Bedrock Creek watershed.

Suspended Sediment: One TSS sample exceeded the target concentration range set by other regional TMDLs. The sample was taken in May, a month when higher run-off flows should be expected. The single sample does show that when flows increase in the spring, Bedrock Creek can carry more sediment than is recommended to support a good fishery. However, the data cannot establish the duration during which the target concentration range was exceeded.

Turbidity levels measured in Bedrock Creek from 2011-2012 exceeded recommended NTU concentrations twice, once in March and again in May. Higher precipitation and higher run-off are expected during these months. The available data cannot determine the duration of either increased turbidity event. Treatment actions and BMPs designed to limit erosion and reduce sediment delivery to Bedrock Creek should continue to be implemented.

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