Key Findings

Data analysis for a five-year review of the Mid Snake River/Succor Creek TMDL was completed in 2011 (DEQ 2011). This document is available at: http://www.deq.idaho.gov/media/699532-snake-river-succor-creek-sba-tmdl-five-year-review-0911.pdf. The identified pollutants in this watershed are exclusively nonpoint source in nature. Tributaries are generally low volume rangeland streams that have a combination of geography, geology, land use, low flow volume, and flow alteration, which can lead to exceeding the Idaho Water Quality Standards for sediment that are necessary to support COLD. Instream channel erosion is the primary source of sediment loading in McBride, Hardtrigger, and Pickett Creeks. As a result, 80% bank stability was selected as a surrogate target to achieve 28% depth fines in these creeks. Conversely, irrigated agriculture is likely the primary source of sediment loading in Birch Creek and Vinson Wash. The target was therefore established at 20 mg/L for a duration of four months throughout the irrigation season (May 1 – September 30).

Segments Listed in the 303(d) List:
The Mid Snake River/Succor Creek §303(d) water quality limited segments for sedimentation/siltation are shown in Figure A. Table A displays the listing in the most recent Integrated Report (2010) and the SBA outcomes based on the 2010 Integrated Report, and data collected by DEQ in 2011 and 2012.

This report is available at: http://www.deq.idaho.gov/media/725927-2010-integrated-report.pdf.

Table A. Summary of 303(d) listed water quality segments and outcomes in this TMDL.

Water Body Name/Assessment Unit	Boundaries	Pollutant	TMDL(s) Completed	Recommended Changes to the 2012 Integrated Report	Justification	TMDL Loads
Birch Creek AU: 021_02, 03, 04	Headwaters to Snake River	Sediment	Sediment	Move to Section 4a	TMDL completed	20 mg/L
Hardtrigger Creek AU: 008_02	Headwaters to Snake River	Sediment	Sediment	Move to Section 4a	TMDL Completed	80% Streambank Stability & Lateral Recession Rates ≤ 0.05
McBride Creek AU: 004_02, 03	Headwaters to Oregon Line	Sediment	Sediment	Move to Section 4a	TMDL Completed	80% Streambank Stability & Lateral Recession Rates ≤ 0.05
Pickett Creek AU: 016_03	Bates Creek Confluence to Browns Creek Confluence	Sediment	Sediment	Move to Section 4a	TMDL Completed	80% Streambank Stability & Lateral Recession Rates ≤ 0.05
Vinson Wash AU:23_03	Poison Creek Confluence to Mouth	Sediment	Sediment	Move to Section 4a	TMDL Completed	20 mg/L

AU – Assessment Unit; mg – milligrams; L – liters

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1. Subbasin Assessment – Watershed Characterization

This document presents an addendum for the 2003 Mid Snake River/Succor Creek subbasin assessment (SBA) and total maximum daily load (TMDL). This document addresses the water bodies in the watershed that are on Idaho's current §303(d) list for sedimentation/siltation.

1.1. Introduction—Regulatory Requirements

This document is prepared in compliance with both federal and state regulatory requirements, as described in the following.

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the CWA, are to adopt WQS necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible.

Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet WQS). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve WQS.

1.2. Public Participation and Comment Opportunities

The development of the Mid Snake River/Succor Creek Addendum included the following public participation:

- Public meetings with the watershed advisory group (WAG) and others,
    - WAG, October 31, 2012
    - WAG, January XX, 2013

1.3. Physical, Biological, and Cultural Characteristics

A thorough discussion of the physical, biological, and culturual characteristics of the Mid Snake River/Succor Creek watershed is provided in the Mid Snake River/Succor Creek SBA/TMDL approved by EPA in 2003 (DEQ 2003), and the Mid Snake River/Succor Creek *TMDL Five-Year Review HUC 17050103* (DEQ 2011).

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1.3.1. Subwatershed Characteristics

Birch Creek (ID17050103SW021_02, 03, & 04)

Birch Creek drains approximately 78 square miles and generally flows in a northeasterly direction. The fourth order creek watershed begins at close to 7,050 feet in elevation and reaches the Snake River at around 2,340 feet. The upper mainstem of Birch Creek is an ephemeral, dry, sandy wash (part of which is used as motorized route) as it leaves the Owyhee front range and passes through sagebrush habitat and managed rangelands for approximately 25 miles. It then enters irrigated agricultural land and flows perennially for approximately 1.7 miles before entering the Snake River.

The upper, ephemeral portion of the wash exhibits some natural entrenchment and unstable banks, due to episodic rain events and the friable nature of the soils. Other portions result from anthropogenic influences such as use of the wash channel by OHVs and other 4-wheel drive vehicles, and livestock grazing.

Alternatively, although the lower, perennial segment of the creek exhibits some entrenchment and unstable banks due to natural soil conditions, the anthropogenic influences on the streambank stability and sediment loading likely results from irrigated agricultural practices. That is, flows in the lower segment of Birch Creek, resulting from irrigated agriculture, are contributing elevated levels of sediment to the Snake River. The primary source of suspended sediment likely comes from these irrigated lands because: a) the ephemeral upper wash segments do not typically flow and rarely reach the lower perennial segments, and b) sediment delivery in the lower perennial segment corresponds to irrigation patterns, and does not correspond well to stream flow throughout the irrigation season.

Land Ownership and Land Use

Figure 1 shows the land ownership patterns within the watershed. Approximately 95% of the Birch Creek watershed is rangeland, while the lower segment near the Snake River is primarily irrigated agriculture (< 4%). While some private lands exist in the upper part of the watershed, this land is primarily BLM- and state-owned. Most of the private holdings in the area are irrigated agriculture near the Snake River between the towns of Oreana and Grand View.

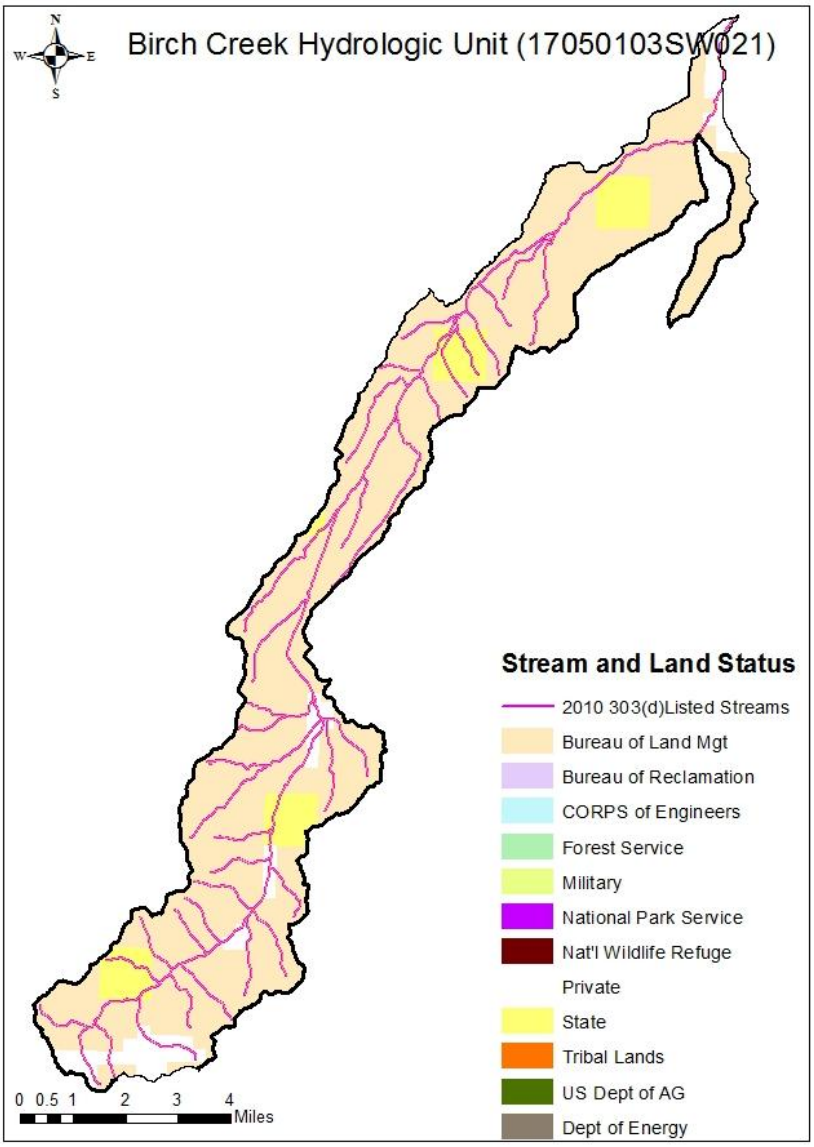

Figure 1. Land ownership in the Birch Creek watershed.

<u>Hardtrigger Creek</u> (ID17050103SW008_02)

Hardtrigger Creek drains approximately 20 square miles and generally flows in a northeasterly direction. This second order creek begins at approximately 6,010 feet and empties into the Snake River at around 2,230 feet. The mainstem of Hardtrigger Creek flows for approximately 13 miles; exiting the Owyhee front to flow through rangeland and then through rural-developed and pastureland areas for the final ¾ miles before its confluence with the Snake River. Hardtrigger Creek has several tributaries that join in the upper rangeland portions, including Middle Fork Hardtrigger and Little Hardtrigger, which contribute approximately 7 miles of additional stream length to the watershed.

This creek exhibits some unstable banks throughout various segments of the watershed, likely due in part to the friable nature of some of the soils, but also due to anthropogenic influences such as 4-wheel drive roads adjacent to the creek and active livestock grazing.

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However, there is also much well established riparian vegetation throughout much of the channel, consisting of willows, wild roses, and grasses.

Land Ownership and Land Use

Figure 2 shows the land ownership patterns within the watershed. Approximately 90% of Hardtrigger Creek watershed is rangeland, while the lower reach near the Snake River is rural development and irrigated pasture (approximately 5%). While private lands exist in the upper part of the watershed, most land in the upper watershed is primarily BLM- and state-owned. Most of the private holdings in the area are closest to the Snake.

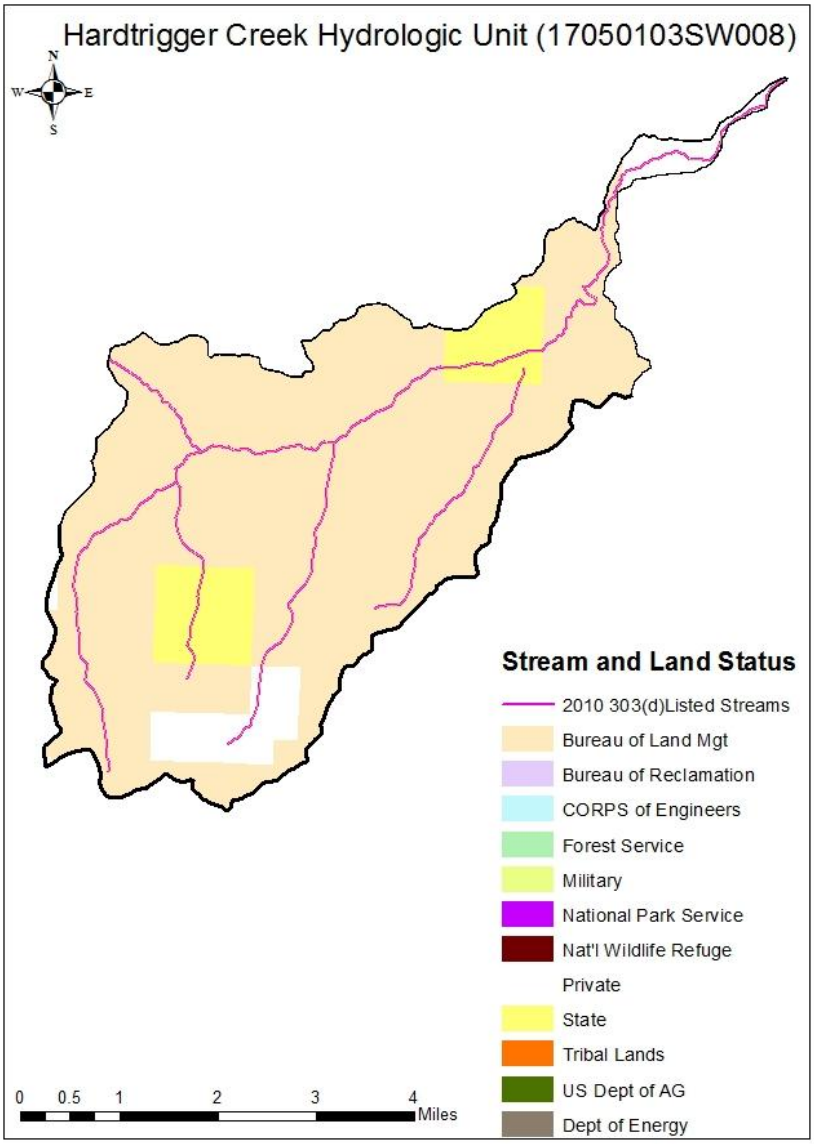

Figure 2. Land ownership in the Hardtrigger Creek watershed.

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McBride Creek (ID17050103SW004_02 & 03)

McBride Creek drains approximately 38 square miles and generally flows in a northwesterly and westerly direction. This second and third order creek begins at approximately 6,740 feet in elevation and crosses into Oregon at around 3,850 feet. The mainstem of McBride Creek flows for approximately 17 miles from the Owyhee front, primarily through rangeland. It then crosses the Oregon border and joins Succor Creek. There are some perennial tributaries, including Little McBride Creek and Willow Fork in the upper portion of the watershed, and a numerous intermittent and ephemeral channels, which join the mainstem of McBride Creek throughout the watershed.

The upper portion of the watershed has some well-established riparian vegetation along the channel, but also exhibits signs of bank instability and erosion, likely due, due to anthropogenic influences such as adjacent roads, culverts, and livestock grazing. Conversely, the lower segments of the watershed are more intermittent in nature, and bank instability appears to be more directly related to a combination of the friable nature of some of the soils, episodic high flow events, adjacent roads and culverts, and livestock grazing. This lower portion also exhibits, in places, signs of current and previous lateral channel movement, and recovery through formation of new channel floodplains and banks.

Land Ownership and Land Use

Figure 3 shows the land ownership patterns within the watershed. Approximately 90% or more of McBride Creek watershed is rangeland, while about 6% is forested, less than 2% is in irrigated agriculture. Although considerable private land exists throughout the watershed, the majority is BLM- and state-owned. Most of the private holdings are along the middle to upper segments of McBride Creek and along the Little McBride and Willow Fork segments. (Figure 5).

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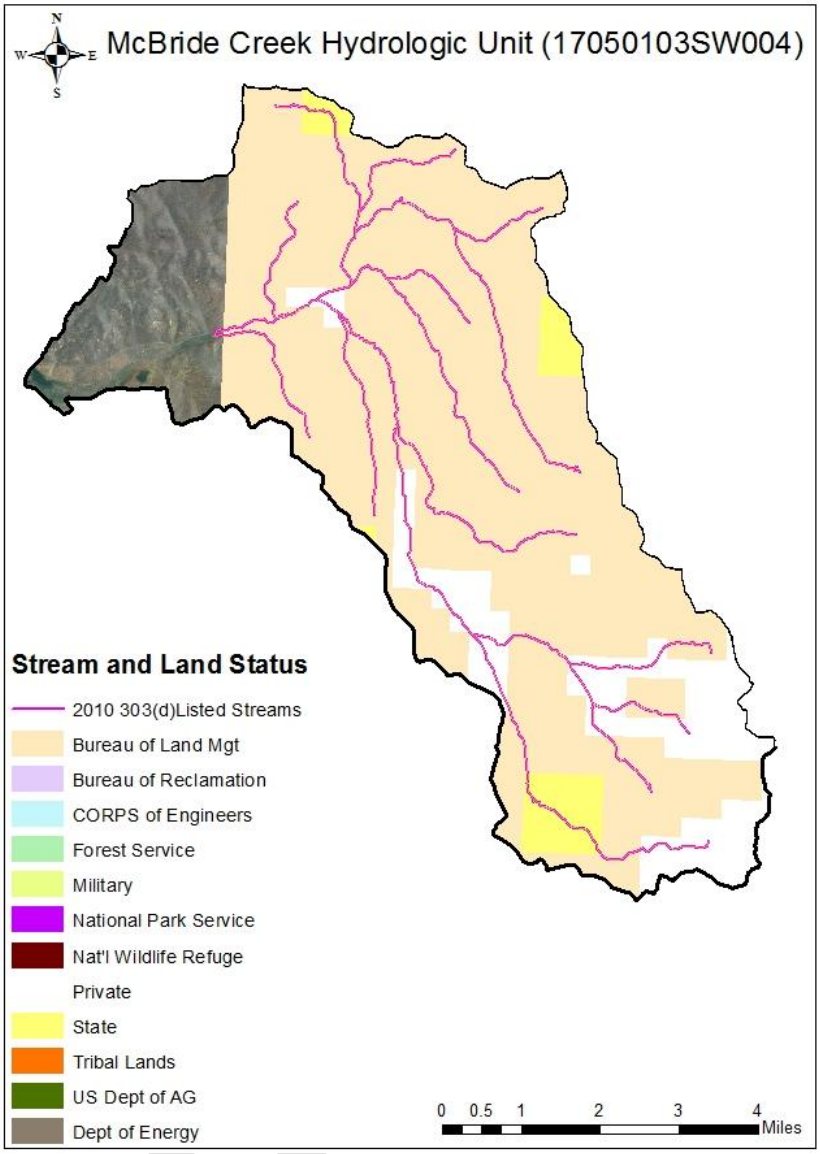

Figure 3. Land ownership in the McBride Creek watershed.

<u>Pickett Creek</u> (ID17050103SW016_03)

Pickett Creek drains approximately 63 square miles to its confluence with Brown Creek and generally flows in a northeasterly direction. The headwaters of Pickett Creek begin at approximately 8,410 feet elevation and drops down to approximately 2,680 feet where it joins Catherine Creek and then Brown Creek. Beyond the scope of this AU and TMDL, Catherine Creek then continues on to join Castle Creek, which then continues on to join the Snake River.

The impaired AU of Pickett Creek, however, only flows for approximately 6.5 miles. It begins upstream at the confluence with Bates Creek, where it flows downstream for approximately 2.6 miles and joins Catherine Creek. It then continues downstream for approximately 3.8 miles where it joins Brown Creek. The AU above the confluence with

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Bates Creek and below the confluence with Brown Creek is not impaired for sediment and not part of this TMDL.

This creek exhibits unstable banks throughout various segments of the watershed, likely due in part to the friable nature of some of the soils, but also due to anthropogenic influences such as livestock grazing and irrigated agricultural practices adjacent to the creek. Where the riparian area has not been disturbed or the channel is not deeply downcut, the riparian area contains cottonwoods, willows, wild roses, and grasses.

Land Ownership and Land Use

Figure 4 shows the land ownership patterns within the Pickett Creek watershed. Approximately 85% of the Pickett Creek watershed is rangeland, while about 12% is forested, less than 2% is in irrigated agriculture. Although considerable private land exists throughout the watershed, especially along the lower segments of Pickett and Catherine Creeks, the majority of land is BLM- and state-owned (Figure 6).

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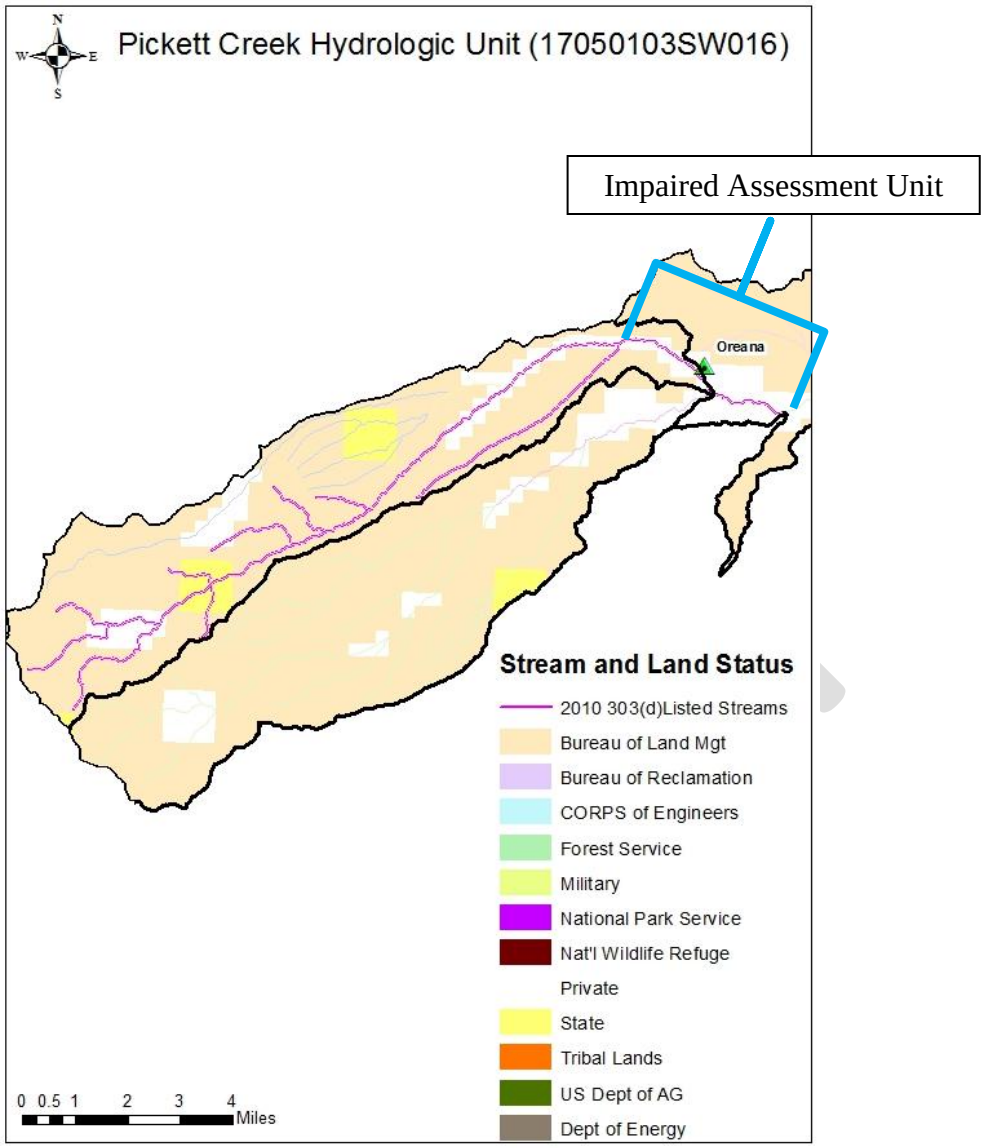

Figure 4. Land ownership in the Pickett Creek watershed.

<u>Vinson Wash</u> (ID17050103SW023_03)

VinsonWash drains approximately 48 square miles and generally flows in a northeasterly direction. The watershed begins at close to 6,320 feet in elevation and reaches the Snake River at around 2,350 feet. The upper portion of the watershed consists of several unimpaired tributaries, including Poison Creek, which join to form Vinson Wash. From there, the ephemeral, sandy, and dry Vinson Wash leaves the Owyhee front range and passes through sagebrush habitat and managed rangelands for approximately 4.5 miles. It then enters irrigated agricultural land and flows perennially for approximately 3.5 miles before entering the Snake River.

Very similar to the conditions on Birch Creek, the upper, ephemeral portion of the wash exhibits some natural entrenchment and unstable banks, due to episodic rain events and the

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friable nature of the soils. Other portions result from anthropogenic influences such as use of the wash channel by OHVs and other 4-wheel drive vehicles, and livestock grazing.

Alternatively, the lower, perennial segment of the creek exhibits some streambank instability and sediment loading that likely result primarily from irrigated agricultural practices and the friable nature of the soils. That is, flows in the lower segment of Vinson Wash, resulting from irrigated agriculture, are the likely source of elevated sediment levels that reach the Snake River. The primary source of suspended sediment likely comes from these irrigated lands because: a) the ephemeral upper wash segment does not typically flow and rarely reaches the lower perennial segment, and b) judging from data collected in the very similar and nearby Birch Creek, sediment delivery in the lower perennial segment likely corresponds to irrigation patterns, but does not correspond well to stream flow throughout the irrigation season.

Land Ownership and Land Use

Figure 5 shows land ownership patterns within the Vinson Wash watershed (the figure only shows the impaired AU, below the confluence with Poison Creek). Approximately 98% of the entire Vinson Wash watershed is rangeland, while the lower segment near the Snake River is private land, primarily as irrigated agriculture (< 2%). Aside from these private lands near the Snake River, the remaining watershed is virtually all BLM- and state-owned.

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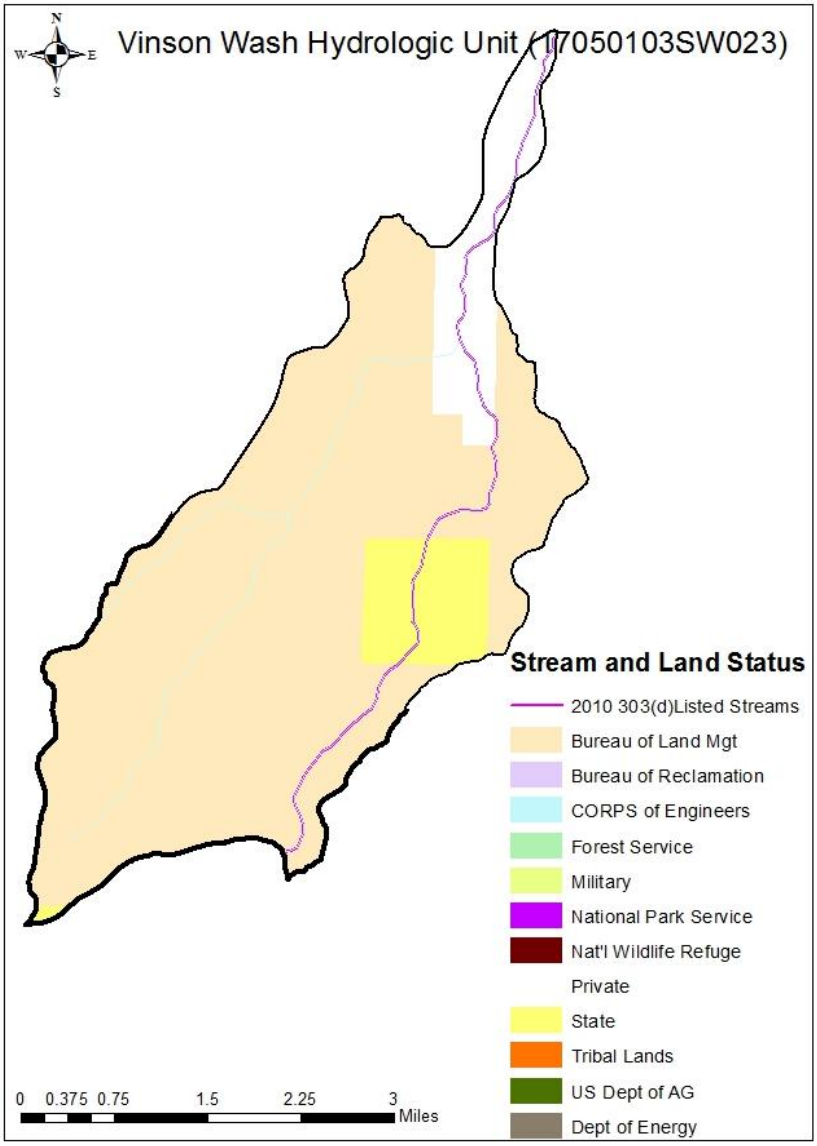

Figure 5. Land ownership in the Vinson Wash watershed.

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2. Subbasin Assessment – Water Quality Concerns and Status

2.1. Water Quality Limited Assessment Units Occurring in the Subbasin

Section 303(d) of the CWA states that waters that are unable to support their beneficial uses and that do not meet WQS must be listed as water quality limited waters. Subsequently, these waters are required to have TMDLs developed to bring them into compliance with WQS.

2.1.1. Additional Waters Listed Since SBA/TMDL Approval

Table 1 shows the pollutants listed and the basis for listing for each §303(d) listed AU in the Mid Snake River/Succor Creek watershed that has been added since the publication of the lower Payette River SBA/TMDL approved by EPA in 2003.

Table 1. §303(d) Segments in the Mid Snake River/Succor Creek subbasin.

Water Body Name	Assessment Unit ID Number	2010 §303(d) Boundaries	Pollutants	Listing Basis
Vinson Wash	ID17050103SW023_03	Poison Creek to Snake River	Sedimentation / Siltation	Combined Biota/Habitat Bioassessments

A thorough investigation, using the available data, was performed before determining whether or not a TMDL is necessary.

2.2. Applicable Water Quality Standards and Beneficial Uses

Idaho WQS, defined in IDAPA 58.01.02, designate beneficial uses, and set water quality goals for the waters of the state.

Idaho WQS require that surface waters of the state be protected for *beneficial uses*, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses as briefly described in the following paragraphs. The *Water Body Assessment Guidance*, second edition (WBAG II) (Grafe et al. 2002) gives a more detailed description of beneficial use identification for use assessment purposes. This document can be accessed at: http://www.deq.idaho.gov/media/457010-wbag_02_entire.pdf.

2.2.1. Existing Uses

Existing uses under the CWA are "those uses actually attained in the waterbody on or after November 28, 1975, whether or not they are included in the WQS." The existing in-stream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.050.02, .02.051.01, and .02.053). Existing uses include uses actually occurring, whether or not the level of quality to support fully the uses exists. A practical application of this concept would be to apply the existing use of salmonid spawning

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to a water that could support salmonid spawning, but salmonid spawning is not occurring due to other factors, such as dams blocking migration.

2.2.2. Designated Uses

Designated uses under the CWA are "those uses specified in WQS for each water body or segment, whether or not they are being attained." Designated uses are simply uses officially recognized by the state. In Idaho, these designated uses include aquatic life support, recreation in and on the water, domestic water supply, and agricultural uses. Water quality must be sufficiently maintained to meet the most sensitive use.

Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use such as cold water aquatic life or salmonid spawning.

Designated uses are specifically listed for water bodies in Idaho in tables in the Idaho WQS (see IDAPA 58.01.02.003.27 and .02.109-.02.160, in addition to citations for existing uses).

2.2.3. Presumed Uses

In Idaho, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations. These undesignated uses are to be designated. In the interim, and absent information on existing uses, DEQ presumes that most waters in the state will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these "presumed uses," DEQ will apply the numeric cold water aquatic life (COLD) criteria and primary or secondary contact recreation (PCR/SCR) criteria to undesignated waters.

If in addition to these presumed uses, an additional existing use, (e.g., salmonid spawning [SS]) exists, because of the requirement to protect levels of water quality for existing uses, then the additional numeric criteria for SS would additionally apply (e.g., intergravel dissolved oxygen, temperature). However, if for example, COLD is not found to be an existing use, a use designation to that effect is needed before some other aquatic life criteria (such as seasonal cold) can be applied in lieu of COLD criteria (IDAPA 58.01.02.101.01).

Table 2. Beneficial uses of Section 303(d) listed streams.

Water Body / Assessment Unit	Beneficial Uses[a]	Type of Use
Birch Creek / AU021_02, _03, & _04	COLD	Presumed
Hardtrigger Creek / AU008_02	COLD	Presumed
McBride Creek / AU004_02 & _03	COLD	Presumed
Pickett Creek / AU016_03	COLD	Presumed
Vinson Creek / AU023_03	COLD	Presumed

[a] COLD – cold water aquatic life

2.3. Criteria to Support Beneficial Uses

Beneficial uses are protected by criteria, which include *narrative* criteria for pollutants such as sediment and nutrients and *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity (IDAPA 58.01.02.250).

Table 3 includes the most common numeric criteria used in TMDLs.

Figure provides an outline of the stream assessment process for determining support status of the beneficial uses of COLD, SS, and contact recreation.

Table 3. Selected numeric criteria supportive of designated beneficial uses in Idaho water quality standards.

Designated and Existing Beneficial Uses			
Water Quality Parameter	**Primary Contact Recreation**	**Secondary Contact Recreation**	**Cold Water Aquatic Life**
Water Quality Standards: IDAPA 58.01.02.250			
Bacteria, pH, and Dissolved Oxygen (DO)	Less than 126 *E. coli*/100 mL as a geometric mean of five samples over 30 days; no sample greater than 406 *E. coli*/100 mL	Less than 126 *E. coli*/100 mL as a geometric mean of five samples over 30 days; no sample greater than 576 *E. coli*/100 mL	pH between 6.5 and 9.0 DO exceeds 6.0 mg/L
Temperature			22 °C or less daily maximum; 19 °C or less daily average
Turbidity			Turbidity shall not exceed background by more than 50 NTU instantaneously or more than 25 NTU for more than 10 consecutive days.
Ammonia			Ammonia not to exceed calculated concentration based on pH and temperature.

E. coli – *Escherichia coli*
mL – milliliters
mg/L – milligrams per liter
˚C – Celsius
Temperature Exemption - Exceeding the temperature criteria will not be considered a water quality standard violation when the air temperature exceeds the ninetieth percentile of the seven-day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station.
NTU – Nephelometric turbidity units

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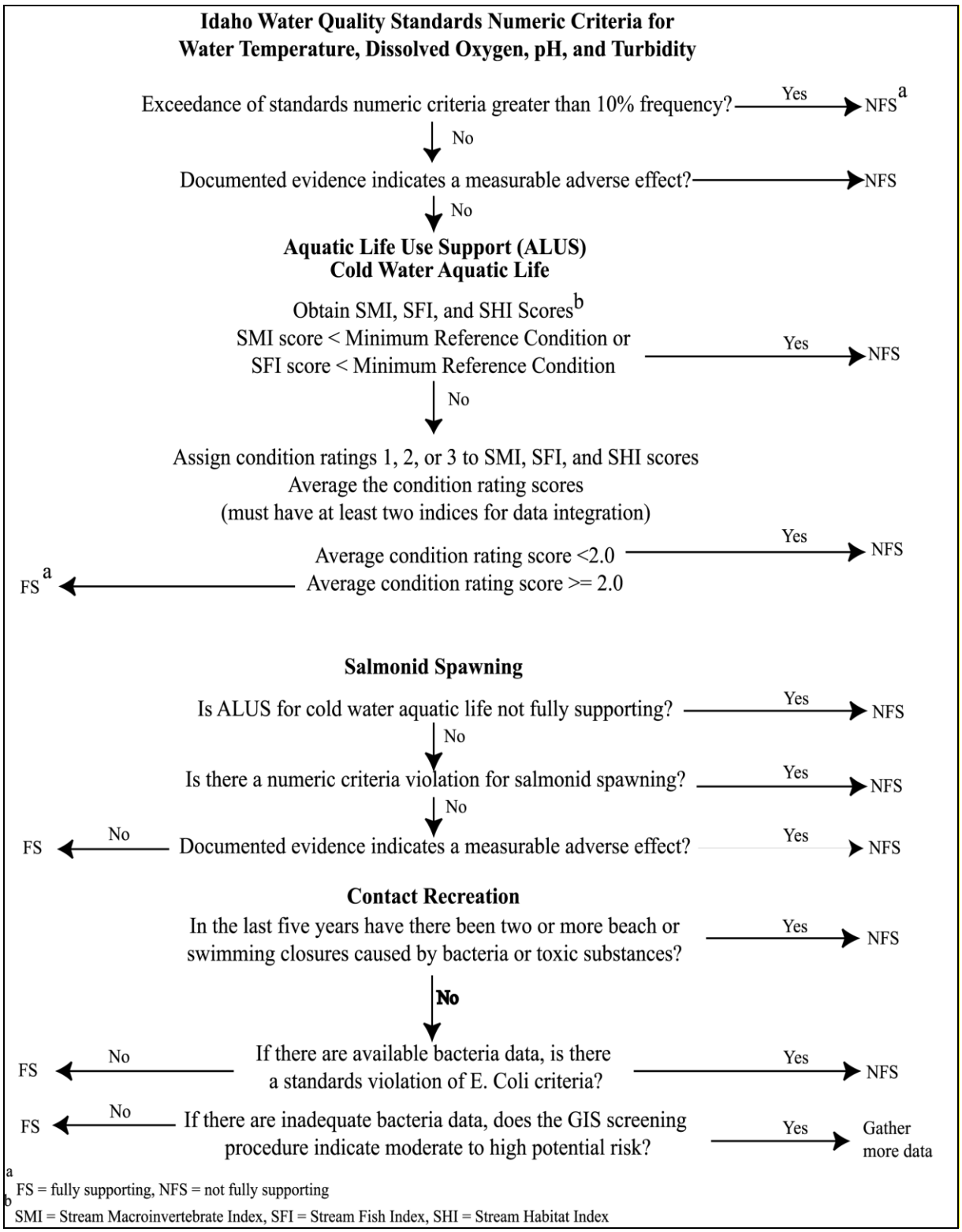

Figure 6. Determination Steps and Criteria for Determining Support Status of Beneficial Uses in Wadeable Streams: *Water Body Assessment Guidance*, Second Edition (Grafe et al. 2002).

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2.4. Summary and Analysis of Existing Water Quality Data

A detailed summary and analysis of existing water column data, flow characteristics and biological and habitat assessment data for the Mid Snake River/Succor Creek subbasin is provided in the *Mid Snake River/Succor Creek SBA and TMDL (DEQ 2003)* and *the Mid Snake River/Succor Creek Five-Year Review* (DEQ 2011). These reports are available at: http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/snake-river-middle-succor-creek-subbasin.aspx.

Birch Creek (ID17050103SW021_02, 03, & 04)

Figure X shows the location of a BURP site in the lower portion of Birch Creek. Two attempts to collect data were undertaken; in 2001 the channel was dry and in 1995 the channel had a measured flow of 3.8 cfs. The 1995 data estimated that the percentage of fines comprising the channel bottom substrate was only 5%, well below the 28% threshold recognized as supporting COLD. The BURP data for Birch Creek are available at: http://mapcase.deq.idaho.gov/wq2010/js/adb2010.aspx?WBIDSEGID=ID17050103SW021_04.

Idaho Power also collected data at the mouth of Birch Creek as part of their Snake River drain and tributary analysis (Idaho Power 2009). The data show that total suspended solids were at 217 mg/L in May, peaked in June at 2720 mg/L and then declined down to 10 mg/L in October. Conversely, flows throughout the sampling period remained between 15.3 and 18.8 cfs for the entire sampling duration. The exception was in October, when flows reached their maximum of 32.3 cfs, which also corresponds to the lowest TSS recorded during the analysis. Table X is a summary reproduction of the sediment data provided in Idaho Power's 2009 Report (the entire report is available as an appendix to this TMDL), while Figure X provides a visual representation of the same data.

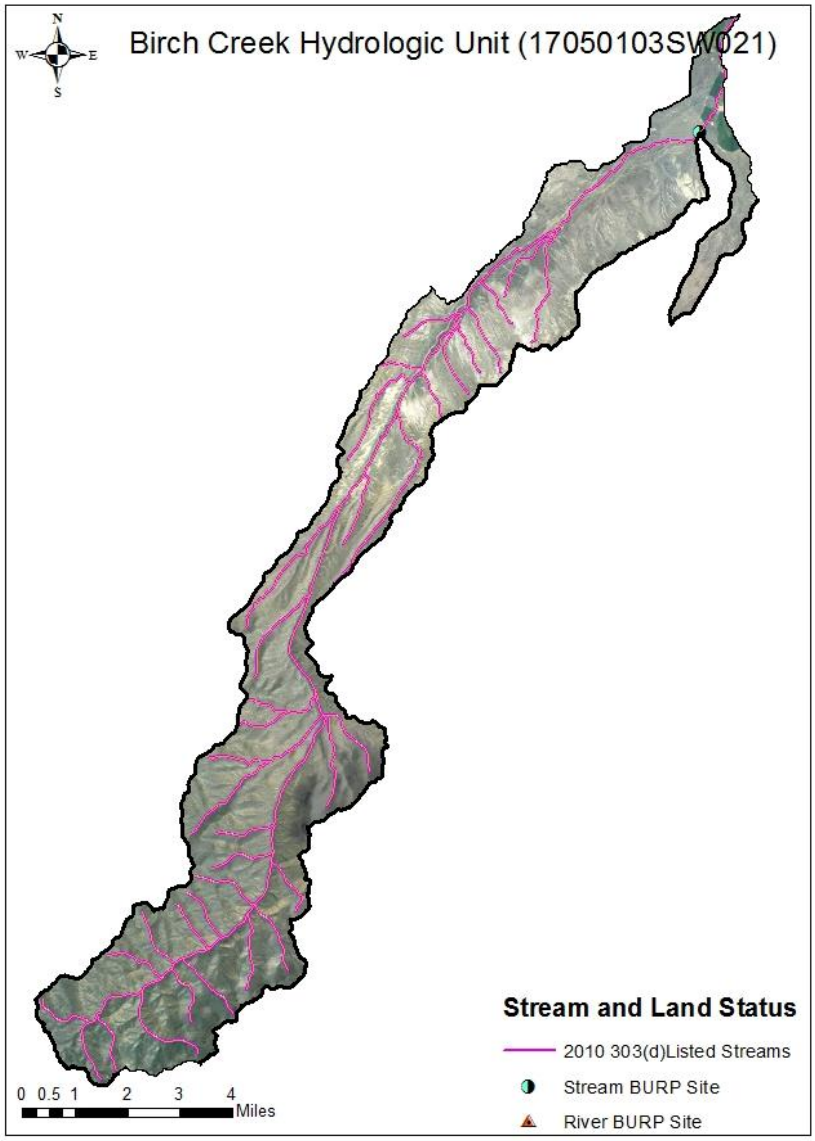

Figure X. DEQ BURP location on Birch Creek. Data was collected in 1995; data was not collected in 2001 because the channel was dry.

Table X. Flow and suspended solid data collected at the mouth of Birch Creek in 2007 by Idaho Power.

Measure Date	Flow (cfs)	Suspended Solids (mg/L)	
		Total	Volatile
5/17/2007	15.4	217	18
6/19/2007	15.3	2720	155
7/31/2007	18.8	742	56
8/29/2007	16.2	531	38
10/8/2007	32.3	10	3

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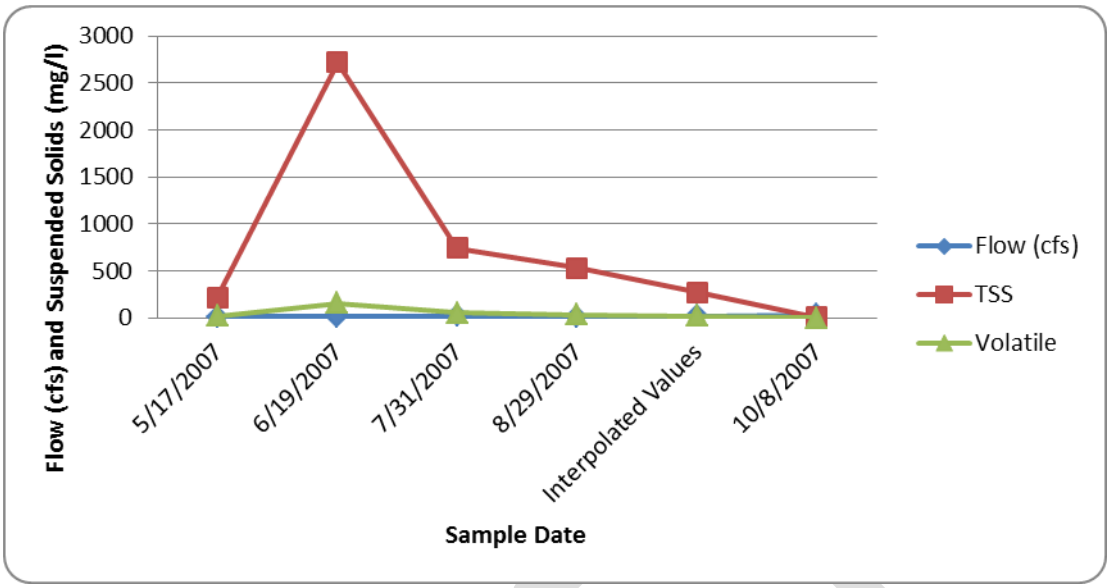

Figure X. Flow and suspended solid data collected at the mouth of Birch Creek in 2007 by Idaho Power.

Hardtrigger Creek (ID17050103SW008_02)

Figure X shows the location of two BURP sites in the Hardtrigger Creek watershed. Attempts were made to collect data in 1995, 1996, and 1998. The channel was dry in 1995 and 1996, but the creek was flowing enough at both sites in 1998 to collect data. The measured flow at each site was 3.9 and 5.1 cfs and total fines for both sites were below the 28% threshold recognized as supporting COLD (19.38 and 23.08%, respectively). The BURP data for Hardtrigger Creek are available at: http://mapcase.deq.idaho.gov/wq2010/js/adb2010.aspx?WBIDSEGID=ID17050103SW008_02.

Additionally, in 2011 DEQ personnel conducted streambank stability inventories along multiple sections of the impaired Hardtrigger Creek AUs (Figure X). The data indicate that Hardtrigger Creek has streambank stability levels of approximately XX.X%, with lateral recession rates (X.XXX ft/year) that contribute to sediment loads.***Hardtrigger Creek data will be re-collected in spring 2013 due to yet, unreconcilable issues with the 2011 data.***

Finally, the BLM also has collected streambank stability data on Hardtrigger Creek between 2005 and 2012 (Table X). During this time, streambank stability measures have varied from as low as 30% up to 94%. During 4 of the 8 years of data collection, streambank stability was greater than 80%, the streambank stability threshold widely recognized as supporting COLD. Conversely, streambank stability over the remaining 4 of 8 years was less than 72%, below the 80% threshold. And, in 2012 the BLM also measured in-channel fines as comprising 36% of the total substrate.

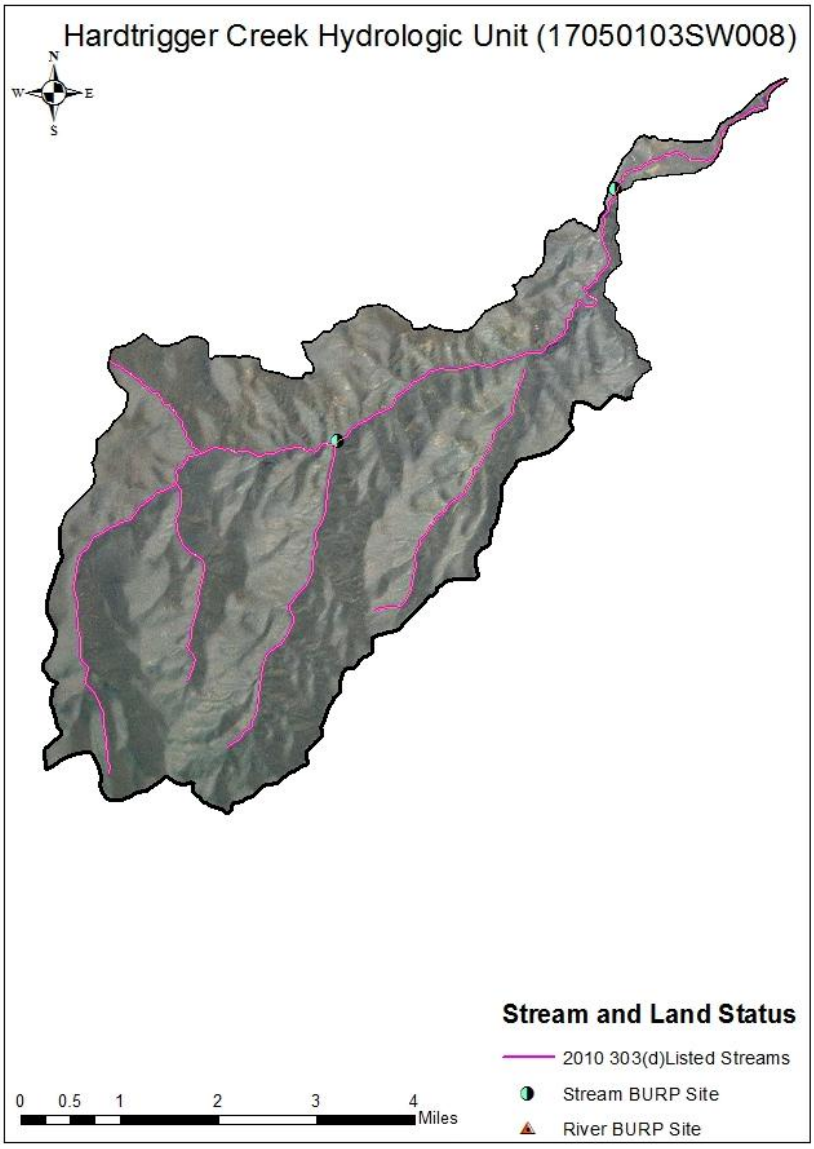

Figure X. DEQ BURP locations on Hardtrigger Creek. Data was collected in 1998; data was not collected in 1995 or 1996 because the channel was dry.*Will need to be updated with 2013 streambank inventory locations.**

Table X. Streambank stability data collected on Hardtrigger Creek (UTM: 4801645N, 517535E) from 2005 through 2012 by the BLM.

Year	Streambank Stability
2005	68%
2006	94%
2007	91%
2008	72%
2009	46%
2010	30%
2011	88%

2012	81%

McBride Creek (ID17050103SW004_02 & 03)

Figure X shows the location of the BURP site in the McBride Creek watershed. The channel was dry in 2001, but in 1996 the creek flow was estimated at 0.2 cfs and channel-bottom substrate fines were estimated at 13%, below the 28% threshold. The BURP data for McBride Creek are available at: http://mapcase.deq.idaho.gov/wq2010/js/adb2010.aspx?WBIDSEGID=ID17050103SW004_02.

Additionally, in 2011 DEQ personnel conducted streambank stability inventories along two sections of Mcbride Creek (Figure X): 1) a lower elevation, intermittent section, and 2) a higher elevation, perennial section. The data indicate that lower elevation and more intermittent segments of McBride Creek have streambank stability levels of approximately 61.1%, but with rather high lateral recession rates (0.135 ft/year) that contribute significantly to sediment loads. Conversely, the data indicate that higher elevation and more perennial segments of McBride Creek have lower streambank stability rates (approximately 51.7%), but with considerably lower lateral recession rates (0.04 ft/year), resulting in lower sediment loading.

Finally, in 2011 the BLM estimated streambank stability data on McBride Creek (UTM: 4787654N, 506299E) at 78%, which falls just below the 80% streambank stability threshold recognized as supporting COLD.

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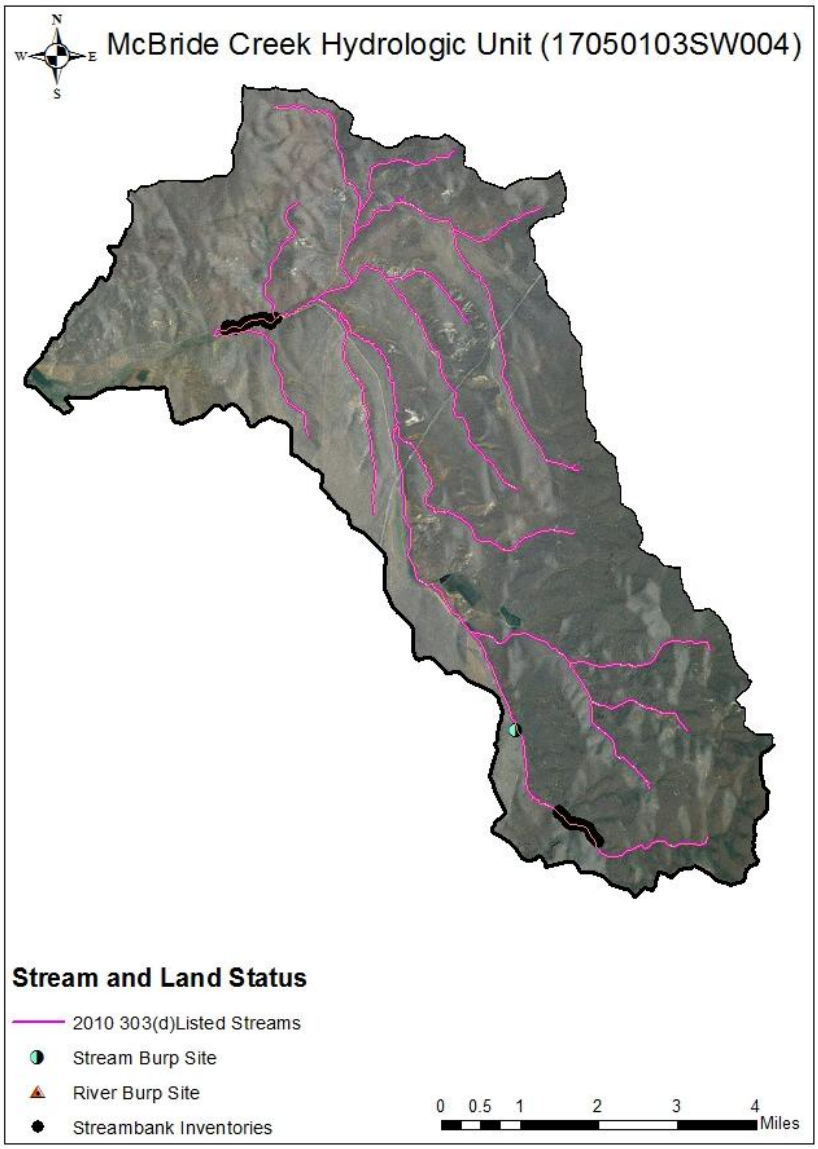

Figure X. DEQ BURP sites and streambank stability inventory locations on McBride Creek. BURP data was collected in 2001; streambank stability data was collected in 2011.

Pickett Creek (ID17050103SW016_03)

Figure X shows the location of BURP sites in the Pickett Creek watershed. The channel was dry in 2001, but in 1996 the creek flow was estimated at 6.1 and 7.4 cfs and channel-bottom substrate fines were estimated at 10% and 7%, below the 28% threshold. The BURP data for Pickett Creek are available at: http://mapcase.deq.idaho.gov/wq2010/js/adb2010.aspx?WBIDSEGID=ID17050103SW016_03.

Additionally, in 2012 DEQ personnel conducted streambank stability inventories along a section of Pickett Creek (Figure X). The data indicate that Pickett Creek have streambank

stability levels of approximately 80.5%, which is right at the threshold believed to support COLD, but with rather high lateral recession rates (0.15 ft/year) that contribute significantly to sediment loads.

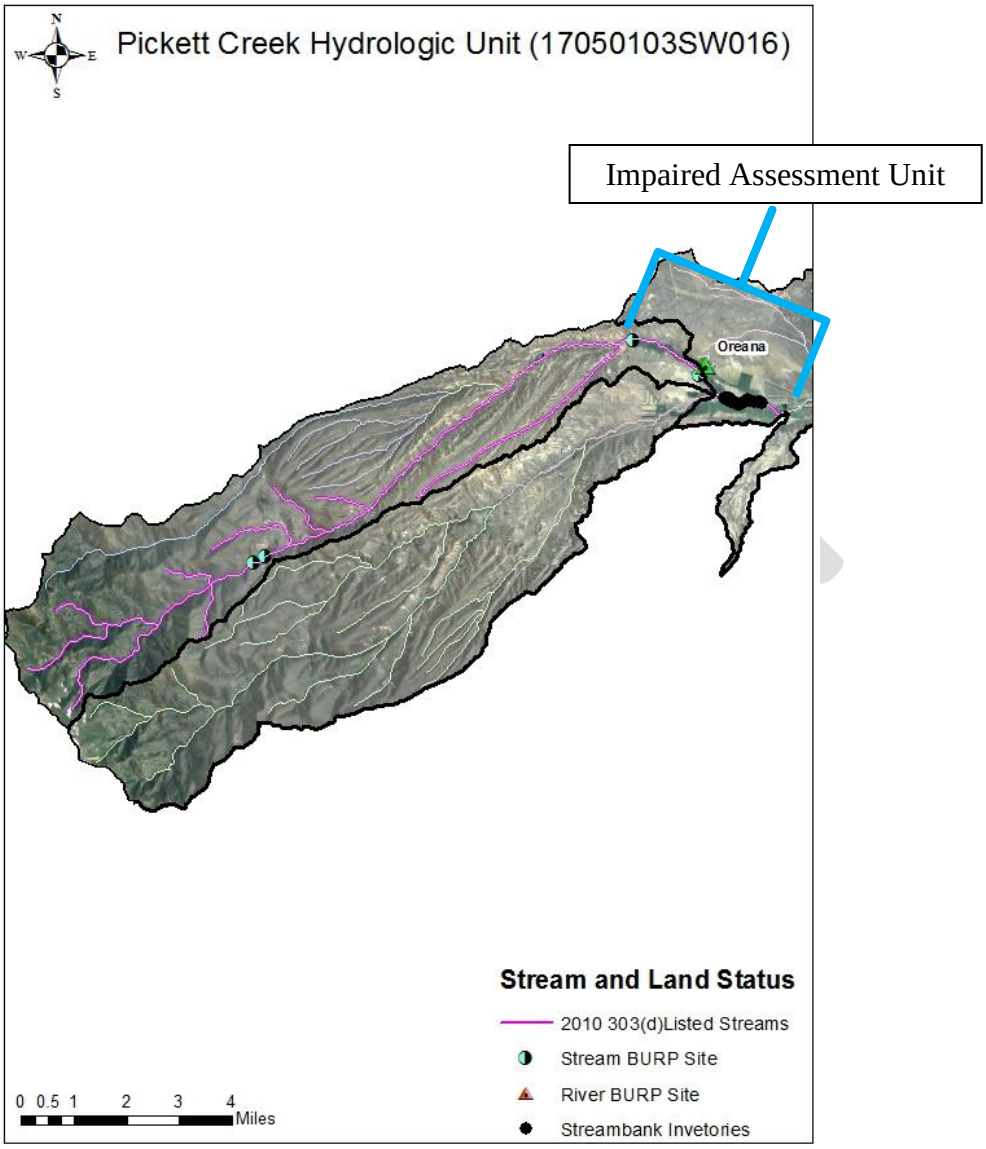

Figure X. DEQ BURP sites and streambank stability inventory locations on Pickett Creek. BURP data was collected in 1996; streambank stability data was collected in 2012.

Vinson Wash (ID17050103SW023_03)

Figure X shows the BURP site in the very lower portion of Vinson Wash. In 2001 this segment of the channel had a measured flow of 1.5 cfs; the percentage of fines comprising the channel bottom substrate was estimated at over 58%, well outside of the 28% threshold recognized as supporting COLD. The BURP data for Vinson Wash are available at: http://mapcase.deq.idaho.gov/wq2010/js/adb2010.aspx?WBIDSEGID=ID17050103SW023_03.

Idaho Power visually observed what is believed to be the mouth of Vinson Wash as part of their Snake River drain and tributary analysis (identified as River Mile 483.1 in Idaho Power 2009). The site was visited on May 17, June 20, July 31, August 29, and October 9, 2007. The site was observed to have water flowing into the river during all site visits, with the exception of the October 9 visit, where no flow was observed October suggesting that it may be primarily comprised of drain returns (pers. comm. 2012).

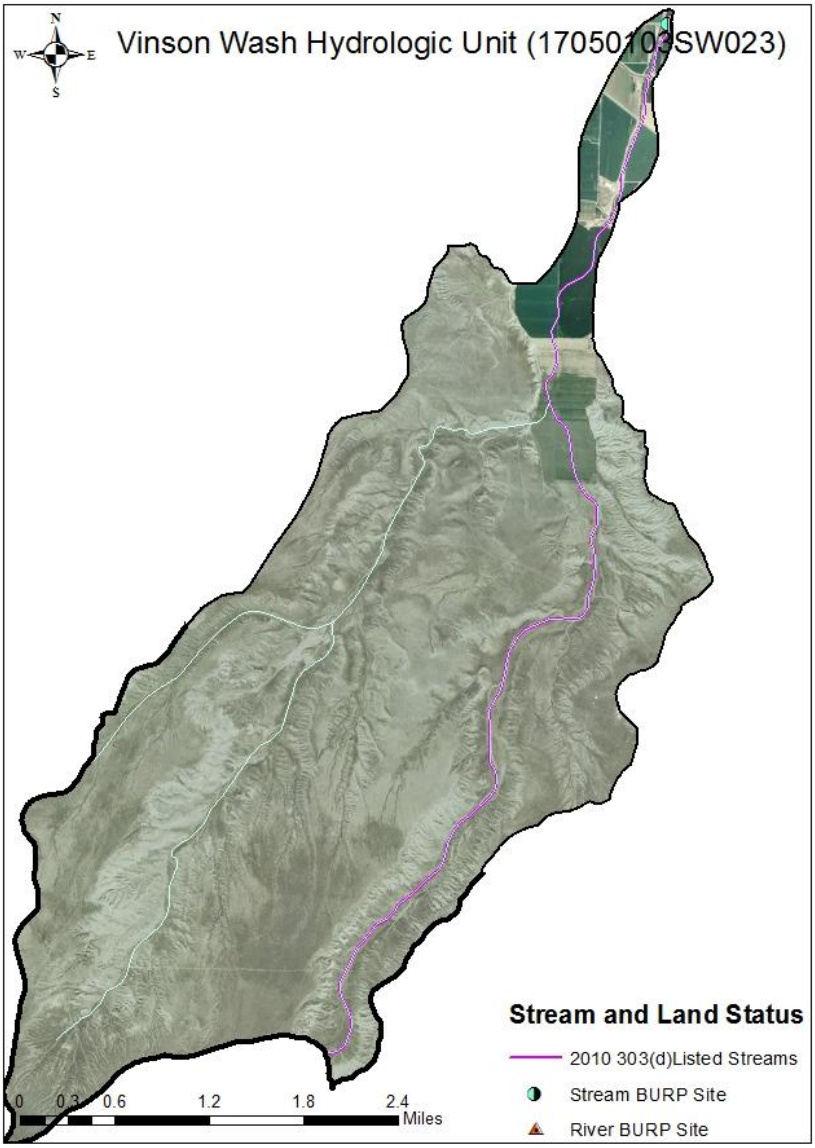

Figure X. The DEQ BURP site on Vinson Wash. BURP data was collected in 2001.

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2.5. Data Gaps

A detailed discussion of data gaps for the Mid Snake River/Succor Creek subbasin is provided in the *Mid Snake River/Succor Creek SBA and TMDL (DEQ 2003)* and *the Mid Snake River/Succor Creek Five-Year Review* (DEQ 2011). These reports are available at: http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/snake-river-middle-succor-creek-subbasin.aspx.

The intention is to address data gaps as activities to restore beneficial use support are undertaken in the watershed. The details of how this could be accomplished will be included in the implementation plan.

2.6. Conclusions

Based on a thorough analysis of the data collected by DEQ BURP crews, streambank stability data collected by DEQ personnel in 2011-2013 and by the BLM from 2005-2012, and from the data and report produced by Idaho Power in 2009, it is evident that COLD beneficial uses are likely impaired by sediment in the specific AUs addressed for Birch Creek, Hardtrigger Creek, McBride Creek, Pickett Creek, and Vinson Wash. Further, it is evident that due to the absence of point sources, nonpoint sources are the most likely source of these impairments.

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3. Subbasin Assessment–Pollutant Source Inventory

Since the lower *Mid Snake River/Succor Creek TMDL (DEQ 2003)* was approved, DEQ has collected data, requested data from other agencies and organizations, searched external databases, and reviewed university publications and municipal or regional resource management plans for additional and recent water quality data. The results of that effort were compiled in *the Mid Snake River/Succor Creek Five-Year Review* (DEQ 2011) and recommendations for impairment listings and TMDL development for these tributaries have been made. This section will address water quality data (sedimentation/siltation) related to beneficial uses, or impairments in the Mid Snake River/Succor Creek subbasin (specifically, Birch Creek, Hardtrigger Creek, McBride Creek, Pickett Creek, and Vinson Wash).

The pollutant of concern for this review is limited to sedimentation/siltation for which narrative criteria are established in Idaho WQS and have been identified as current or potential limiting factors for attainment of designated, existing, or presumed beneficial uses in the Mid Snake River/Succor Creek subbasin.

3.1. Sources of Pollutants of Concern

A review of identified or observed sources of impairment to surface water in the subbasin, including permitted point sources, nonpoint sources, natural events, and documented or otherwise known accidental releases was completed in the *Mid Snake River/Succor Creek TMDL (DEQ 2003)* and included in *the Mid Snake River/Succor Creek Five-Year Review* (DEQ 2011).

3.1.1. Point Sources

There are no individually-permitted point sources in the Birch Creek, Hardtrigger Creek, McBride Creek, Pickett Creek, or Vinson Creek watersheds.

There are, however, several RCRA and CERCLA sites in the Mid Snake River/Succor Creek subbasin, which are identified in the *Mid Snake River/Succor Creek TMDL (DEQ 2003)* and the *Mid Snake River/Succor Creek Five-Year Review* (DEQ 2011).

3.1.2. Nonpoint Sources

A detailed discussion of nonpoint sources in the subbasin is provided in the *Mid Snake River/Succor Creek TMDL (DEQ 2003)* and the *Mid Snake River/Succor Creek Five-Year Review* (DEQ 2011). While locations of agricultural diversions, dams, and drains in the subbasin can be indicated as specific points on the landscape, the CWA designates these as nonpoint sources due to the impact that widespread land use activities have on the water channeled through agricultural irrigation systems. Septic system leakage, paved and unpaved road surfaces are unquantified sources also likely to contribute sediment to surface waters. Contributions from these orphan sources are acknowledged data gaps and implementation plans could include details regarding future data collection from these sources. Figures X

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through X show the land use and habitat patterns within Birch Creek, Hardtrigger Creek, McBride Creek, Pickett Creek, and Vinson Wash Watersheds.

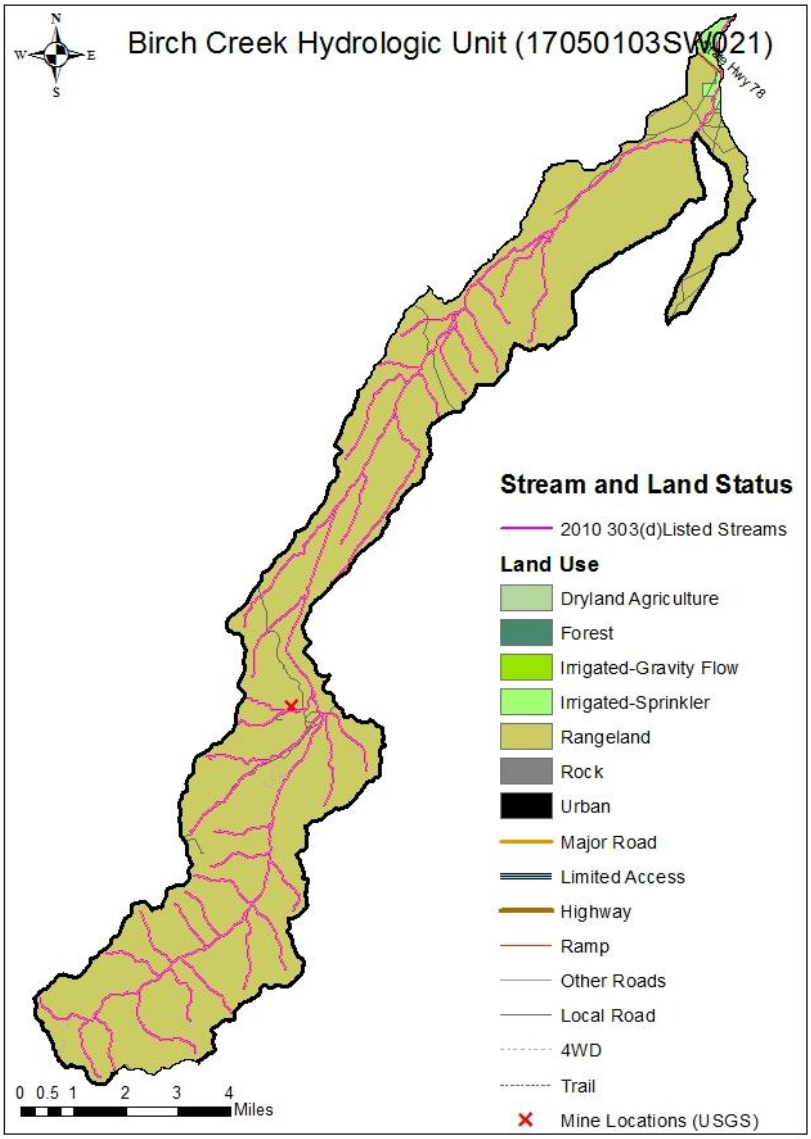

Figure X. Land use in the Birch Creek watershed.

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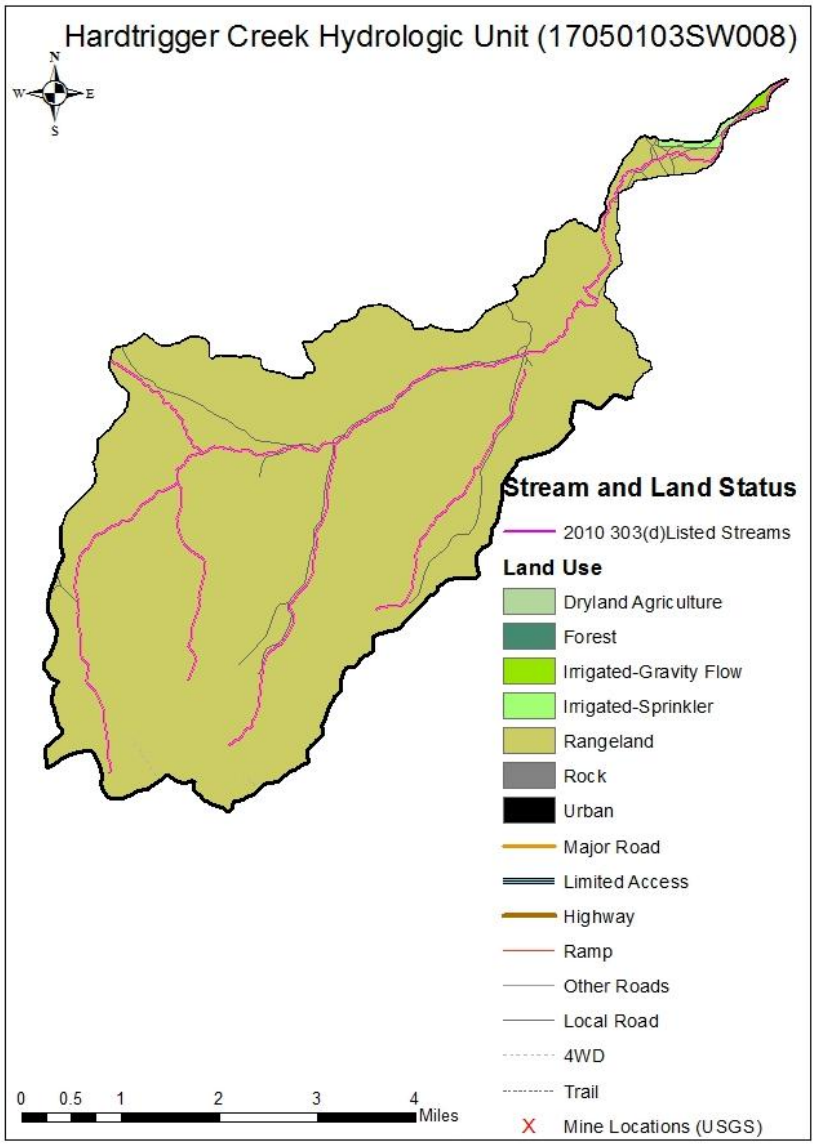

Figure X. Land use in the Hardtrigger Creek watershed.

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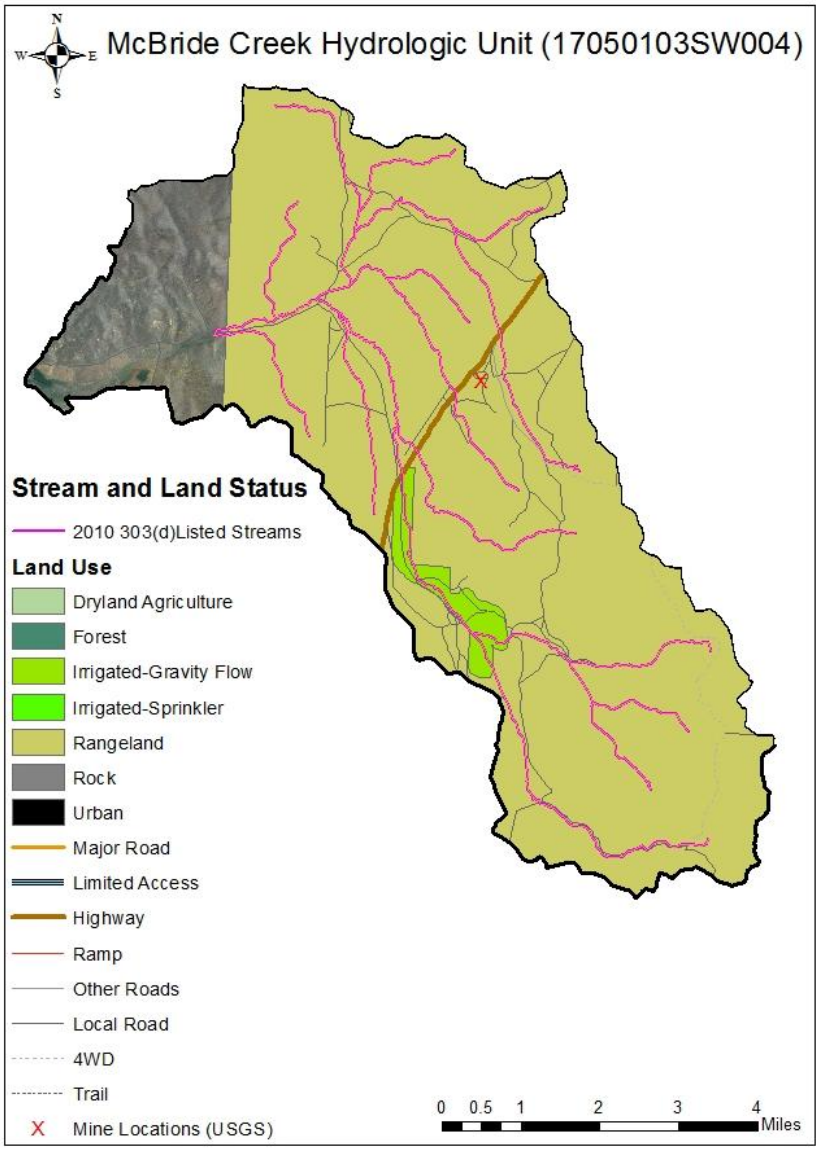

Figure X. Land use in the McBride Creek watershed.

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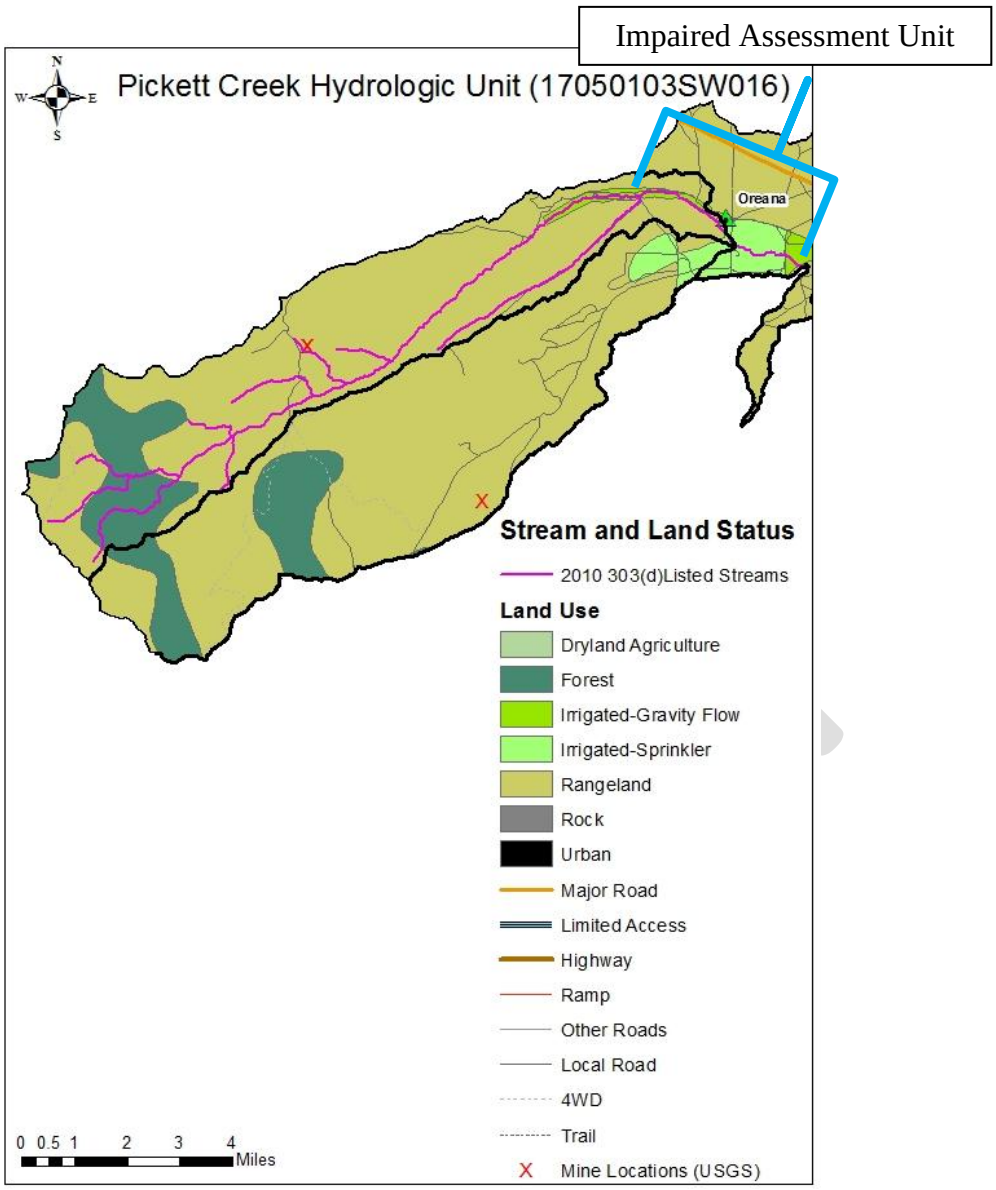

Figure X. Land use in the Pickett Creek watershed.

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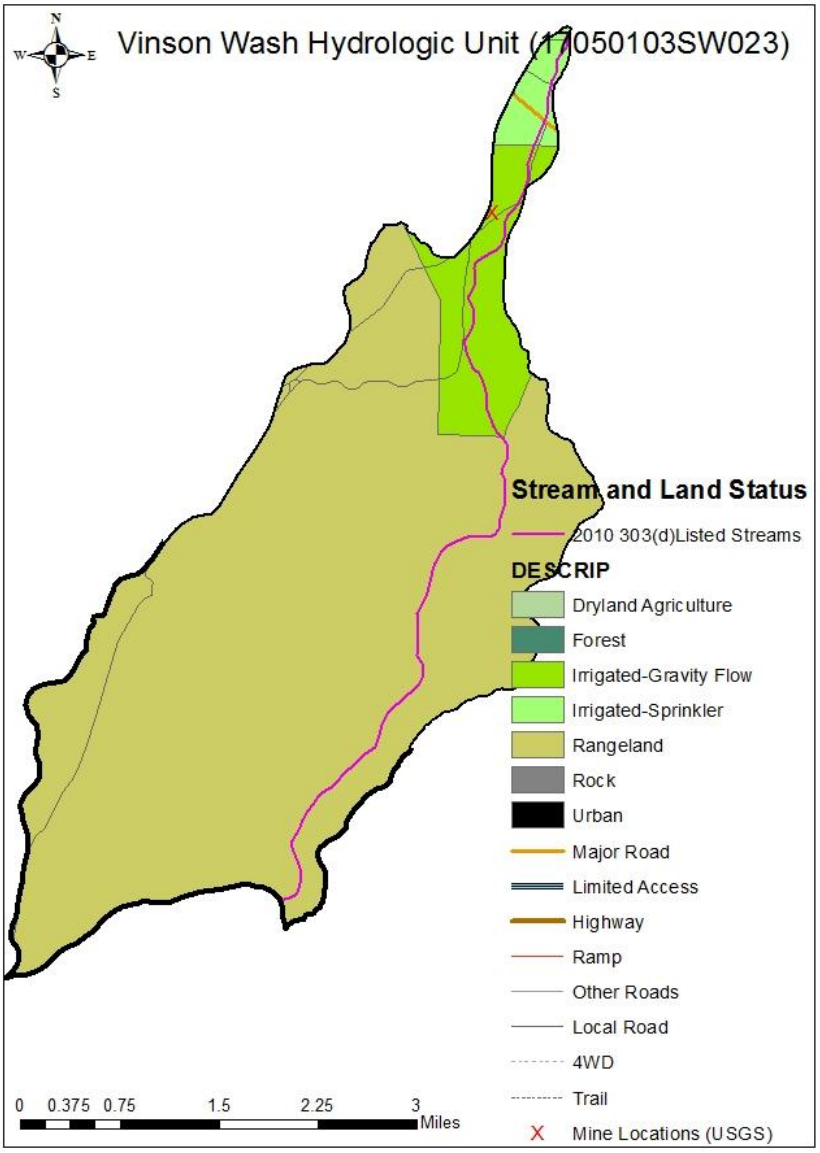

Figure X. Land use in the Vinson Wash watershed.

3.1.3. Pollutant Transport

A discussion of pollutant transport in the subbasin is provided in the *Mid Snake River/Succor Creek TMDL (DEQ 2003)* and the *Mid Snake River/Succor Creek Five-Year Review* (DEQ 2011).

3.2. Data Gaps

Uncertainty in TMDLs is largely the result of insufficient or limited data. However, while it is easier to develop and refine loading analyses and models with adequate data, there is sufficient data from Birch Creek, Hardtrigger Creek, McBride Creek, and Pickett to identify likely pollution sources and develop reasonable LAs and WLAs to reduce pollutant loads.

One potential exception that we have limited streamflow and percent fines data for is Vinson Wash; and we do not have sediment concentration data. However, because much of Vinson Wash is quite similar to Birch Creek (both in the upland, ephemeral, dry sandy wash areas and the lower irrigated agricultural areas, we expect comparable results for both streamflow and sediment concentrations.

Additional data gap issues in the Mid Snake River/Succor Creek subbasin include:

- Spatial data sets for land use, hydrology, and channel morphology are sparse.
- Detailed analyses of in-stream flow conditions, water column chemistry, and stream and riparian characteristics in some locations are difficult or not possible.
- Mass-balance and load calculations are based on low-resolution information.
- Statistically valid representations of natural, undisturbed, or background stream conditions are difficult to obtain.
- Dynamic or highly variable conditions are not evaluated.
- Small-scale processes are not evaluated.
- Water returns and withdrawals are not quantified or are over-simplified.

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4. Monitoring and Status of Water Quality Improvements

The goal of the *Mid Snake River/Succor Creek Watershed TMDL Implementation Plan for Agriculture (ISCC 2005)* is to assist and/or compliment other watershed efforts to restore beneficial uses for the 303(d) listed stream segments within the Mid Snake River/Succor Creek Watershed. The agricultural component of the Implementation Plan (IP) includes an adaptive management approach for the implementation of Resource Management Systems (RMSs) and Best Management Practices (BMPs) to meet the requirements for the Mid Snake River/Succor Creek TMDL. Agricultural RMSs and BMPs on privately owned land will be developed and implemented on site with individual agricultural operators as per the 2003 Idaho Agricultural Pollution Abatement Plan (APAP).

The IP can be accessed at http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/snake-river-middle-succor-creek-subbasin.aspx, and includes a watershed implementation priorities, schedules, and milestones for helping meet WQS.

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5. Total Maximum Daily Load(s)

A TMDL prescribes an upper limit (or *load capacity*) on discharge of a pollutant from all sources to assure water quality standards are met. This load capacity (LC) can be represented by an equation:

LC = MOS + NB + LA + WLA

Where:

> Current load = the current concentration of the pollutant in the water body
>
> MOS = margin of safety. Because of uncertainties regarding quantification of loads and the relation of specific loads to attainment of water quality standards, 40 CFR Part 130 requires a margin of safety, which is effectively a reduction in the load capacity available for allocation to pollutant sources.
>
> NB = natural background. When present, NB may be considered part of load allocation (LA), but it is often considered separately because it represents a part of the load not subject to control. NB is also effectively a reduction in the load capacity available for allocation to human-made pollutant sources.
>
> LA = the load allocation for all nonpoint sources
>
> WLA = the wasteload allocation for all point sources

A load is a quantity of a pollutant discharged over some period; numerically, it is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, federal rules allow for "other appropriate measures" to be used when necessary. These "other measures" must still be quantifiable, and relate to water quality standards, but they allow flexibility to deal with pollutant loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads and allow "gross allotment" as a load allocation where available data or appropriate predictive techniques limit more accurate estimates. For certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads.

5.1. In-stream Water Quality Targets

Instream water quality targets are selected for the purpose of restoring beneficial uses to the water body. A detailed discussion of in-stream water quality targets is provided in the *Mid Snake River/Succor Creek TMDL (DEQ 2003)* and the *Mid Snake River/Succor Creek Five-Year Review* (DEQ 2011).

5.1.1. Design Conditions

Design conditions are those methods used to determine LC, existing pollutant loads, WLAs, and LAs. Because these elements are variable for each pollutant and AU combination, design conditions are discussed separately for sediment concentration and bank stability measures. Load capacity is the calculated watershed sediment load that fully supports beneficial uses. The LC for a TMDL designed to address a sediment caused limitation to use

support is complicated by the fact that the State's water quality standard is narrative rather than numerical.

Within the Mid Snake River/Succor Creek subwatersheds, the sediment interfering with COLD beneficial uses is likely to be primarily fine sediment, < 0.063 mm in size. Adequate quantitative measurements of the effect of excess sediment on the aquatic life uses in the subwatersheds have not been fully developed. Given this reality, a sediment LC for the TMDL can be developed using literature-based values from effects-based studies (empirical). The sediment LC values for these Mid Snake River/Succor Creek subwatersheds are based the following assertions:

- Natural background concentrations of suspended sediment and bank stability measures in similar watersheds and values identified in scientific literature are fully supportive of COLD beneficial uses.
- The stream system has some finite ability to process (transport) suspended sediment at concentrations greater than background values without impairing beneficial uses.
- The beneficial use will respond positively to a concentration of full support, which can be quantified when the finite, yet unquantified, ability of the stream system to process sediment is met.

5.1.1.1. Sediment Concentration (Birch Creek and Vinson Wash)

Detailed analyses of the support of COLD beneficial uses in the Birch Creek and Vinson Wash watersheds have not been conducted and, at this time, it is not possible to a clearly appropriate sediment concentration values with statistical accuracy. Therefore, indirect methods are used to arrive at a LC for these Snake River tributaries to serve as target water column values until such time as more direct and empirical data are available.

Sediment conditions as they relate to WQS are assessed through the interpretation of the narrative criteria based on impacts to aquatic life. Guidelines established by previous and developing TMDLs (for example the Lower Boise River Sediment TMDL 1998 and the developing Lower Boise River Tributary Sediment TMDL) efforts are based on the work of Newcombe and Jensen (1996). These established sediment concentrations likely to support designated beneficial uses based on a Severity of Ill Effects (SEV) of 8, which Newcombe and Jensen identified as sublethal and identified by DEQ and the EPA (pers. comm. 2012) as protective of aquatic life, water quality, and meeting the requirements of the CWA.

An SEV of 8, or any other level for that matter, can result from specific combinations of sediment concentration and exposure duration that is believed to be supportive of fish and other aquatic life. As identified in Newcombe and Jensen (1996), a constant SEV can be maintained by either increasing or decreasing the level of in stream sediment concentration, while doing the opposite with exposure duration (Figure X). For example, juvenile salmonids are likely to experience an SEV of 8 under sediment concentrations of 403 mg/L over 2 days (a high dose over a short time period), but also under sediment concentrations of 20 mg/L over 4 months (a low dose over a long time period).

FISH RESPONSES TO SUSPENDED SEDIMENT

Juvenile Salmonids

Duration of exposure to SS ($\log_e$ hours)

(B) Average severity-of-ill-effect scores (calculated)

Concentration (mg SS/L)	0	1	2	3	4	5	6	7	8	9	10	($\log_e$ mg SS/L)
162755	9	10	11	11	12	13	14	14	-	-	-	12
59874	9	9	10	11	11	12	13	14	14	-	-	11
22026	8	9	9	10	11	11	12	13	13	14	-	10
8103	7	8	9	9	10	11	11	12	13	13	14	9
2981	6	7	8	9	9	10	11	11	12	13	13	8
1097	6	6	7	8	9	9	10	11	11	12	13	7
403	5	6	6	7	8	9	9	10	11	11	12	6
148	4	5	6	6	7	8	9	9	10	11	11	5
55	4	4	5	6	6	7	8	8	9	10	11	4
20	3	4	4	5	6	6	7	8	8	9	10	3
7	2	3	4	4	5	6	6	7	8	8	9	2
3	1	2	3	4	4	5	6	6	7	8	8	1
1	1	1	2	3	4	4	5	6	6	7	8	0
	1	3	7	1	2	6	2	7	4	11	30	
	Hours			Days			Weeks		Months			

Figure X. Observed and expected responses of juvenile salmonids under varying sediment concentrations and periods of exposure. This figure was taken from page 703 in Newcombe and Jensen (1996).

Birch Creek and Vinson Wash likely contain elevated suspended solid concentrations as a result of agricultural return water. Using the available site-specific data and scientific literature, a suspended sediment target value of 20 mg/L over 4 months (an SEV of 8) will be applied during the average irrigation season (May 1 through September 30) to ensure water quality standards are met and COLD beneficial uses are fully supported. The target of 20 mg/L over 4 months during the irrigation season will address TSS conditions in these AUs during the time of year when loads are the highest. Additionally, this value is very similar, yet even more supportive than concentrations allocated to Succor Creek (22 mg/L) and Bissel Creek (22 mg/L) in EPA-approved TMDLs (DEQ 2003a, 2003b).

5.1.1.2. Streambank Stability (Hardtrigger, McBride and Pickett Creeks)

The primary source of sediment for the remaining listed tributaries in this addendum is likely instream erosional processes. For these tributaries where the largest amount of sediment is produced from instream erosion, a target of greater than 80% stream bank stability is recommended. This surrogate measure has been used in other EPA-approved TMDLs, including the *Mid Snake River/Succor Creek TMDL (DEQ 2003)*, the Pahsimeroi and Blackfoot TMDLs (DEQ 2001a, 2001b), and is based on findings by Overton et al. (1995). Using NRCS (1983) derived equations, erosion rates and total tons of eroded sediment/year

can be calculated using bank inventory ratings. This 80% bank stability target has been linked to a 28% fines target and has been shown to support salmonids and, thus by corollary, is protective of other aquatic life.

To qualify the seasonal and annual variability and critical timing of sediment loading, climate and hydrology must be considered. The sediment analysis characterizes loads using average annual or seasonal rates determined from empirical characteristics that develop over time within the influence of peak and base flow conditions. While deriving these estimates it is difficult to account for seasonal and annual variation within a particular time frame; however, the seasonal and annual variation is accounted for over the longer time frame under which observed conditions have developed.

The annual average sediment load is not distributed equally throughout the year. Annual erosion and sediment delivery are functions of climate, where wet water years typically produce the highest sediment loads. Additionally, most of the erosion typically occurs during a few critical months. For example, in the Mid Snake River/Succor Creek watershed, most stream bank erosion occurs during spring runoff. The sediment analysis uses empirically derived hydrologic concepts to help account for variation and critical time periods. First, field-based methods consider critical hydrologic mechanisms. For example stream bank erosion inventories account for the fact that most bank recession occurs during peak flow events when banks are saturated. Second, the estimated annual average sediment delivery from a given watershed is a function of bankfull discharge or the average annual peak flow event.

Reduction of stream bank erosion prescribed within this TMDL is directly linked to the improvement of riparian vegetation density and structure to armor stream banks, reduce lateral recession, trap sediment, and reduce the erosive energy of the stream, thus reducing sediment loading. In reaches that are down-cut, or that have vertical erosive banks, continued erosion may be necessary to re-establish a functional floodplain that would subsequently be colonized with stabilizing riparian vegetation, a process that often takes many years.

5.1.2. Target Selection

Targets are selected with the intention to select reasonably achievable values that can be expected to support the beneficial uses in these impaired AUs. The sediment concentration and bank stability targets are based on site-specific empirical data, published scientific literature, and similar watershed analyses.

5.1.2.1. Sediment (Concentration) – Birch Creek and Vinson Wash

A TSS target value of 20 mg/L for a maximum of 4 months, applied continuously throughout the irrigation season (May 1-September 30), has been developed for Birch Creek and Vinson Wash. The target is linked to conditions that will ensure Idaho WQS are met and COLD beneficial uses are returned to full support. The TSS target was derived from similar watersheds (Succor Creek, Bissel Creek, and Lower Boise River Tributaries), and by referencing the extensive metadata analysis conducted by Newcombe and Jensen (1996). Since the irrigation season represents the TSS conditions in these waterbodies during a time

of year when loading in the stream is highest, the target of 20 mg/L over 4 months will ensure aquatic life beneficial uses will be supported.

This analysis calculates existing loads based on recorded flow and TSS values from data collection efforts in 2007 (Idaho Power 2009), providing estimated average monthly rates based on empirical information.

5.1.2.2. Sediment (Streambank Stability) – Hardtrigger, McBride, and Pickett Creeks

An 80% streambank stability target, applied year-round, has been developed for Hardtrigger, McBride, and Pickett Creeks. The target is linked to conditions that will ensure Idaho WQS are met and COLD beneficial uses are returned to full support. The streambank stability target was modeled after similar watersheds and EPA-approved TMDLs (Mid Snake River/Succor Creek TMDL 2003, Pahsimeroi TMDL 2001, and Blackfoot TMDL 2001), and is based on findings by Overton et al. (1995) and NRCS-derived (1983) bank inventory ratings and erosion rate equations.

Background sediment production from stream banks equates to the load at 80% stream bank stability as described in Overton et al. (1995), where stable banks are expressed as a percentage of the total estimated bank length. Natural condition stream bank stability potential is generally at 80% or greater for A, B, and C channel types in plutonic, volcanic, metamorphic, and sedimentary geology types.

The 80% streambank stability target is designed to meet the established instream water quality target of 28% or less fine sediment (less than 6.35 mm in diameter) in riffle areas suitable for salmonid spawning. Stream bank erosion reductions are quantitatively linked to tons of sediment per year. An inferential link is identified to show how sediment load allocations will reduce subsurface fine sediment to or below target levels. This link assumes that by reducing chronic sources of sediment, there will be a decrease in subsurface fine sediment that will ultimately improve the status of beneficial uses. Stream bank erosion load allocations are based upon the assumption that stream bank erosion is the primary source of sediment.

Site-specific analyses calculate existing loads based on streambank stability data collection efforts by DEQ personnel in 2011-2013, and BLM personnel in 2005-2012.

5.1.3. Monitoring Points

The monitoring locations for the DEQ BURP and streambank stability data are illustrated in Figures X through X. The monitoring locations for the Idaho Power collected flow and sediment data are available in their report (Idaho Power 2009). The location for the BLM streambank stability and other data are available at XXXX.

In addition future data collection in the AU should take place at locations and frequencies consistent with Idaho WQS for determining beneficial use support during the implementation phase of the TMDL.

5.2. Load Capacity

The LC is the amount of pollutant a water body can receive without violating water quality standards. Seasonal variations and a MOS to account for any uncertainty are calculated within the LC. The MOS accounts for uncertainty about assimilative capacity, the precise relationship between the selected target and beneficial use(s), and variability in target measurement. The LC is based on existing uses within in the watershed. The LC for each water body and specific pollutant are tailored to both the nature of the pollutant and the specific use impairment. A required part of the loading analysis is that the LC be based on critical conditions – the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both LC and pollutant source loads vary, and not necessarily in concert, determination of critical conditions can be more complicated than it may appear on the surface.

5.2.1.1. Sediment (Concentration) – Birch Creek and Vinson Wash

The LC for sediment concentration is based on the instream load that would be present when a concentration of 20 mg/L is met. The LC for Birch Creek and Vinson Wash is based on maintaining 20 mg/L TSS for 4 months during the critical flow, irrigation season, period (May 1 through September).

5.2.1.2. Sediment (Streambank Stability) – Hardtrigger, McBride, and Pickett Creeks

In those instances where the majority of sediment is generated from stream bank erosion, the LC is based on the load generated from banks that are greater than 80% stable. This load defines the LC for the remaining segments of the stream. The 80% streambank stability target is designed to meet the established instream water quality target of 28% or less fine sediment (less than 6.35 mm in diameter) in riffle areas suitable for salmonid spawning.

5.3. Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading," (Water quality planning and management, 40 CFR § 130.2(I)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the type of sources (land use) and area (such as a subwatershed), but may be aggregated by type of source or land area. To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads.

5.3.1.1. Sediment (Concentration and Bank Stability)

In instances where sediment was generated via agricultural or other nonpoint source activities (Birch Creek and Vinson Wash), the existing loads were calculated using measured water column data. In instances where the primary source of sediment is from bank erosion (Hardtrigger, McBride, and Pickett Creeks), existing sediment loads were determined using the bank erosion inventory process. This method provided direct measurement of erosion rates within the reach. This erosion rate was then used to calculate the current instream delivery of sediment within the system.

5.4. Load Allocation

Load allocations (LAs) may take the form of required percentage reductions rather than actual loads. Each point source must receive a waste load allocation (WLA). Nonpoint source allocations may be allocated by subwatershed, land use, responsibility for actions, or a combination of sources and activities. It is not necessary to allocate a reduction in load for all nonpoint sources so long as water quality targets can be met with the reductions that are specified. In developing LAs, the total allocations must include a margin of safety (MOS) to take into account seasonal variability and uncertainty. Uncertainty arises in selection of water quality targets, LCs, and estimates of existing loads. The uncertainty is attributable, in part, to incomplete knowledge or understanding of the system, such as unknown assimilation processes, and variable data. The MOS is effectively a reduction in LC that "comes off the top" (i.e., the LC is reduced by the MOS before the remaining LC is allocated to sources). The second factor is the natural background load, a further reduction in LC available for allocations. It is also prudent to allow for growth by reserving a portion of the remaining available load (if any) for future sources.

5.4.1.1. Sediment (Concentration) – Birch Creek and Vinson Wash

The targets for TSS in Birch Creek and Vinson Wash are 20 mg/L over a 4 month duration during the critical irrigation season period (May 1 through September 30). The 20 mg/L target is intended to provide protection for aquatic life species that may inhabit the stream.

Table X shows the LAs for Birch Creek and Vinson Wash. The allocations are designed to meet the TSS goals of 22 mg/L with checkpoints near end of each stream. The load is calculated using the standard pollutant mixing equation: $mixed\ conc. = (conc_1 * flow_1) + (conc_2 * flow_2) / (flow_1 + flow_2)$ (Hammer 1986). Fixed load targets were selected because management practices that affect sediment loading to the streams are not expected to change on a day-to-day basis. Thus, the management practices should be developed to meet the load goals.

Because the loading capacity for Birch Creek and Vinson Wash is based on maintaining the instream target throughout the critical irrigation period (May 1 through September 30), the actual mass load capacity changes at any given time or location in the stream as flows increase or decrease. As shown in the Table X, if the load allocations are met, the loading capacity will be met.

Table X. Gross TSS Load Allocations for of Birch Creek (AU021_02, 03, & 04) and Vinson Wash (AU023_03). Data does not exist for Vinson Wash, so calculations are derived from Birch Creek due to their watershed similarity, proximity, and sediment sourcing. Green shading indicates the load capacity (target) for each waterbody.

Month	Flow (cfs)	TSS Concentration (mg/L)	TSS Load (tons/day)[1]	Load Capacity at 20 mg/L (tons/day)	Load Reduction
May	15.4	217	9.1	0.8	8.2 tons/day; 91%
June	15.3	2720	112.4	0.8	111.5 tons/day; 99%
July	18.8	742	37.7	1.0	36.6 tons/day; 97%
August	16.2	531	23.2	0.9	23.4 tons/day; 96%
September	24.3[2]	271[2]	17.8	1.3	16.5 tons/day; 93%
October	32.3	10	0.9	1.7[3]	0 tons/day; 0%[3]

[1]The existing loads and load allocations are calculated using a portion the standard pollutant mixing equation with a built-in conversion factor: *(conc*flow*5.4)* (Hammer 1986).
[2]Interpolated flow and sediment concentration values; no data was available to September.
[3]No reduction is necessary because the existing load is less than the loading capacity. However, no additional sediment should be discharged to the stream.

The analysis for Birch Creek and Vinson Wash shows that TSS loads must be reduced by an average 95% in order to maintain 20 mg/L in the stream throughout the irrigation season (May 1 through September 30).

5.4.1.2. Sediment (Streambank Stability) – Hardtrigger, McBride, and Pickett Creeks

The remaining sediment-impaired stream segments in the Mid Snake River/Succor Creek basin are receiving allocations due to excess stream bank erosion. Table X shows the load allocations for these segments. The worksheets used to derive these load allocations are located in Appendix X. The current erosion rate is based on the bank geometry and lateral recession rate (as describe in Appendix G) at each measured reach.

The target erosion rate is based on the bank geometry of the measured reach and the lateral recession rate at the reference reach. The reference reach is an area that contains greater than 80% bank stability and less than 28% fine substrate material. The loading capacity is the total load that is present when banks are at least 80% stable with a recession rate of 0.05. As such, the loading capacity and the load allocations are the same. Note that these are the overall decreases necessary in the stream, but only apply to areas where banks are less than 80% stable and/or the lateral recession rate exceeds 0.05. The determination of the reference reach was based solely on the water quality surrogates (e.g. bank stability, percent fines) at a previously identified reference site in the Mid Snake River/Succor Creek subbasin (DEQ 2003).

Table X. Streambank erosion load allocations for Hardtrigger, McBride, and Pickett Creeks. Green shading indicates the load capacity (targets) for each waterbody.

Water Body	Current Load - Erosion Rate (tons/mile/year)	Current Load - Total Erosion (tons/year)	Load Capacity - Target Erosion Rate (tons/mile/year)	Load Capacity -Target Total Erosion (tons/year)	Load Reduction (tons/year; %)
Hardtrigger Creek (AU 008_02)	~~63~~	~~1380~~	~~35~~	~~773~~	~~607 tons/year 44%~~
McBride - Lower (AU 004_03)	85	1400	16	267	1133 tons/year 81%
McBride - Upper (AU 004_02)	41	706	21	366	340 tons/year 48%
Pickett Creek (AU 016_03)	34	217	12	74	143 tons/year 66%

*****Will need to be updated with 2013 streambank inventory for Hardtrigger Creek.**

5.4.2. Margin of Safety

The MOS factored into all load allocations is implicit. The MOS includes the conservative assumptions used to determine existing sediment loads. Conservative assumptions made as part of the loading analysis are discussed below.

5.4.2.1. Sediment (Concentration) – Birch Creek and Vinson Wash

Total suspended solids water column targets are used for lower Birch Creek and Vinson Wash. The TSS target is 20 mg/L over 4 months during the irrigation season (May 1 through September 30). This target is linked by reference, but even more stringent than, segment targets for Succor Creek, Bissel Creek (22 mg/L), and the lower Boise River tributaries (probably 20 mg/L, but still in development). An implicit MOS applies because of the current target is actually lower than Bissel and Succor Creeks, which are believed to be protective of aquatic life.

Second, the 20 mg/L target over 4 months directly references work by Newcombe and Jensen (1996), which identified this combination as producing an sub-lethal on juvenile salmonids (SEV of 8). Conversely, Newcombe and Jensen also identified that lethal effects (SEV of 9) would occur at sediment concentrations of 55 mg/L over 4 months. Therefore, during a 4 month exposure period, sediment concentrations between 20 and 55 mg/L would result in impacts to fish that may or may not be lethal, probably depending on a number of other environmental factors. Thus, using 20 mg/L for 4 months is a conservative target for Birch Creek and Vinson Wash.

5.4.2.2. Sediment (Streambank Stability) – Hardtrigger, McBride, and Pickett Creeks

An implicit MOS exists due to a number of reasons: 1) desired bank erosion rates are representative of background conditions; 2) water quality targets for percent fines are consistent with values measured and as set by land management agencies based on stable salmonid production. In the case of other Mid Snake River/Succor Creek watersheds (Succor, Castle, and Sinker Creeks) reference bank conditions are based on banks that are greater than 80% stable with 28% fines target; and 3) the target also includes a minimum lateral recession rate $\leq$ 0.05, which means that even streams with $\geq$ 80% bank stability (for example, Pickett Creek) may need to further reduce erosional processes to meet the corollary sediment load capacity.

5.4.3. Seasonal Variation and Critical Period

In the Mid Snake/Succor Creek hydrologic unit there are seasonal influences on nearly every pollutant. Based on the data available it is not possible to definitively determine the seasonal variability of sediment in these Mid Snake River/Succor Creek watersheds. However, in general, the summer growing season is when concentrations of sediment and nutrients are the highest. Seasonal variation as it relates to development of this TMDL is addressed simply by ensuring that loads are reduced during the critical period (when beneficial uses are impaired and loads are controllable). Thus, the effects of seasonal variation are built into the load allocations (Table X).

Table X. Critical periods for waterbodies receiving TMDLs.

Waterbody	Pollutant	Critical Period (Time of Year Applicable)
Birch Creek (AU021_02, 03, & 04)	Sedimentation/Siltation (Concentration)	Year Round
Hardtrigger Creek (AU 008_02)	Sedimentation/Siltation (Streambank Stability)	May 1 through September 30
McBride - Lower (AU 004_03)	Sedimentation/Siltation (Streambank Stability)	May 1 through September 30
McBride - Upper (AU 004_02)	Sedimentation/Siltation (Streambank Stability)	May 1 through September 30
Pickett Creek (AU 016_03)	Sedimentation/Siltation (Streambank Stability)	May 1 through September 30
Vinson Wash (AU023_03)	Sedimentation/Siltation (Concentration)	Year Round

Sediment can be easily transported through the agricultural irrigation system and is easily transported through those systems when irrigation water is flowing across cropland during the growing season and when runoff from any source is delivered into the irrigation system in the dormant season. Because irrigation systems are permanent structures designed to transport water across the landscape, pollutants are easily transmitted through the watershed

all year, regardless of crop status. These structures are easily accessible to most community members and border and traverse grazed and cultivated agricultural lands.