Upper Salmon River Subbasin Assessment and TMDL

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IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY
1410 North Hilton
Boise, Idaho 83706

UPPER SALMON RIVER SUBBASIN ASSESSMENT AND TOTAL MAXIMUM DAILY LOAD

EXECUTIVE SUMMARY

Water quality, native fish populations and riparian habitat conditions have been issues of concern in the Upper Salmon River Subbasin. The cumulative effects of mining, warm season grazing, grazing over-utilization of riparian areas, timber harvest and associated roads, introduction of exotic fish and plant species, residential and recreational development, and human-caused stream alteration and diversion of surface waters have combined to limit the production and survival of native resident and anadromous fishes throughout the subbasin. There are numerous restoration projects that have been completed, are under construction, or are planned in the Upper Salmon River Subbasin to offset historic management and land use as well. These projects have resulted in dramatic improvement in water quality and fisheries of many miles of streams in the Upper Salmon River Subbasin. The waters of the Upper Salmon River have been identified as an essential component of anadramous fish, and bull trout restoration in Idaho. This Subbasin Assessment and Total Maximum Daily Load (TMDL) is intended to identify where improvements in water quality are needed, and possible, to support the intent of the federal Clean Water Act that waters of the United States be fishable and swimable.

The Clean Water Act requires that the state of Idaho identify water quality limited surface waters and develop a plan to restore beneficial use support to these waters. The Endangered Species Act requires that conservation plans be developed and implemented to restore anadromous fish and bull trout populations to levels that insure their persistence in the Upper Salmon River Watershed.

The Idaho Department of Environmental Quality (DEQ) has identified that Challis Creek is not fully supporting the beneficial uses of salmonid spawning and coldwater biota as defined in state Water Quality Standards and the federal Clean Water Act. A Total Maximum Daily Load for sediment has been prepared for this water to restore full support of these beneficial uses.

To the extent practical and possible the Challis Creek Total Maximum Daily Load, in addition to restoring beneficial uses on the water quality limited reach, will assist any conservation plan for endangered species recovery. This will be done by improving water quality and habitat conditions through the implementation of best management practices identified by the Idaho Soil Conservation Commission; the designated management agency for implementation of agriculture related best management practices.

The beneficial use support status of other waters in the subbasin are described and categorized within this document to initiate tracking of their support status in relation to land use management needs and existing implementation projects.

Assessments by DEQ have identified that water quality has been limited by deposition of sediment in the stream channel of Challis Creek due to streambank and road erosion and historic mass wasting. Previous assessments by the Bureau of Land Management, the USDA Forest Service, and the State Soil Conservation Commission have also identified similar sources of

pollutants and the problems associated with water quality in the Challis Creek watershed. A TMDL has been prepared for Challis Creek within this document.

Recent improvement in land management practices have created the potential for improving water quality, fish habitat conditions, fish passage, spawning success and connectivity within the subbasin including Challis Creek, its tributaries, and the Salmon River. Water quality and habitat conditions have shown improvement where best management practices have been implemented and natural conditions have been given an opportunity to improve. It is expected that with continued riparian management beneficial uses will be restored in Challis Creek.

It is not likely, however, that beneficial uses will be restored in streams of the watershed where dewatering from surface water diversion occurs during significant periods of the year. The potential exists, however, for voluntary and cooperative management agreements that improve flow conditions without negatively impacting the rural economy of the subbasin. The natural and social conditions within the watershed play an important role when attempting to identify the reduction of pollutant loads necessary for beneficial use restoration while maintaining the viability of the local economy and quality of life for residents in the subbasin.

DEQ has developed recommendations for the reduction of sediment from streambank erosion, mass wasting and road erosion within the Challis Creek watershed that would ultimately likely result in beneficial use support through improving streambank stability, reducing road erosion and stabilizing mass wasting, ultimately improving riparian vegetation. Sediment loads are quantified through stream bank erosion inventories that estimate streambank erosion based on streambank conditions observed and documented along 4 reaches of Challis Creek. Road erosion was quantified along two reaches that were combined.

Instream sediment targets have been identified from literature values that are supportive of salmonid spawning and coldwater biota. These target values are set at less than 28% fine sediment less than 6.35mm (1/4 in.) diameter in spawning habitat and will be used to track the progress of streambank stabilization, and associated reduction of depth fines to determine the need for additional management practices to improve water quality on Challis Creek.

The recommended load allocation within this TMDL is an overall reduction of 34% in sediment from streambank, mass wasting and road erosion into Challis Creek. The Table below summarizes the prescribed sediment reductions for Challis Creek. This reduction of sediment from erosion in Challis Creek should result in a reduction of streambed fine sediment (sediment smaller than 6.35 mm (0.25 in)) to the target level of 28%, or less, to a depth of 4 inches in spawning habitat. These reductions incorporate an implicit margin of safety (MOS) to assure restoration of beneficial uses. The identified MOS equates to streambank erosion rates expected from streambanks that exhibit 80% or greater streambank stability, which is considered natural background erosion within this TMDL. Monitoring will be conducted by land management agencies to determine the adequacy of reductions and management practices.

Challis Creek Sediment Loading Summary

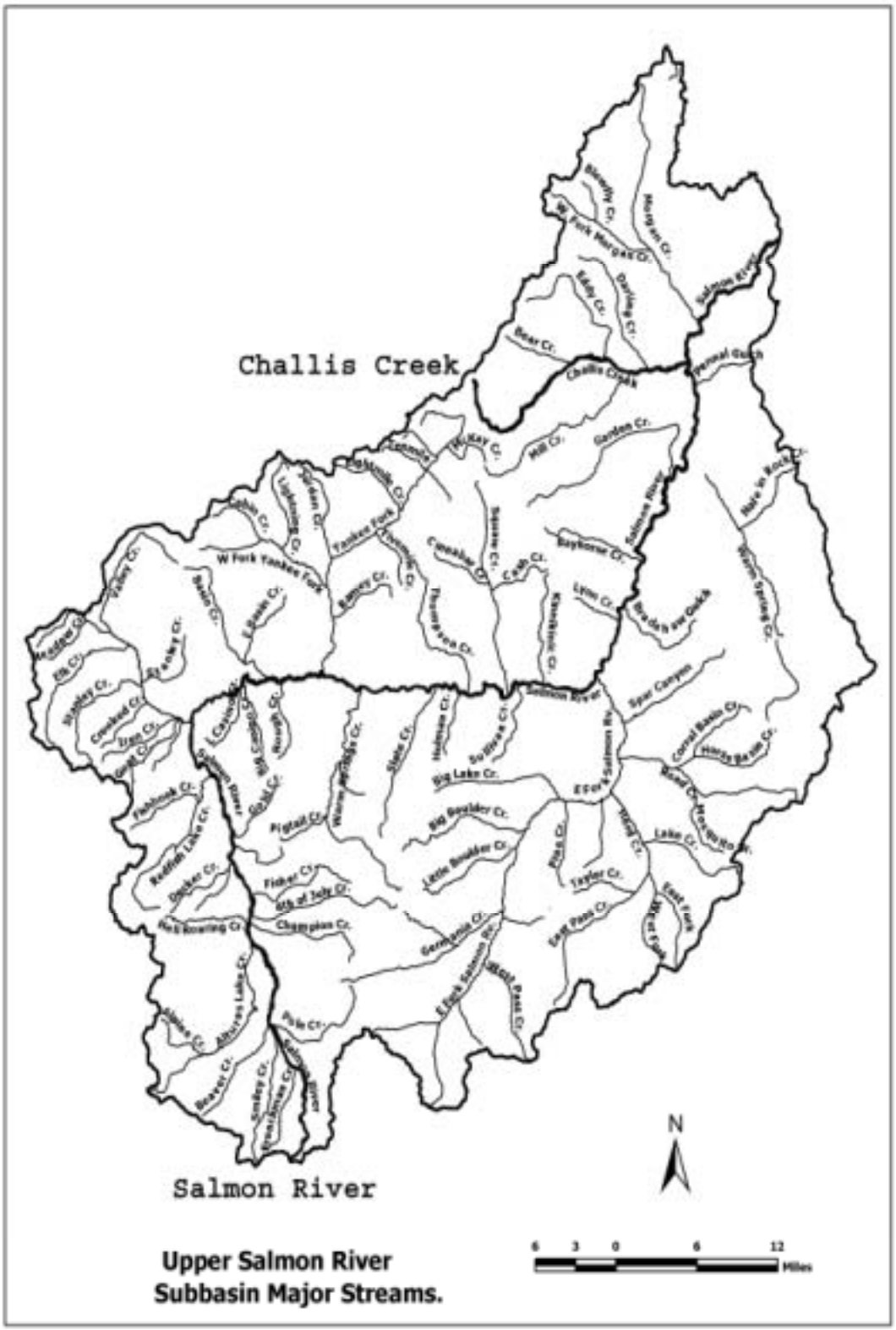
Reach Number (from downstream to upstream)	Existing Erosion Rate (t/mi/y)	Total Erosion Rate (t/y)	Proposed Erosion Rate (t/mi/y)	Load Allocations (t/y)	Erosion Rate Percent Reduction	Percent of Total Erosion
Landslide	N/A	195	N/A	146	25	19
Upper	71	318	36	159	49	31
3 (Upper Middle)	10	46	6	28.5	40	5
2 (Middle)	5	6	6	8	0	<1
1 (Lower)	96	422	71	313	26	42
5 Road	9	24	5	14	44	2
Totals	**----------**	**1011**	**----------**	**668**	**34**	**100**

There are 11 §303(d) listed stream/river segments on 9 waters in the Upper Salmon River Subbasin. There is one TMDL for Challis Creek prepared in this document. The disposition of the remaining §303(d) listed streams that will not have a TMDL prepared for pollutant loads is based on guidance provided by the Environmental Protection Agency in a memorandum from November 2001 titled 2002 Integrated Water Quality Monitoring and Assessment Report Guidance.

Streams already having implementation of best management practices that should result in attainment of water quality standards and beneficial use support in the near future do not require TMDLs as described in section 4b of the memorandum. Streams that fall into this category are Thompson Creek and Kinnikinic Creek. The listed reaches of the Salmon River do not require TMDLs because they fully support beneficial uses.

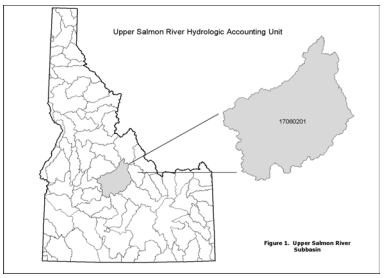
Streams that have flow less than 1 cfs are not used to represent segments with higher flow, and are not held to narrative water quality standards. Numeric water quality standards do apply during periods of optimal flow, however. Lost Creek in the upper Stanley Basin is such a creek. It was listed in error and will not have a TMDL developed for it.

Streams that are frequently dewatered for significant periods of the year, or throughout the year do not have a reasonable potential to support beneficial uses of cold water biota or salmonid spawning. Flow, in and of itself, is not considered a pollutant, however a listing category of flow alteration exists for these streams. The same is true for habitat alteration. Anthropogenic causes of flow alteration in the Upper Salmon River Subbasin are diversion for irrigation and stock watering, aquaculture and hydroelectric power generation. Road Creek, from the lower private/BLM boundary downstream, and Warm Spring Creek from the hatchery diversion downstream falls into the category of flow alteration. Garden Creek from the upstream Challis City Limit to the confluence with the Salmon River will be listed for flow and habitat alteration. The Yankee Fork of the Salmon River will be listed for habitat alteration from 4th of July Creek to the Salmon River. A TMDL will not be developed for them. In the event that voluntary and cooperative water conservation projects are developed and implemented these streams will be re-evaluated.



Upper Salmon River Subbasin Major Streams.

Total Maximum Daily Load (TMDL) Upper Salmon River Watershed
Hydrologic Unit Code 17060201



Water Quality Limited Segment (Assessment Units)	Stream Name	303(d) Listed *Reach*	*Miles*	Pollutant	Subbasin Assessment Recommendation
3009 (17060201SL019_04 17060201SL027_05 17060201SL031_05 17060201SL047_05)	Salmon River	Redfish Lake Creek to E.F. Salmon River	44.45	Sediment and Temperature	No TMDL; Beneficial Uses Fully Supported
3010 (17060201SL068_05 17060201SL072_05 17060201SL073_05)	Salmon River	Hellroaring Creek to Redfish Lake Creek	13.34	Sediment	No TMDL; Beneficial Uses Fully Supported
3013 (17060201SL09_03 17060201SL07_04)	Challis Creek		9.35	Sediment; Nutrients and Flow Alteration	Sediment TMDL: 34% Reduction; remove other listings
3017 (17060201SL015_03 17060201SL015_02 17060201SL015 _04)	Garden Creek	Forest Boundary to Salmon River	14.40	Sediment and Nutrients	Remove Listings for Sediment and Nutrients; source of Impairment is Flow Alteration
3019 (17060201SL131_04 17060201SL133_02 17060201SL132_04)	Warm Springs Creek	Headwaters to Sink	13.85	Sediment and Nutrients	Remove Listings for Sediment and Nutrients; source of Impairment is Flow Alteration
3031 (17060201Sl028_03)	Thompson Creek	Scheelite Jim Mill to Salmon River	1.02	Sediment, Habitat Alteration	No TMDL, Relist in § 4b, all BMPs fully implemented;
3035 (17060201SL034_04)	Yankee Fork	Jordan Creek to Salmon River	9.00	Sediment, Habitat Alteration	No TMDL, Source of Impairment is Habitat Alteration

Total Maximum Daily Load (TMDL) Upper Salmon River Watershed Hydrologic Unit Code 17060201 January 2002 – continued					
Water Quality Limited Segment **(Assessment Units)**	**Stream Name**	**303(d) Listed** *Reach*	*Miles*	**Pollutant**	**Subbasin Assessment Recommendation**
3036 **(17060201SL032_04)**	**Yankee Fork**	**4th of July Creek to Jordan Creek**	**2.92**	**Sediment, Habitat Alteration**	**No TMDL, Source of Impairment is Habitat Alteration**
5226 **(17050201Sl081_02a)**	**Lost Creek**	**Headwaters to Sink**	**4.45**	***Unknown***	**Remove; Listed in Error**
5227 **(17060201SL020_02)**	**Kinnikinic Creek**	**Sawmill Creek to Salmon River**	**2.99**	***Unknown***	**No TMDL, Relist in § 4b, all BMPs fully implemented and Metals Concentration below criteria**
7009 **(17060201SL124_04 17060201SL125_02 17060201SL125_03)**	**Road Creek**	**Headwaters to E.F. Salmon River**	**15.77**	***Unknown***	**List for Flow Alteration below lower BLM boundary**
3029; 3030 **(17060201SL021_04)**	**Squaw Creek**	**Headwaters to Mouth**	**8.28**	***Temperature***	**No TMDL, Geothermal Influence**

- ***Beneficial Uses Affected: Salmonid Spawning and Coldwater Biota***
- Key Resources: Chinook Salmon, Sockeye Salmon, Steelhead Trout, Bull Trout, Westslope Cutthroat Trout
- ***Pollutant Sources: Nonpoint source sediment from streambank erosion and Roads,***

About This Document

The Upper Salmon River Subbasin Assessment and TMDL is the last document that will be written without a template that is intended to standardize TMDLs written by the Idaho Department of Environmental Quality. The structure of this document is a hybrid of sorts that has been used in several previous subbasin assessment/TMDL packages with success. The intent of this structure is to start at the watershed scale and work inward toward specific waters that have been placed on the §303(d) list.

After general discussions about geology, climate, hydrology, topography etc., each sub-watershed is described with regard to historic use, where historic data was available and fluvial morphology is discussed, in general terms. The Water Quality Concerns and Status section provides a review of applicable water quality standards and then develops the available data on particular streams on the §303(d) list. The disposition of each stream is described with regard to its beneficial use support status, any changes in §303(d) listing, and why or why not a TMDL is being prepared for the Stream.

The last part of the Water Quality Concerns and Status section includes assessments by other agencies, directed data regarding abandoned mined, NPDES outfalls, data gaps, a pollutant source inventory, and a summary of pollution control efforts and a summary of findings for each §303(d) listed stream.

The Challis Creek TMDL follows, which is the only TMDL developed in this document. Readers not wanting to go through all of the sections can get a succinct overview of the findings and direction of this document by reading the Watershed at a Glance, Executive Summary, and Water Quality Status Summary on Page 75.

Comments received during the public comment period are included after the TMDL along with the response to comments. This section is followed by references, a glossary of terms and appendices.

The implementation plan for best management practices that will be developed on Challis Creek is due within 18 months of the approval of the TMDL by EPA. There are numerous implementation projects already underway in this watershed as a result of efforts to restore anadramous fish species.

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UPPER SALMON RIVER SUBBASIN ASSESSMENT AND TMDL

CHARATERIZATION OF THE WATERSHED

The Upper Salmon River subbasin (from here on referred to as the "Upper Salmon" subbasin) is located in the central Idaho mountains (Figure 1). This subbasin, identified in the USGS Hydrologic Unit Code nomenclature system, a system to group surface waters, as HUC #17060201, contains 2,425 square miles of land area with 5,711 miles of stream. The northern boundary of the subbasin is bordered by the Frank Church River of No Return Wilderness. The western extent is bordered by the Sawtooth Mountains. To the south are the Boulder Mountains and Galena Summit, where the headwaters of the Salmon River originate. The Eastern boundary runs along the Pahsimeroi Mountains of the Lost River Range. Up through the center of the subbasin run the Boulder-White Cloud Mountains. This mountainous terrain has produced many steep-valley stream systems and glacial lakes and troughs that feed the headwaters of the Salmon River.

Climate

The climate of the Upper Salmon Subbasin is primarily influenced by Pacific Maritime air masses moving eastward over the area on prevailing westerly winds (BLM, 1998). Cold winters and warm dry summers characterize the area. Influences in elevation, climate, and aspect of the area cause climate conditions to be variable throughout the subbasin.

The maximum summer temperatures within the subbasin can exceed 100° F with a minimum winter temperature dropping below 0°F (BLM, 1998). The average maximum monthly temperatures for the subbasin range from 78° F in Stanley to 85° F in Challis (Idaho Climate Summaries, 2000). The average monthly minimum for the Upper Salmon subbasin range from 6° F in Stanley to 9° F in Challis.

Extremely high and low temperatures occur nearly every year but only persist for a short period (BLM, 1998). Daily freezing and thawing occur during the late fall and early spring months. The frost free growing season lasts for less than 100 days in the lower elevations and may be as few as 10 days in the higher elevations of the subbasin. During the winter months, extended durations of extremely cold temperatures may cause water bodies to ice over. Ice build up within the streams and rivers of the region can cause flooding or severe bank damage as the ice breaks away from the banks.

Approximately 70% of the precipitation falls within the spring and fall seasons (DEQ, 1998). The wettest months occur during April, May, and June, with the driest months occurring during January through March (BLM, 1998). The average annual precipitation ranges from 14.54 inches in Stanley to 7.4 inches in Challis (Idaho Climate Summaries, 2000). Snow depths within the subbasin vary considerably with greater amount of accumulation occurring at the higher elevations. The average annual snowfall ranges from 72.4 inches in Stanley to 15.7 inches in Challis.

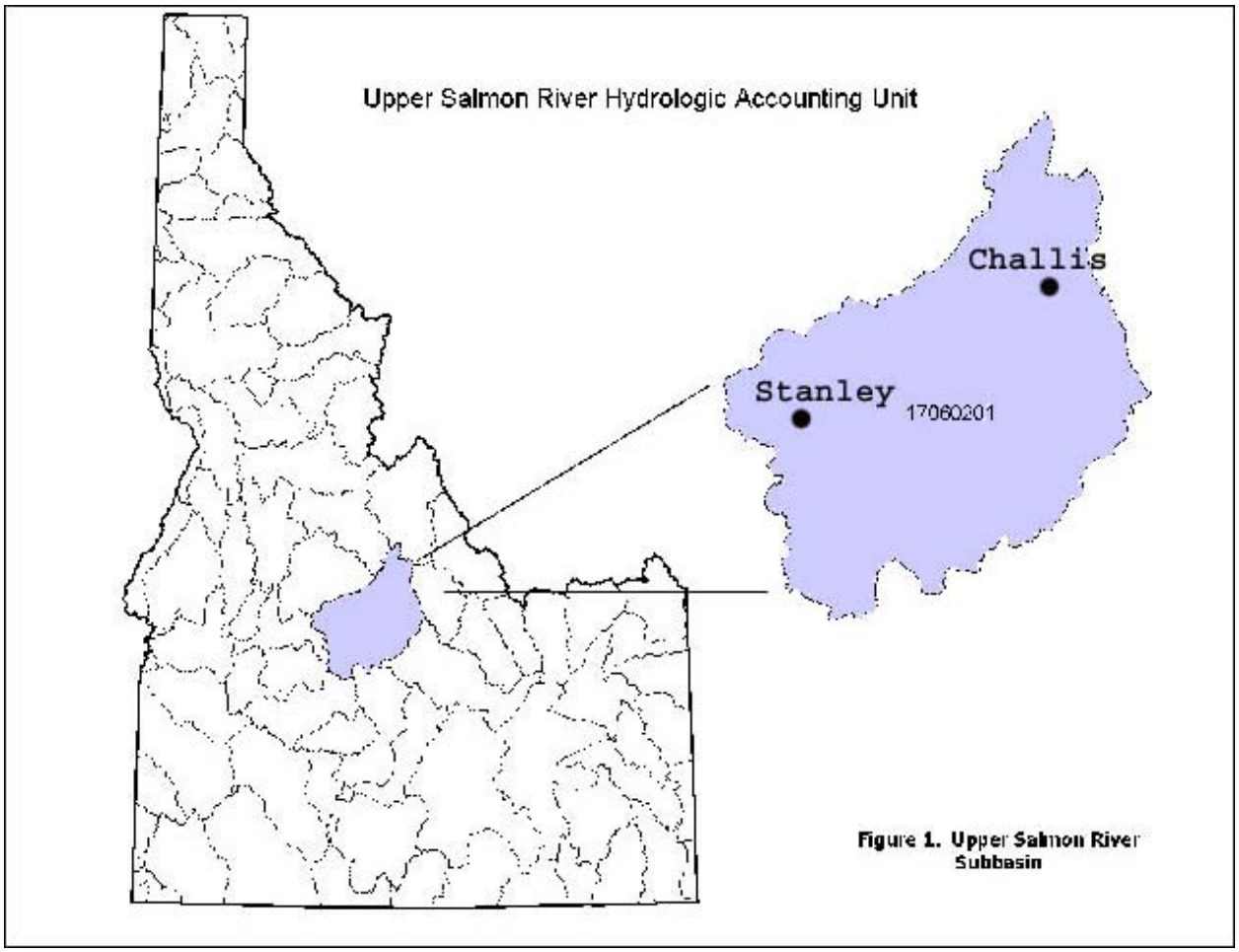

Figure 1. Upper Salmon River Subbasin

Diverse snowmelt patterns within the subbasin may cause significant runoff events in early spring through the summer. Snowmelt in the lower reaches of the subbasin begins in early spring while snowmelt in the higher elevations occurs in early to mid-summer. The greater snow pack in the higher elevations results in larger streamflow discharge in mid to late summer. Rain on snow events that occur in the spring season also contribute to the increased stream flows.

Thunderstorms occurring in late spring and summer may also vary precipitation patterns throughout the subbasin. In some instances, precipitation from the high intensity storms can cause flash flooding and subsequent erosion damage within a stream system.

Geology

The geology of the Upper Salmon Subbasin is variable across the subbasin. A basic map of the Upper Salmon River Subbasin geology that groups course unconsolidated alluvial deposits with glacial deposits under alluvium is found in the Idaho Department of Water Resources base coverage found in Figure 2. The oldest rocks underlying the majority of the subbasin include the Precambrian Basement complex. It is comprised of 1.5 billion

year old gneiss and schist, metamorphosed from much older rock under intense heat and pressure (Maley, 1987).

Sedimentary rocks formed during the Paleozoic Era about 500 to 600 million years ago were deposited on top of Precambrian formations and are found in eroded or exposed areas throughout the subbasin (USDA FS, 1997a). During the Paleozoic Era, large parts of Idaho were submerged under shallow seawater for long intervals (USDA FS, 1997b). Rocks that formed include limestone and argillite, a hardened or consolidated mudstone or shale.

Another rock type found in the Upper Salmon subbasin is the Challis Volcanics. The Challis Volcanics include a series of widespread lava eruptions beginning about 51 million years ago, followed by violent rhyolitic ash-flow eruptions from caldera complexes starting about 48 m.y. ago. The volcanics overlie much of the Precambrian and Paleozoic complexes within the subbasin, and erupted from various calderas north and west of (and including) the Twin Peaks Caldera. In some areas, these rocks are interbedded with Paleozoic sediments generated from the paleozoic formations that eroded between the series of volcanic flows.

Paleozoic complexes and minor Challis Volcanics dominate the Pahsimeroi Moiuntains of the Lost River Range along the eastern border of the subbasin. The Lost River Range is part of the Basin and Range Province formed by faulting that has occurred over the last million years. The Basin and Range Province is characterized by linear mountain ranges separated by flat valleys. This area has active ground movements such as the 1982 Challis earthquake, which moved the valley floor and the Lost River Range further apart.

Along the south and western portion of the subbasin are the Boulder, White Clouds, and Sawtooth Mountain Ranges. These ranges are comprised of metamorphic rock originating from the Idaho batholith granitics and the younger Sawtooth batholith. The fine-grained gray colored granites originate from the Idaho Batholith and the pink granites with larger crystals come from the Sawtooth batholith complex. Much like the Lost River Range, the Sawtooths were formed from faulting creating the Stanley Basin and Sawtooth range. The rugged appearance of the Sawtooth Range on the west side of the subbasin was formed by alpine glaciation. The granite forming the Sawtooth batholith has well developed jointing, causing the distinctive ragged topography.

The major sediment sources in the subbasin include granitics from the Idaho and Sawtooth batholith, Challis Volcanics, lakebed sediments deposited in the lower part of the subbasin and glacial till deposited in the upper subbasin, particularly the Stanley Basin (USDA FS/BLM, 1998). The erosional processes of these soils are variable. Granitics soils from the batholith are susceptible to sheet, gully, and rill erosion processes. Soils formed from the Challis Volcanics are more susceptible to compaction and is slick when wet (from clay) making them sensitive to erosion. Soils containing ash from the Challis Volcanics have weathered to clay and have a high water holding capacity. In some cases, mudflows or landslides may occur when clay soils reach

saturation. An example of this occurring is the 1998 debris flow in Slate Creek. Soils formed from glacial till have a high sediment content and are also easily erodable.

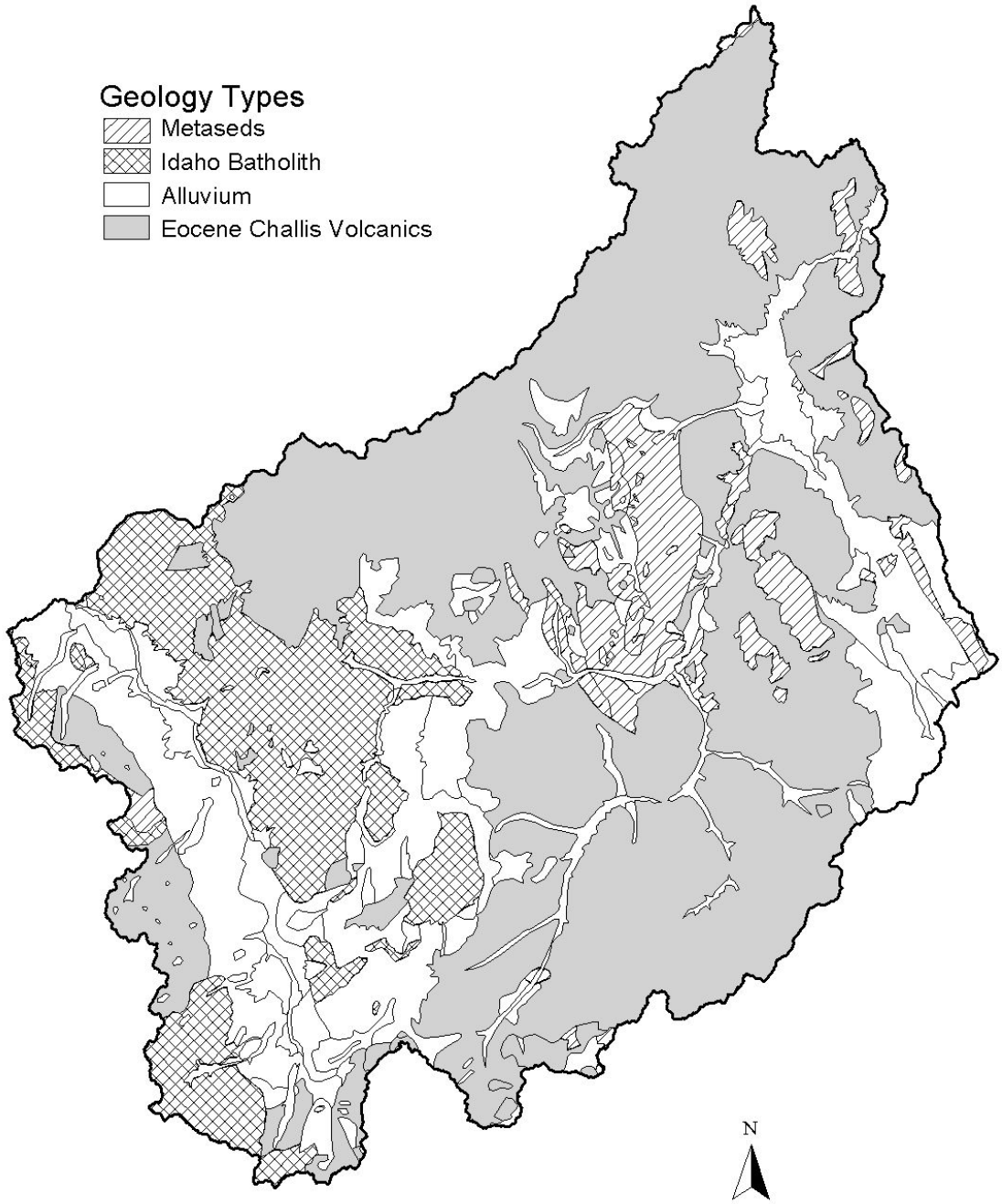

Figure 2. Upper Salmon River Subbasin Geology.

Topography

The Upper Salmon subbasin is a glacially carved mountain and valley system. The major mountain ranges of the subbasin are the Sawtooth, Boulder White Cloud, and Lost River Mountain Ranges. The White Cloud Mountain Range is in the interior of the subbasin with the other ranges bordering the edges of the subbasin. The highest elevations are found in the Boulder Mountain Range (e.g. Galena Peak, 11,170 feet).

The general relief of the area varies from nearly flat on the valley floors of the major drainages, to nearly vertical cliffs on the mountain faces and cirque walls (BLM, 1998). The Salmon River, the major drainage of the subbasin, flows through narrow V-shaped valleys flanked by cliffs, rock outcrop, and moderate to very steep terrain as well as intermittent open valleys near it's headwaters and the lower part of the subbasin. Glacial, fluvial, and alluvial deposits form the bottoms of the stream valleys.

The glaciers that occurred throughout the area also influenced the Sawtooth topography of the area. Glaciers came down the valleys of the subbasin gouging out deep valleys of the area just above the Basin bottom. Mountain lakes in the region, such as Alturas, Stanley, Petit, and Redfish Lakes are remnants of the glaciation.

The general aspect of the subbasin varies. The north facing slopes tend to be colder and wetter and retain snow longer. The south facing slopes are warmer and drier and have less vegetation.

Vegetation

The dominant forest vegetation includes lodgepole pine/subalpine fir mix (USDA FS/BLM, 1998). At higher elevations whitebark pine becomes locally abundant. Other conifers include limber pine and Engelmann Spruce (BLM, 1998). At low elevations, lodgepole pine gives way to almost pure stands of Douglas fir on northerly aspects (BLM, 1998). Low elevation woodlands include Rocky Mountain juniper, limber pine, quaking aspen, and black cottonwoods (BLM, 1998).

The non-forest vegetation can be divided into two shrub/grass types: a dry shrub/bunchgrass type dominated by Wyoming big sagebrush and bluebunch wheatgrass, and a low shrub type dominated by low sagebrush and black sagebrush. Other species of importance include bitterbrush, curl-leaved mountain mahogany, arrowleaf balsamroot, and Idaho fescue (BLM, 1998).

Historically, riparian vegetation and woodlands included aspens, alders, willows, and abundant herbaceous vegetation (e.g. sedges). However, their extent is much reduced and is now Commonly dominated by exotic species and noxious weeds (USDA FS/BLM, 1998).

Land Ownership and Use

The majority of the Upper Salmon Subbasin is publicly owned (Figure 3). The Public lands are shared by the Sawtooth National Recreation Area (35%), the Salmon-Challis National Forest (34%), the Bureau of Land Management (BLM) Challis Resource Area (24%), and the State of Idaho (2%). Private ownership occupies 5% of the land area and is generally concentrated around the City of Challis and along the Salmon River, especially near Stanley.

The largest city within the subbasin is Challis, with a population of 1,072 (Idaho Department of Commerce, 2000). Smaller towns include Stanley and Clayton. The majority of the subbasin is

included within Custer County (population: 4,107 people) (Idaho Department of Commerce, 2000). Custer County includes area outside the subbasin such as the Middle Fork Salmon River, Pahsimeroi River Subbasin and the Big and Little Lost River Subbasins. On average, Custer County has had virtually no increase in population from 1990 to 1998.

Land use for the subbasin is depicted in Figure 4. The dominant uses of public lands within the subbasin are livestock grazing, mining, and recreation. Mining is very important to the economy of the Upper Salmon subbasin. Nationally, 0.45% of the mining occurs within this subbasin (USDA FS/BLM, 1998). Many of the Upper Salmon River Subbasin watersheds have experienced mining activities in the past, with some still on-going today. Historically, hydraulic and placer mining were widely used succeeded by shaft and adit mines. The largest active mine of the region is the Thompson Creek Molybdenum Mine located within the Thompson Creek and Squaw Creek watersheds. The Grouse Creek Gold Mine, located in the Jordan Creek watershed, went into closure in 1997, but at this time does not have a remediation plan. Jordan Creek is a tributary to the Yankee Fork of the Salmon River. Potential exists for future mining opportunities throughout the subbasin.

Livestock grazing includes sheep, cattle and horses, is widespread throughout the subbasin, and has been a constant land use for over a century. The subbasin lowlands are primarily used for grazing and feed production with a few upper rangeland areas grazed by sheep. The Challis Creek area, for example, has been grazed heavily by sheep, cattle and horses from the late 1800's. Regulated grazing began in 1906 in that watershed, in that fees were charged and permits were issued. Grazing remained at high intensity until 1950, when grazing management began to improve with issuance of permits for specific allotments (USDA FS 1997b). The majority of grazing allotments within the subbasin are managed under an Allotment Management Plan administered by the BLM and USDA Forest Service (BLM, 1998). Livestock grazing and irrigated cut hay pasture are the dominant activities on private land, although residential development is increasing substantially.

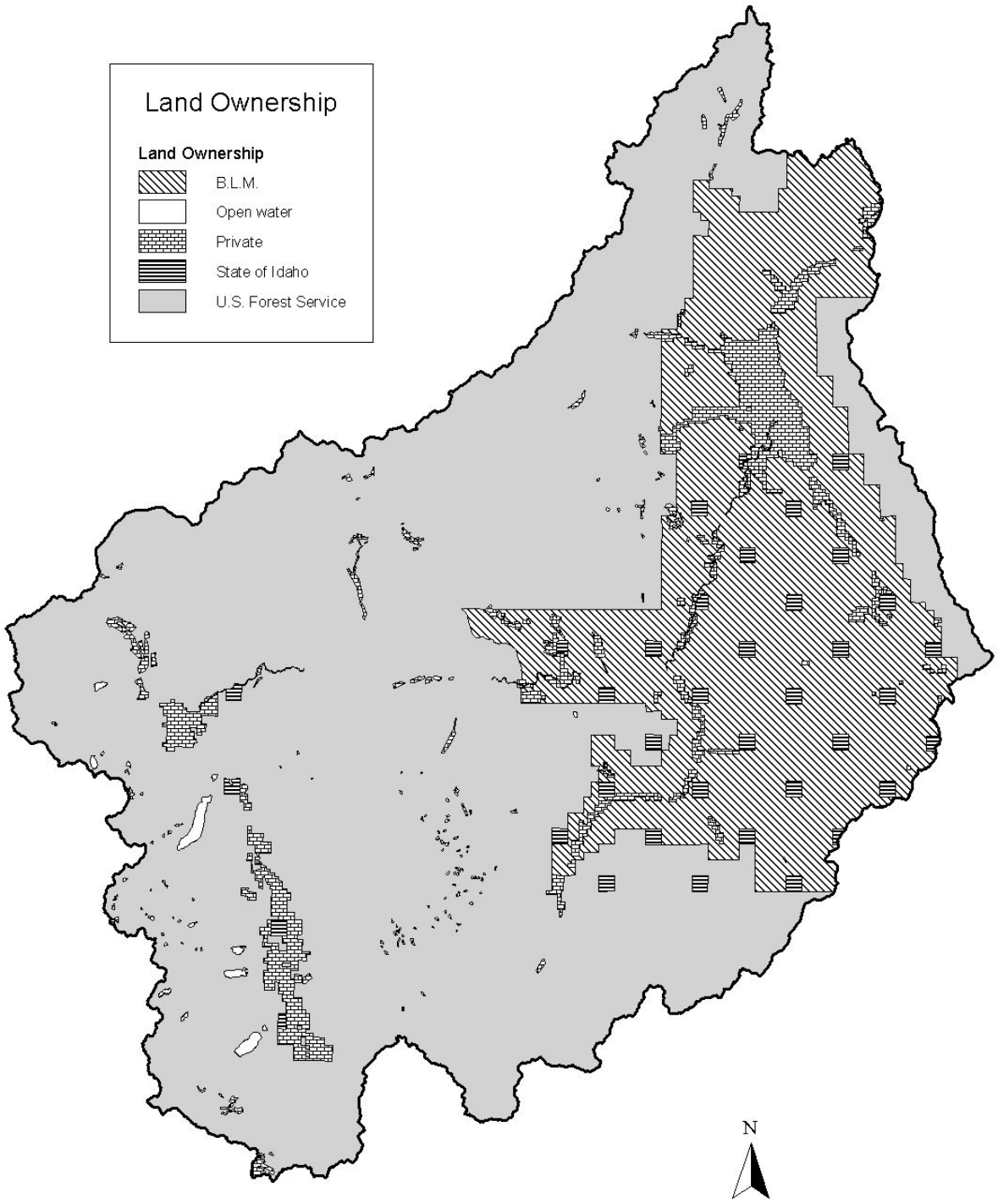

Figure 3. Upper Salmon River Subbasin Land Ownerships.

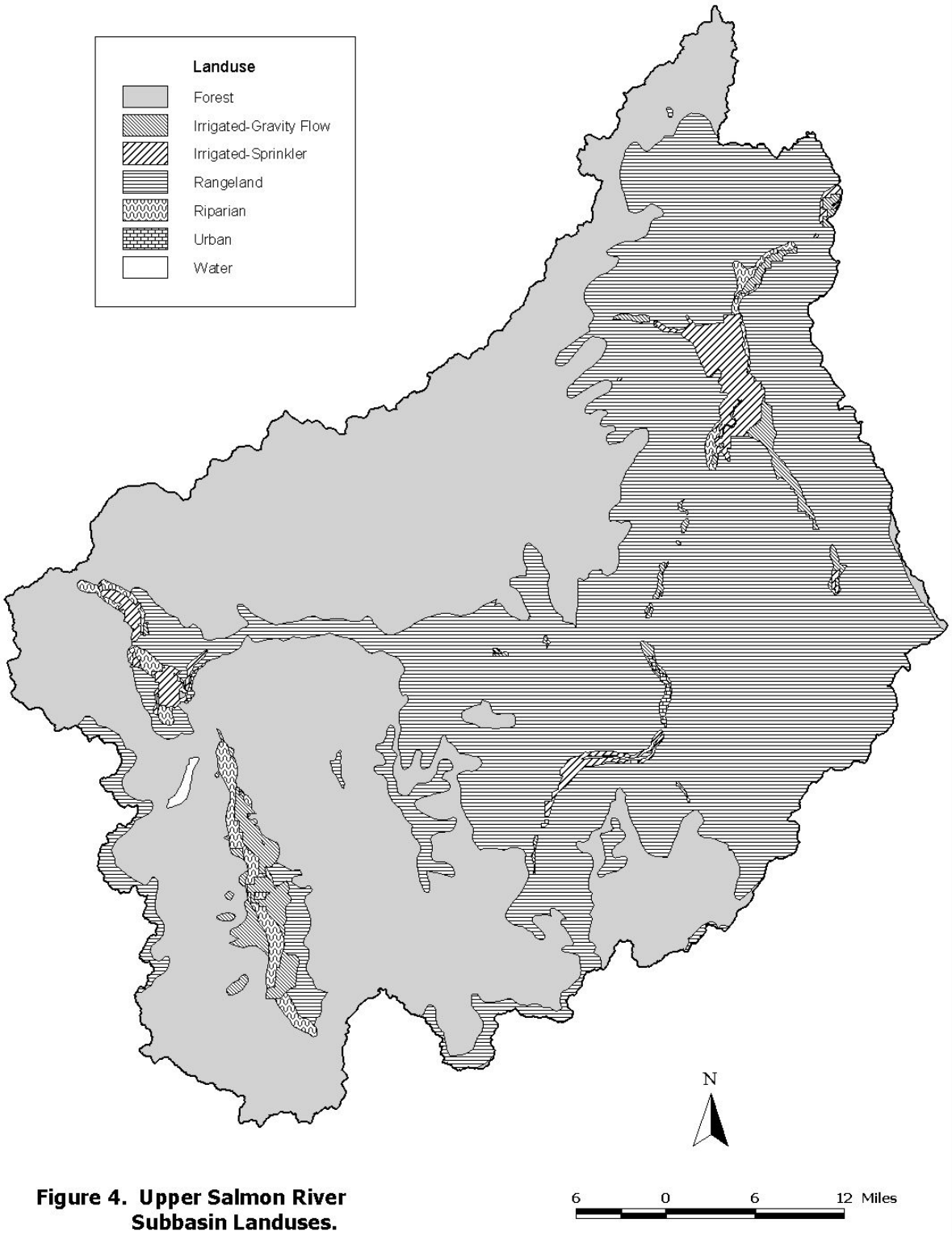

Figure 4. Upper Salmon River Subbasin Landuses.

Recreational opportunities have become increasingly popular in the subbasin. A significant source of employment for the town of Stanley, near the headwaters of the Salmon River, is based in the hospitality industry, which is strongly related to recreation. The US Forest Service administers the Sawtooth National Recreation Area (SNRA). Recreational uses in the area include fishing, hunting, hiking, horse back riding, camping, backpacking, mountain biking, rock climbing, all terrain vehicle use, and river rafting. Competition for limited recreational resources between different uses within this subbasin is also increasing.

Hydrology

The Upper Salmon Subbasin is within the Columbia River Basin hydrologic region. The principle drainage of the subbasin is the Salmon River from its headwaters to the confluence with the Pahsimeroi River. There are 65 major streams within the subbasin (Figure 5) consisting of 5,711 miles of streams (USDA FS/BLM, 1998). The drainage area is approximately 2,425 square miles. Stream flow regimes are typical of central Idaho mountain streams with seasonal peak flows in late spring to early summer from snowmelt runoff. Summer thunderstorms are the usual supply for daily peak flows. Low flow occurs in late summer through the winter. There is substantial variability from year to year due to fluctuating precipitation and temperatures.

The Upper Salmon Subbasin is primarily composed of steep, narrow drainages with V-shaped valleys. The floodplain of the Upper Salmon River, in the Stanley Basin, is fairly broad compared to floodplain in the canyon reach of the Salmon River further downstream. Irrigated agriculture exists on the river's floodplain throughout the lower reaches of the subbasin below the canyon.

The East Fork of the Salmon River is the largest tributary to the Salmon River within the Upper Salmon River subbasin. The lower portions of the East Fork Salmon River have gradients less than 1% with an average channel width between 40 to 60 feet. Many tributaries to the Salmon River in the subbasin are relatively small with steep gradients.

Several gaging stations were located throughout the subbasin, but only two remain active during the high flow season (Table 1). These are located at Thompson Creek above the Salmon River confluence and on the Salmon River below the Yankee Fork confluence. The average annual flow of the Salmon River within the subbasin varies from 81 cubic feet per second (cfs) at Obsidian to 987 cfs near Clayton. Near the mouth of the subbasin, average annual flows may increase to approximately 1500 cfs. Average annual flow for the Salmon River near Salmon, about 40 miles downstream from the subbasin, is 1941 cfs.

Table 1. Salmon River average annual flow data.

Station Name	Source or Station #	Data Years	Ave. Annual Flow (CFS)	Minimum Ave. Flow (CFS)	Maximum Ave. Flow (CFS)
Salmon River at Obsidian	(USDA FS/ BLM, 1998)	unknown	81	55	128
Salmon River below Valley Cr.	(USDA FS/ BLM, 1998)	unknown	664	410	1020
Salmon River below Yankee Fork	(USDA FS/ BLM, 1998)	unknown	995	466	1640
Salmon River near Clayton	13296500 (USGS)	1921-1991 (high flow) 1991-present	987	315	2800
Salmon River near Bayhorse Creek	(USDA FS/ BLM, 1998)	unknown	1490	855	2470
Salmon River above Pahsimeroi River (estimated)	(USDA FS/ BLM, 1998)	unknown	1595	935	2600
Salmon River near Salmon	13302500 (USGS)	1913-1916, 1919-1996	1941	328	17400

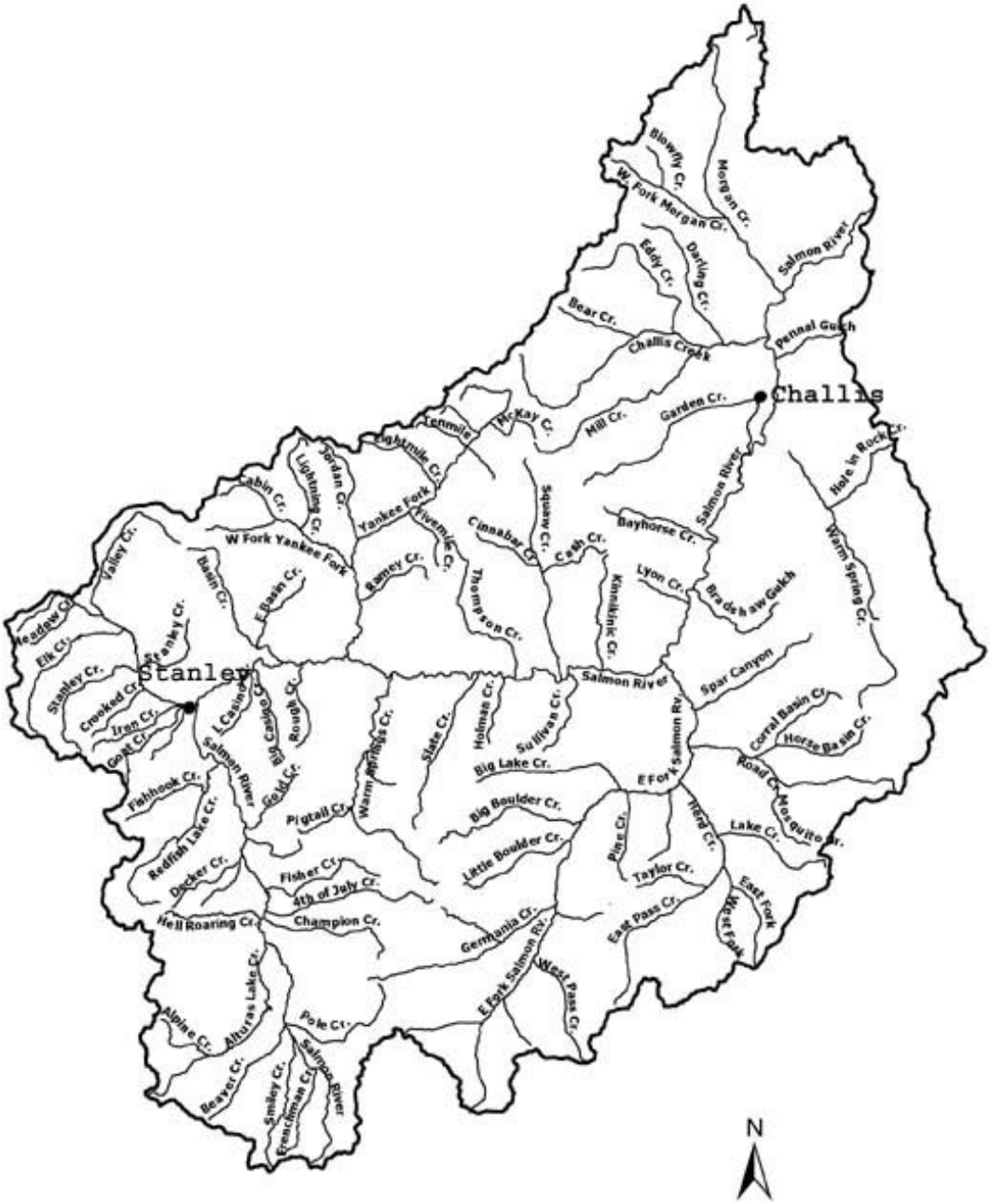

Figure 5. Upper Salmon River Subbasin Major Streams.

Natural stream channel types within the subbasin are generally classified as Rosgen A-, B-, and C-type channels. Rosgen A-type channels are referred to as sediment source

channels and have high relief and are entrenched in steep mountain terrain. This type channel has a low width to depth ratio and low sinuosity, with vertical pools and high debris flow potential. Many of these streams are intermittent and support little riparian vegetation.

Rosgen B-type channels are sediment transport channels and are most common throughout the subbasin. These channels have a moderate: gradient, sinuosity, width to depth ratio and entrenchment ratio. They occur in narrow, moderately sloping valleys and are dominated by riffles with occasional pools. Rosgen B-type channels usually have stable bottom material and are more dependant on riparian vegetation and large woody debris for stability.

Rosgen C-type channels, also called sediment response reaches (sediment depositional), are low gradient channels located in gently sloping valleys with floodplains and terraces. Rosgen C-type channels are meandering and slightly entrenched with moderate width to depth ratios. These channels tend to meander, but under natural conditions do so at a rate that allows for streambank stability over 80% (by definition a stable streambank is associated with a stream that can handle it's sediment load (David Rosgen 2001, personal communication)). These reaches tend to have high aquatic and riparian species diversity. This is where the greatest amount of human use also occurs.

Surface water quality varies throughout the subbasin and is dependant on land uses, local geology, and discharge. Most surface water originates in the high mountainous areas above the principle drainage and is of high quality near the source. Water quality in the lower reaches tends to become more degraded. Water quality degradation occurs as sediments and other pollutants are deposited into the stream. Primary sediment pollutant sources within the Upper Salmon subbasin are excessive streambank erosion, road runoff, mine tailings and waste rock, agriculture practices, and runoff from developed areas. Natural sediment sources include hill slope erosion, streambank erosion, occasional mass wasting of steep slopes and products of weathering carried by runoff. Surface waters are also affected by irrigation impoundment, and diversion structures at lower elevation reaches, precluding, in some cases, flow from reaching the mainstem Salmon River.

Fish

The Upper Salmon subbasin is generally characterized by its clear, cool mountain streams. Most streams historically contained a number of native salmonids, including bull trout, westslope cutthroat trout, resident rainbow trout, mountain whitefish, Chinook salmon, and steelhead trout . The subbasin contains spawning and rearing waters for anadromous fish, including steelhead trout, Chinook salmon, and sockeye salmon, and represents the second longest migration route in North America (USDA FS/BLM, 1998). The subbasin also contains the sole remaining population of anadromous sockeye within the Snake River Basin (USDA FS/BLM, 1998). Chinook salmon and steelhead trout are listed as threatened species under the Endangered Species Act. Sockeye are listed as endangered under the Endangered Species Act. Critical habitats for sockeye salmon designated in 1993 include five lakes (Redfish, Alturas, Stanley, Pettit, and Yellowbelly)

in the Sawtooth National Recreation Area (SNRA) and all their connecting tributaries including the mainstem Salmon River. Stocking of sockeye has been taking place in Redfish, Alturas, and Pettit Lakes as a part of recovery efforts since 1993 (DEQ, 1999a).

The Upper Salmon subbasin supports some of the most important spawning and rearing habitats for the Snake River spring/summer Chinook salmon, although current stocks are severely depressed compared to historic levels (USDA FS/BLM, 1998). Chinook spawn in all sizes of rivers and streams in the subbasin, thus, most streams are designated critical habitat (DEQ, 1999a). Adult chinook arrive in May and June and spawn from August to October.

The central Idaho mountains are core habitat areas for remaining bull trout populations. Bull trout distribution tends to be patchy even when population numbers are strong and habitat is good (USDA FS/BLM, 1998). Bull trout generally spawn in mid to late September through October in the Salmon River basin (DEQ, 1999a). In the SNRA and Salmon-Challis NF, they spawn in early September, or in some cases, early to mid August at the highest elevations. Threats to bull trout in this subbasin include channelization, diking, riprap, loss of stream-side vegetation, and changes in channel dynamics such as flood plain access in low elevation reaches.

Similar issues threaten westslope cutthroat trout, although populations may be a little more widespread, especially in wilderness/roadless areas. Cutthroat trout are now primarily found in small headwater streams (DEQ, 1999a). The larger migratory form of cutthroat is essentially extinct from the subbasin (DEQ, 1999a). The last large cutthroat trout were seen in the 1920s and 1930s in the Stanley area. The last migratory population in Valley Creek disappeared in the 1940s. The East Fork Salmon River had a few migrating cutthroat until the 1980s.

Hatchery cutthroat trout are being stocked into mountain lakes in the subbasin, and an intensive re-introduction of cutthroat and bull trout is taking place in Valley Creek (DEQ, 1999a).

The Salmon River in general is considered a core area for remaining stocks of wild steelhead trout. Rainbow trout are the most widely distributed native salmonid (DEQ, 1999a). Many surveys tend not to separate young steelhead from resident rainbows, although it is likely that most rainbow trout surveyed are likely residents, potentially isolated by irrigation diversion structures.

Many of these salmonids have experienced declines in habitat, abundance, and life histories during the last century (USDA FS/BLM, 1998). The decline in the anadromous species has been the greatest. Within the subbasin, problems include habitat degradation and stream flow alteration and diversion in the lower watersheds that prevent migration and the introductions of non-native salmonids especially brook trout. Outside of the basin anadromous fish are severely impacted by hydroelectric dams. Dams on the Lower Snake River and Columbia River create migration barriers and slack water that limit fish passage to and from the ocean and estuaries.

Introductions of non-native fish into the subbasin include sunapee char, arctic grayling, golden trout, lake trout, brook trout and non-indigenous rainbow trout. These fish have been introduced into high mountain lakes, lowland lakes, rivers and streams (USDA FS/BLM, 1998). Brook trout are widely distributed and are found in many tributaries within the subbasin (DEQ, 1999a). In this subbasin, brook trout prefer small tributaries and are not found in the mainstem Salmon River. Brook trout tend to dominate the lower elevation reaches and native trout stay in higher elevation reaches. In 1995, Valley Creek fish surveys produced high percentages of brook trout. Also, some mountain lake systems (lakes and inlet/outlet streams) are dominated by brook trout.

Recent sampling associated with DEQ's large river Beneficial Use Reconnaissance Project (BURP), monitoring of aquatic life in Idaho's streams, resulted in collection of multiple age classes of salmonids as well as several sculpin and dace species, largescale sucker, chiselmouth, northern pikeminnow, and redside shiner (Table 2).

Table 2. Large river BURP fish collections in 1999.

Location	Fish Collected	Age Classes
Salmon River near Obsidian (passes 1 and 2 combined)	19 brook trout, 10 cutthroat trout, 18 shorthead sculpin,	Trout ages = 4 Salmonid ages = 4 Sculpin ages = 4
Salmon River at Yankee Fork near Clayton	8 chinook, 40 mountain whitefish, 3 rainbow trout, 2 mottled sculpins, 62 shorthead sculpin, 3 longnose dace	Trout ages = 2 Salmonid ages = 6 Sculpin ages = 5
Salmon River at Pahsimeroi River near Challis	16 chinook, 73 mountain whitefish, 6 rainbow trout, 53 mottled sculpin, 2 shorthead sculpin, 25 largescale sucker, 1 chiselmouth, 2 longnose dace, 1 northern pikeminnow, 8 redside shiner, 8 speckled dace	Trout ages = 3 Salmonid ages = 6 Sculpin ages = 4

Other native fish include the Pacific lamprey, once abundant where anadromous host fish resided (DEQ, 1999a). The presence of white sturgeon in the Salmon River is documented as recent as 1996 by the Salmon-Challis NF.

SUB-WATERSHED DESCRIPTIONS

The sub-watershed boundaries used in this subbasin assessment are those depicted in Figure 6. Sub-watershed descriptions are based on descriptions of drainages provided by various resource agencies and documents. Often sub-watershed boundaries differ from agency to agency and from document to document. Thus, data are often less than precise when different boundary conventions can affect various measurements such as area estimates. These descriptions lay the foundation for discussions of specific water quality concerns and water quality-limited waters in the next section and are intended to be introductions to specific watersheds within the subbasin.

The Salmon River Corridor (303d listed for sediment and temperature)

The mainstem Salmon River is described as a large, powerful river capable of moving large amounts of sediment naturally produced by snowmelt runoff and thunderstorm events in its tributaries. The floodplain has been modified considerably by conversion to cropland. Riverbanks have been altered by the construction of numerous dikes and diversions associated with residential development, agriculture and state highway 75 and 93. Much of the natural sinuosity of the river has been reduced in an effort to protect residential and agricultural lands on either side of the river channel. Recreation, especially river floating in rafts and drift boats, is an increasing use of the river corridor. There are eight developed campgrounds in the reach from the headwaters to Holman Creek as well as several day use areas and river boat access facilities (SNRA, 1996). From Holman Creek to the confluence with the Pahsimeroi, on BLM administered land there are three developed campgrounds.

Soils throughout much of the canyon are derived from Challis volcanics, quartz monzonite, sedimentary limestone, and quartzite (USDA FS, 1999a). From the standpoint of sediment production, the poorly cemented silt, sandy silt, and bentonite fractions of the lakebed sediments and deposits of glacial till are probably the most prolific sediment sources to the river (USDA FS, 1999a). An additional source of sediment is the residual deposits of highly weathered material held on steep canyon walls and elevated terraces which is mainly derived from Challis Volcanic rhyolite or Idaho Batholith granitic material that can be washed down in heavy thunderstorms.

The Salmon River canyon from Peach Creek to Basin Creek is a classic V-shaped canyon with steep side walls. Geologic scour has left the small tributaries hanging, forming steep cascades as they plunge into the river (SNRA, 1999c). Upstream from Basin Creek to the Salmon River headwaters, the river extends through a fault-bounded valley once filled with wet meadows remnant of glacial outwash plains. Historic stream flow records (Appendix G) show annual peaks near Obsidian vary from 300 cfs to 650 cfs. Further downstream near Stanley annual peaks are from 1,500 cfs to 5,700 cfs (USGS, 2000).

The Salmon River from Peach Creek to the East Fork Salmon River drops in elevation from about 6,100 feet to 5,400 feet with an average gradient of less than 1% (USDA FS, 1999a). Mainstem baseflow is estimated to be around 500-800 cfs, and channel types are again Rosgen B-type in canyons and C-type in flatter areas. Although most of the private land in the valley bottom is in agricultural use, more and more of it is being converted to residential uses. Riparian and floodplain areas have been highly modified by agricultual activities and bank stability structures associated with State Highway 75 including riprap, rock and log barbs, and in some cases levees.

The Salmon River from the East Fork Salmon River to the Pahsimeroi River drops in elevation from 5,400 feet to 4,620 feet. Gradients are generally less than 4% and channel types are a mix of Rosgen B-types through canyon areas and C-types in flatter, often agricultural areas (USDA FS, 1999b). Through this stretch, the river flows generally in a fairly narrow, rocky canyon except in the vicinity of the city of Challis where it opens up

into a broad valley from one to three miles wide. North of Challis, the river re-enters a canyon configuration to the Pahsimeroi River. Mainstem baseflow is estimated to be around 1,000 cfs (USDA FS, 1999b).

Warm Spring Creek Sub-watersheds (303d listed for nutrients and sediment)

Lone Pine Creek and Broken Wagon Creek

The Warm Springs drainage parallels the Pahsimeroi River drainage with the Lost River Mountain Range separating the two drainages. Warm Spring Creek is on the north end of the divide with the Big Lost River drainage. These two sub-watersheds are considered together as they both make up the Warm Spring Creek drainage. This drainage is located about 3 miles south of Challis on the south side of the Salmon River. Approximately 50 m below its spring source Warm Spring Creek is diverted in it's entirety through an aquaculture operation. The effluent from the aquaculture operation then enters a ditch that ultimately supplies a hydroelectric project over a mile down-gradient. Outfall from the hydroelectric project continues through a system of agricultural ditches that do not return water to the natural stream channel. Historically flow from Warm Spring Creek would infiltrate and not reach the Salmon River as surface water.

The two sub-watersheds together include 61,425 acres with most of the area in federal ownership (36,075 acres in BLM; 16,650 acres in Forest Service), 6,750 acres in private, and 1,950 acres in State ownership (USDA FS, 1999b). Private ground is found throughout the valley on both sides of Warm Springs creek. The principle use of private land is agricultural, including aquaculture, irrigated cut hay, and pasturing. The remaining lands are used primarily for livestock grazing.

Warm Spring Creek is geothermal and water temperatures exceed 20°C throughout its length (USDA FS, 1999b). Upstream of the diversions warm water fish (tilapia, largemouth bass, and catfish) have been introduced and are reproducing naturally. Because the sub-watersheds are isolated from the Salmon River, there is no potential for migrating salmonids to enter this system.

Figure 6. Upper Salmon River Subbasin 5th Field HUCs.

Mainstem Salmon River Sub-watersheds

Morgan Creek

The Morgan Creek sub-watershed is the northernmost sub-watershed in the subbasin (Figure 5 and Figure 16). Morgan Creek enters the Salmon River from the north side about midway between Challis and the Pahsimeroi River. The sub-watershed includes 77,305 acres of land under federal and private ownership (USDA FS, 1999b). Portions of valley floors are in private irrigated agricultural use.

Morgan Creek is a typical central Idaho mountain stream with annual peak flow driven by snowmelt runoff. Average annual flow at the confluence with the Salmon River is 35.6 cfs, with an average peak flow of 278 cfs, and an average low flow of 6.2 cfs (USDA FS, 1999b). Approximately 60% of the annual flow occurs in May and June. Morgan Creek has a narrow riparian corridor heavily vegetated by cottonwoods and willows. Sediment in Morgan Creek varies from small suspended sediment to cobble size substrate. Elevations range from 9,700 feet to 5,200 feet.

Bank stability ratings in 1995 – 1997 were generally above 80% for three out of four monitoring stations on Morgan Creek, but were 50 – 64% at one station on Morgan Creek below Trail Creek. Trail Creek apparently suffered a "blow out" of some beaver dams which has affected downstream reaches. Percent fines by depth were also measured at these sites in 1995-1997. Fines varied from 23 to 42 % depending on year and location. Depth fines have decreased at three out of the four stations over the three-year period.

The principle uses in the sub-watershed are grazing, agriculture and dispersed recreation. There have been small timber sales on Forest Service land. There are numerous unscreened agricultural diversions that have been in place since the late 1800's. Currently, there are 23 water rights claims for 49.01 cfs during March 15 through November 15 on Morgan Creek (USDA FS, 1999b). During the irrigation season, Morgan Creek can be dewatered before it reaches the Salmon River. There is a large diversion above Corral Creek that dewaters a portion of Morgan Creek. Morgan Creek flow is recharged again by flow from Corral Creek.

The County Road that parallels Morgan Creek through much of it's course, particularly where the valley narrows appears to constrict the stream through fill slope. This constriction may be a source of instability downstream.

Ellis Creek

The Ellis Creek sub-watershed includes Ellis Creek and Spring Gulch on the west side of the Salmon River just south of the town of Ellis, and a number of small drainages on the east side of the Salmon River including Shotgun Creek, Shep Creek, Dry Gulch, and Penal Gulch. Very little information is available on these streams. They are small and intermittent, and some are dewatered by agricultural diversions.

Challis Creek and Mill Creek (303d listed for nutrients, sediment, flow alteration)

Challis Creek and Mill Creek sub-watersheds are considered together here because streams in the Mill Creek sub-watershed are tributary to Challis Creek. The Challis Creek Watershed area is 75,147 acres. Challis Creek originates in near vertical headwall cirque basins carved out of Challis Volcanics at elevations near 10,000 feet. The topography becomes more gently sloped benches and bottomlands at lower elevations. The hydrology is typical of central Idaho mountain streams with high flows in May and June from snowmelt runoff and low flows during winter months. Flows may increase temporarily due to local summer thunderstorms. Historic stream flow records (Appendix G) show peak discharges varying from about 140 cfs to as high as 800 cfs (1965), although most years are below 250 cfs. Channels in the upper sub-watersheds are relatively narrow and steep with gradients generally greater than 4% and some above 10% (USDA FS, 1997b). Stream gradients from the Forest boundary to Mosquito Flat Reservoir range from 4 –5 % (USDA FS, 1999b). Channel types are typically Rosgen A- and B-type above the confluence of Bear Creek. There is evidence of alternate widening with aggradation above the Forest Service boundary from the Forest Road crossing below Mosquito Flat Reservoir downstream to the confluence of White Valley Creek. Further downstream gradient is less. On private property downcutting becomes apparent below a debris dam that blew-out. Historic severe overgrazing has influenced the Challis Creek Channel and associated riparian vegetation. Annual flood stage was described as 160 cfs and annual yield was 40 cfs (USDA FS, 1997b).

Aquatic habitat was surveyed by the Forest Service in 1993 using R1/R4 protocol (USDA FS, 1997b). Tributaries to Challis Creek within the Forest boundaries were considered good to excellent quality. However, Challis Creek proper immediately above the Forest boundary was identified as having poor water quality with: elevated bedload sediment, poorly defined channels, and excessive erosion and sedimentation, elevated suspended sediment, poorly oxygenated water, and unstable banks.

Observations by DEQ and affiliated contractors have noted a significant landslide below the Mosquito Flat reservoir that has not been stabilized by natural processes or land management best management practices. This feature may have resulted in channel aggradation that subsequently reduced streambank stability, which resulted in increased deposition down stream. Beaver activity just below the confluence of Bear Creek and Lodgepole Creek has produced dams that have stored sediments over many years. Channel aggradation from increased bedload and sedimentation has filled beaver dams and resulted in the stream cutting around the beaver impoundments. This process appears to be having an impact on channel dynamics as a result of heavy sediment and bedload deposition.

Challis Creek watershed contains good populations of resident rainbow trout, cutthroat trout, whitefish and sculpin (USDA FS, 1997b). Steelhead have also been found in the lower sections of Challis Creek, although no spawning and rearing areas occur above the Forest boundary. Brook trout, introduced in the 1950's, have established naturally reproducing populations in a variety of locations. Bull trout, once thought to be both

migratory and resident life history types, are now restricted to small resident populations in headwater areas. Challis Creek was identified as critical habitat for chinook salmon, although no spawning or rearing salmon have been seen in the watershed for the last 20 years (USDA FS, 1997b).

The two sub-watersheds total 75,150 acres and have 105 miles (0.89mi/mi^2) of road and motorized trails (USDA FS, 1997b). The majority of the sub-watersheds are in dense forest (65%) with sagebrush openings making up an additional 26%. Grazing and recreation are primary uses. There are two developed campgrounds at Mosquito Flat Reservoir and Mill Creek Campground, and a number of other primitive camping areas (USDA FS, 1999b). Below the Forest boundary most of the land surrounding Challis Creek is private and in agricultural uses. A dam creating Mosquito Flat Reservoir was built in 1950 for the purpose of irrigation water storage. This reservoir has been maintained as year-round storage since the 1970's. Though reservoir operations prior to1970 are not documented, the potential exists for historic detrimental effects to the Challis Creek stream channel from sudden water release affiliated with storm events, debris dams at the reservoir outlet and snow-melt driven extreme hydrologic events. A debris dam was noted in April, 2002 that raised the lake level by over 12 inches. Sudden release of this water could result in significant erosion. It may be possible that the landslide below Mosquito Flat reservoir was triggered by such an event.

There are numerous diversions for irrigation on Challis Creek and Mill Creek (USDA FS, 1997b). Middle and lower reaches of Challis Creek are frequently dewatered. Challis Creek Lakes, Spruce Gulch, and West Fork Creek also have water storage structures to enhance irrigation (USDA FS, 1999b). According to the Idaho Department of Water Resources (IDWR) records, there are over 80 water rights for Challis Creek water. Most rights are for less than 1 cfs flow each.

Garden Creek (303d listed for nutrients and sediment)

The Garden Creek sub-watershed is approximately 50,000 acres in surface area and is located directly above the city of Challis, Idaho. This sub-watershed is often considered with Challis Creek because of their similarities of geology, soils, and hydrology (USDA FS, 1999b). Garden Creek, however, is relatively small and has no perennial tributaries. Stream gradients can vary from 5% to greater than 10%. Garden Creek flows directly through the city of Challis, and supplements the municipal water supply for the city during some summer months. The stream channel below the USDA FS boundary has been extensively altered and channeled, particularly within the City of Challis.

The land area on both sides of Garden Creek below the National Forest boundary is entirely private. Much of this land is used for irrigated agriculture and residential development. There are approximately 46 water rights claims for Garden Creek water including the city's drinking water supplementation. Collection of drinking water is achieved through an infiltration basin or gallery buried below a sand filtration layer below the stream channel. The water is made safe for drinking by further filtration away from the stream channel. Challis drinking water is known to be of high quality and there

have been no water quality issues identified in periodic testing to maintain certification by DEQ. In addition to habitat alteration from streamside development Garden Creek is frequently dewatered above the City of Challis (IDWR data). Several site visits by DEQ during the 2000 and 2001 field seasons confirmed this to be true from just above the City boundary to well below the City. Within the City limits the streambanks are stable but highly channeled with riprap. Above the City of Challis BURP scores are above the full support thresholds and fisheries data show full support of the salmonid spawning beneficial use.

Keystone Mine consists of shafts and adits and it exists on the northeast flank of Keystone Mountain above Keystone Gulch just inside the National Forest boundary. The mine was in production from 1882 through 1930 producing 4,700 oz of Silver, 2,400 lbs. of copper, and 3,800 lbs. of lead. Elements associated with various minerals found at the Keystone mine include fluorine, beryllium, silver, lead and copper. Lead, copper and zinc are also affiliated with other area mines (Chambers, 1966). It appears uncertain as to where the materials were milled. Given the low quantities of product the materials may have been milled off site or there may have been a mill site positioned downslope of the mine in the ephemeral drainage of Keystone Gulch. The mine is located at approximately 8,000 ft elevation approximately 0.3 miles west of Keystone Gulch. There is no data available that indicates that the Keystone mine has had an impact on water quality in Garden Creek. Garden Creek is in full support of beneficial uses above and below Keystone Gulch to just above the City of Challis, where the stream is periodically dewatered.

The principal land use within the watershed on Forest Service and BLM land is grazing. Much of the private land is used for irrigated pasture and feed production.

Bayhorse Creek

The Bayhorse Creek sub-watershed is a large section that includes Bayhorse Creek and a number of smaller face drainages to the Salmon River between Garden Creek and the East Fork Salmon River. Some of the smaller drainages included are Birch Creek, Rattlesnake Creek, and Lyon Creek on the west side of the Salmon River, and Malm Gulch and Bradshaw Gulch on the east side of the Salmon River.

The west side watersheds including Bayhorse Creek, Birch Creek, Rattlesnake Creek, and Lyon Creek total about 41,607 acres in size (Bayhorse Creek) (USDA FS, 1999b). Elevations on the west side range from 10,072 feet on Bald Mountain to about 5,200 feet. Bayhorse Creek originates in Bayhorse Lake and flows downstream with gradients from 8% to almost 20% in Rosgen A and B channels. The lowest reach near the mouth has gradients around 3-4%. Birch Creek, Rattlesnake Creek, and Lyon Creek have gradients generally around 10%. Bayhorse Creek flow varies from 1 cfs to over 70 cfs. Stream banks are stable and generally well shaded (USDA FS, 1999b). Water temperatures are consistently low and remarkably stable (between 9° and 14°C from July 1 to September 30, 1997) (USDA FS, 1999b). Other fish habitat parameters are generally in excellent condition. Steelhead are known to be present in Bayhorse Creek.

The Bayhorse Creek watershed has a history of mining activity including Skylark Mine, Ramshorn Mine, Pacific Mine, and Riverview Mine among others. No mines are currently active and no reclamation has occurred. The possibility of heavy metal leaching exists (USDA FS, 1999b). There are three water rights claims totaling 8.5 cfs on private land (USDA FS, 1999b). These rights include the entire summer flows of Bayhorse Creek. Other uses in the watershed include grazing, recreation (including Bayhorse Lake Campground), residential and agricultural. Logging occurred in the valley bottoms fairly agressively until the late 1950's (USDA FS, 1999b).

Spud-Sullivan (Kinnikinic Creek 303d listed for unknown)

The Spud-Sullivan sub-watershed includes Spud Creek and Sullivan Creek on the south side of the Salmon River and Kinnikinic Creek on the north side of the Salmon River between the East Fork Salmon River and Squaw Creek. Spud and Sullivan Creeks are primarily in federal ownership with 8,640 acres of Forest Service land, 4,480 acres of Bureau of Land Management (BLM) land, 1,280 acres of State land, and 40 acres of private land (USDA FS, 1999a). The Kinnikinic Creek drainage has 4,350 acres of Forest Service land, 4,280 acres of BLM land, and 320 acres of private ground.

The estimated mean annual flow for Spud and Sullivan Creeks combined is less than 2 cfs (USDA FS, 1999a). Sullivan Creek is affected by a water diversion on private land in the lowest reach. Gradients are generally over 4% with channel types predominantly Rosgen A- and B-type channels. Elevations vary from 8,500 feet to 5,300 feet on the Spud/Sullivan side of the Salmon River. A small, natural lake located at the headwaters of Sullivan Creek is stocked on a regular basis with cutthroat trout by the Idaho Department of Fish and Game. There are no bull trout present in either Spud Creek drainage or Sullivan Creek drainage (USDA FS, 1999a).

Livestock grazing is the dominant land use within the Spud and Sullivan drainages. There are grazing allotments on federal land and private land is used for residential homes, cultivated fields, or livestock grazing. Mining and recreation are also major uses in the Kinnikinic Creek drainage(USDA FS, 1999a).

Kinnikinic Creek has seven small perennial tributaries on Forest Service land and an estimated mean annual flow between 5 and 10 cfs (USDA FS, 1999a). Gradients are generally over 7% with a predominance of Rosgen B channel types, although there are some A-type channels in tributaries with gradients as high as 25%, and C-type channels near the mouth of Kinnikinic Creek. Elevations on the north side of the Salmon River vary from 9,400 feet to 5,700 feet. Kinnikinic Creek was previously affected by patented mining claims associated with the Clayton Silver Mine and Mill complex (USDA FS, 1999a). Tailings piles are directly adjacent to the creek. Tailing piles were subject to wind and water erosion with deposition directly into Kinnikinic Creek. After being investigated for possible clean-up action by EPA in 2000, tailings were capped to prevent wind and water erosion. Tailings piles were re-sloped and seeded to further aid erosion reduction. The Kinnikinic Creek channel was re-constructed away from the tailings in 2001 to reduce erosion into the tailings. Historically the operation of the mill diverted the

water from Kinnikinic Creek into a pipeline that led to a hydroelectric power facility downstream which prevented fish migration due to dewatering the stream channel, when in operation. The hydropower diversion was discontinued in 2001 and no longer dewaters the stream channel. There is also a migration barrier at the culvert under Highway 75 near the mouth of Kinnikinic Creek. This culvert barrier is being evaluated for replacement to allow fish passage from the Salmon River into Kinnikinic Creek. Until this barrier is made passable Kinnikinic Creek will be isolated from anadramous and migratory fish. There are bull trout present in Kinnikinic Creek (DEQ, 1999a). Bull trout are found in the following Kinnikinic Creek tributaries: Happy Hollow, Broken Ridge, and Sawmill Creeks as well as Transfer, Corral, Cabin and Coal Creeks (DEQ, 1999a).

Squaw Creek (proposed 303d listed for temperature)

The Squaw Creek sub-watershed is located on the north side of the Salmon River west of the town of Clayton. The sub-watershed includes Squaw Creek and numerous smaller tributaries on predominantly federal land. There are over 41,000 acres of Forest Service land, 10,667 acres of BLM land, 433 acres of State lands, and 1,534 acres of private land (USDA FS, 1999a). Squaw Creek has a mean annual flow of about 20 cfs, and gradients are over 4% with a predominance of Rosgen B-type channels. There are A-type channels in headwaters and C-type channels near the mouth of Squaw Creek. Elevations within the sub-watershed vary from 8,200 feet to 5,570 feet. Squaw Creek and one of its tributaries, Martin Creek, have bull trout present in them (USDA FS, 1999a).

The primary activity within the sub-watershed is associated with mining, followed by livestock grazing, irrigated pasture and recreation (USDA FS, 1999a). The Thompson Creek molybdenum mine sits on the watershed divide between several drainages contributing to Thompson Creek and Bruno Creek, a major tributary to Squaw Creek. There is an all weather haul road to the mine that traverses the ridge between Thompson Creek and Squaw Creek. A large mine wastewater tailings impoundment is located on Bruno Creek. Thompson Creek Mine has three NPDES discharge outfalls, two in the Thompson Creek drainage and one to Bruno Creek, a tributary to Squaw Creek (Mebane, 2000). Thompson Creek Mine has been in the process of renewing their NPDES permit and additional outfalls are being proposed, one to Squaw Creek and one to the Salmon River. The Environmental Protection Agency has completed the final draft of the NPDES permit and issuance is expected in January of 2002. Extensive studies have taken place and metals monitoring has occurred above and below discharge points. According to Mebane (2000) clean metals monitoring in the Squaw Creek drainage indicated that no criteria violations occurred in Squaw Creek below the mine discharge, however, there may be some elevated lead concentrations above the mine in sediments. There are other mines for lead and silver in the Squaw Creek drainage primarily below the Forest Service boundary surrounded by BLM and State land. These mines have operated periodically from the late 1800s to as late as 1976.

A road parallels the mainstem of Squaw Creek from its mouth to its headwaters with a number of spur roads accessing old timber sale sites and old mine sites throughout the

sub-watershed. There are five diversions, which have dewatered the stream in the past, near the mouth of Squaw Creek, used primarily for agricultural activities (USDA FS, 1999a). The diversion dam acts as a fish migration barrier. The lowest reaches (3.5 miles) of Squaw Creek are bordered by private land, with mostly agricultural and residential use.

There is some potential that the lower portion of Squaw Creek is influenced by geothermal activity. Elevated stream temperature can result from the combined effect of flow alteration and geothermal inflow.

Thompson-Slate (Thompson Creek 303d listed for metals, sediment)

The Thompson-Slate sub-watershed includes the Thompson Creek drainage on the north side of the Salmon River and the Slate Creek watershed on the south side. A number of smaller face drainages are included in this sub-watershed including Peach, Treon, Gardner, Burnt, Beaver, Badger, Mill, Holman, and French Creeks.

Thompson Creek has a mean annual flow of about 18 cfs (1973-1999 data, see Appendix G) and a base flow near 2 cfs (USDA FS, 1999a). Minimum and maximum daily mean flows for Thompson Creek are 1.4 cfs (1979) and 373 cfs (1997), respectively. Upper Thompson Creek on Forest Service land is generally steep with an average gradient near 5%. The lower half, which is bordered on the east side by BLM land and Forest Service land on the west side, has an average gradient near 3%. Elevations range from 9,600 feet to 5,580 feet. Thompson Creek contains bull trout and all other known species in the area (USDA FS, 1999a). An improved dirt road parallels Thompson Creek, mostly in the riparian area, for most of its length. Short spur roads to access timber sale sites and mining structures are also present.

Early post colonial use in the Thompson Creek watershed involved mining and the cutting of timber for coke production and mine structures (USDA FS, 1999a). Currently mining is the dominant land use in the watershed followed by grazing. Two timber sales totaling 164 acres were harvested on Buckskin Creek in the 1960s. Two additional sales occurred on Pat Hughes Creek to salvage timber on the Thompson Creek molybdenum mine. Other timber sales totaling 417 acres have occurred in the watershed further upstream.

The Thompson Creek molybdenum mine is an open pit mine at the headwaters of Buckskin and Pat Hughes Creeks, and sits on the divide with the Squaw Creek sub-watershed. Total disturbance area in the two sub-watersheds is approximately 2,460 acres (USDA FS, 1999a). There are two NPDES discharges to Pat Hughes Creek and Buckskin Creek, tributaries to Thompson Creek (Mebane, 2000). Past clean metals sampling associated with the mine discharges indicated that total selenium may be slightly elevated in the mine discharge, but no other metals have exceeded chronic criteria (Mebane, 2000).

Further downstream at about 1.5 miles from the mouth of Thompson Creek is an abandoned tungsten milling operation called the Scheelite Jim Mill site. Extensive reclamation of the site was completed in 1992, prior to 303(d) listing. Prior to reclamation work iron hydroxide (also known as yellowboy) deposits existed in Thompson Creek adjacent to the mill site and up to ¼ mile downstream (USDA FS, 1999a). Since reclamation work deposition of iron hydroxide has been greatly reduced, and is only visible over a few feet across from the lower pond adjacent to the reclaimed tailings. Also, as a result of remediation, pH values are consistently below acute and chronic water quality criteria. Steelhead have been observed spawning just below the wetland reclamation project (USDA FS, 2002).

The Thompson Creek tungsten mine, sometimes referred to as the "Scheelite Jim mine" or "Tungsten Jim mine" or "Salmon River Scheelite mine" is located further upstream of the Thompson Creek molybdenum mine near Basin Creek (Van Gosen et al., 2000). This small mine, with two shafts and a single, now collapsed adit, operated during the early 1950s when tungsten prices were unusually high (SAIC, 2000; Van Gosen et al., 2000). The tungsten ore was hauled down 7.5 miles or so to the Scheelite Jim mill site for milling and processing (SAIC, 2000). It is important to note that the 303(d) listed segment of Thompson Creek is from the Scheelite Jim "mill" site to mouth (1.02 miles), not from the mine by the same name which is more than six miles further upstream.

One irrigation diversion structure exists near the mouth of Thompson Creek which has dewatered the stream in the past (USDA FS, 1999a), but is no longer actively used. Private land (100 acres), residential and agricultural, is confined to the lowest reach of Thompson Creek. The Forest Service manages 14,546 acres and the BLM manages 5,173 acres (USDA FS, 1999a).

Slate Creek originates high in the Boulder-White Cloud Mountains and descends northward to the Salmon River falling nearly 6,500 feet (USDA FS, 1999a). The estimated mean annual flow for Slate Creek is 20 cfs, with gradients on Slate Creek and Livingston Creek less than 4%. Other tributaries to Slate Creek are generally greater than 4% gradient. Slate Creek has had sediment debris torrents periodically throughout recorded history. The most recent was on September 6, 1998 as a result of a high intensity rainstorm. A similar event occurred on August 9, 1963, and possibly in 1950-1951, 1934, 1929-1930, and 1840-1860 (USDA FS, 1999a). Despite these periodic natural channel-altering events, Slate Creek and Livingston Creek contain bull trout.

Livestock grazing is the primary activity in the watershed, and there are numerous mining claims although none are active. One inactive hardrock underground mine (Hoodoo Mine) exists in the Hoodoo Creek drainage near the headwaters of Slate Creek.

There are 23,680 acres of Forest Service land in the watershed and 280 acres of private ground, mostly used for agricultural and residential uses (USDA FS, 1999a). Slate Creek receives steelhead trout smolts from IDFG annually and steelhead incubator hatch boxes from the Sho-Ban Tribe (USDA FS, 1999a).

Gardner Creek (partial intermittent) and French Creek (mean annual flow = 3-5 cfs) are dewatered for portions of the irrigation season by an agricultural diversion. Holman Creek (mean annual flow of 5 cfs) had a diversion at one time which has since been removed. There is a culvert at the mouth of Holman Creek that limits fish passage.

Mill Creek (mean annual flow of 3 cfs) flows out onto a large alluvial fan and flows subsurface with no above ground connection to the Salmon River. Peach Creek has two diversions on Forest Service land for agricultural purposes on private land below. Most of these face drainages are steep and may not contain fish populations regardless of diversions (USDA FS, 1999a).

Yankee Fork (303d listed for sediment, habitat alteration)

The Yankee Fork watershed has been divided into three sub-watersheds in Figure 6. For simplicity, the three sub-watersheds will be discussed together here. This watershed includes the Yankee Fork and its tributaries the West Fork Yankee Fork, Ramey Creek, Jordan Creek, Fivemile Creek, Eightmile Creek, and McKay Creek. The entire watershed is within the Salmon-Challis National Forest with several large private land inholdings used primarily for mining activities. Historic stream flow records (1921-1947, Appendix G) show peak discharges from about 600 cfs to as high as 2,750 cfs.

The lower reaches of the Yankee Fork and Jordan Creek were dredge mined in the middle part of the 20th Century. In 1940 a dredge barge was built and dredging for gold proceeded up the Yankee Fork and Jordan Creek until 1952 (covering approximately 13 miles distance). Most of the lower Yankee Fork valley is strewn with rubble piles with scarce vegetation. The Yankee Fork channel is generally consolidated though there are numerous backwater pools in amongst the rubble piles. There is little riparian vegetation to provide shading and instream habitat has been extensively altered. The Shoshone-Bannock Tribes and numerous land management and wildlife agencies have been involved in extensive habitat improvement projects within the Yankee Fork and Jordan Creek watersheds. The Yankee Fork is also presumed to be a major source of sediment to the Salmon River (SNRA, 1999c).

In addition to dredge mining, there are a number of other active and inactive mining operations, including the Grouse Creek Mine owned by Hecla Mining Company. Grouse Creek Mine contains one of several National Pollution Discharge Elimination System (NPDES) permits to discharges in the subbasin. The NPDES discharge is to Jordan Creek, a tributary to the Yankee Fork. This permit is currently in the process of renewal. In December, 2001 IDEQ recognized that significant changes had occurred in the chemistry of the tailing pond solution and the overall status of the closure of the Grouse Creek Facility. The NPDES permit was updated with a letter of amendment from DEQ that incorporated changes into the permit. IDEQ has determined that if Hecla complies with the terms and conditions imposed by the NPDES permit there is reasonable assurance the discharge will comply with the applicable requirements of the Clean Water Act (CWA), including the Idaho Water Quality Standards and Wastewater Treatment Requirements (IDAPA 58.01.02)

Additionally, discharges from a leaking containment pond are being addressed through a consent agreement between the USDA Forest Service, Hecla Mining Company (Hecla) and EPA under the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), formerly referred to as Super Fund. The Administrative Order on Consent for Time Critical Removal Action, EPA Docket No. CERCLA-10-2000-0201, identifies site characterization and implementation of time-critical removal actions under an identified Statement (Scope) of Work (SOW). The objective of the SOW is to reduce concentrations of cyanide and other hazardous substances, pollutants and contaminants to levels that do not result in exceedences of applicable water quality criteria for surface water or ground water. In order to achieve this objective, the main work elements will include dewatering of the tailings impoundment, (removal of tailings impoundment supernatant), recovery of contaminated ground water and closure of the tailings impoundment. A new discharge point will likely be established to the Yankee Fork under that process.

Also in the watershed, Custer, Bonanza, and Sunbeam are place names of small mining settlements. Today there are a number of developed campgrounds within the watershed.

Warm Springs Creek

The Warm Springs Creek sub-watershed includes the Warm Springs Creek drainage from its headwaters in the White Cloud Mountains to the Salmon River at Robinson Bar. This large drainage includes a number of tributaries including Gowan Creek, Line Creek, Gooseberry Creek, Lone Pine Creek, Pigtail Creek, Martin Creek, Bear Lake Creek, Garland Creek, Swimm Creek, and Prospect Creek. Upper Warm Springs Creek, above Pigtail Creek, includes The Meadows, Mountain Home Canyon, Strawberry Basin and Iron Basin. Elevations vary from near 12,000 feet to 6,000 feet. Historic stream flow records (1921-1922, Appendix G) show flows peaking at 600 to 800 cfs with low flows below 100 cfs. The USGS gauge on Robinson Bar, near Clayton, Idaho was discontinued in March 1923. It is assumed that the flow regime has not changed.

The upper portion of the sub-watershed is a glacial carved U-shaped valley. The Meadows are a former glacial lake that has filled with outwash gravels, fine sediments and a thick mat of organic matter from bog-like vegetation development (SNRA, 1999c).

Chinook, steelhead, bull trout, and cutthroat trout have been observed in lower Warm Springs Creek near the mouth (SNRA, 1999c). Chinook and steelhead are believed to have been historically excluded from upper Warm Springs Creek by a falls below the Meadows (SNRA, 1999c). Bull trout and cutthroat trout have been observed in the Meadows area and the mouths of Pigtail Creek and Martin Creek (1992 data). Bull trout were abundant in Martin Creek, cutthroat were present there as well (1993 data).

Surface fines were greater than 30% in assessed reaches in lower Warm Springs Creek. This sediment probably resulted from upstream reaches as well as an intensive thunderstorm in 1998 which caused a debris flow from several eastern tributaries to lower

Warm Springs Creek (SNRA, 1999c). Most assessed reaches in lower Warm Springs Creek, Swimm Creek, and Garland Creek have bank stability greater than 90%.

Of sixteen reaches in upper Warm Springs Creek assessed in 1992, six reaches exceeded 30% surface fines, two reaches were between 26% and 29% surface fines, and the remaining eight reaches were below 25% surface fines (SNRA, 1999c). A high intensity thunderstorm in 1993 resulted in large quantities of sediment delivered to the system. Streambank stability is below 80% in parts of Warm Springs Creek (SNRA, 1999c). Martin and Pigtail Creeks have banks 80-90% stable. Channel entrenchment and confinement occurred in the Meadows sometime in the past, probably resulting from intensive grazing (SNRA, 1999c). Sediment will continue to be delivered to the system from unstable banks until equilibrium is established.

Upper Harden-Big Casino

The Upper Harden-Big Casino sub-watershed includes that portion of the Salmon River from Redfish Lake Creek downstream to Warm Spring Creek. A number of smaller drainages face directly into the Salmon River within this sub-watershed. Some of the larger tributaries include Little and Big Casino Creeks, Rough Creek, and Upper and Lower Harden Creeks.

Numerous chinook and steelhead, and a few bull trout and cutthroat trout have been observed in the Salmon River in this sub-watershed (SNRA, 1999b; 1999c). Cutthroat trout were observed in Upper and Lower Harden Creeks (SNRA, 1999c).

This sub-watershed includes private ground along the Salmon River associated with the towns of Stanley and Lower Stanley. Uses include residential, commercial, agricultural, and recreation. Big Casino Creek has a diversion for agricultural purposes. Spot temperature measurements in the Salmon River show water temperatures as high as 18°C (SNRA, 1999b). No data are available on sediment and bank stability, however, impacts are evidenced by obvious channel widening presumed to be related to historic season-long cattle grazing, channel alteration from Highway 75, and impacts of residential and commercial development within the Salmon River floodplain (SNRA, 1999b; 1999c).

Basin Creek

The Basin Creek sub-watersheds (there are two in Figure 6, both are considered together here) are located on the north side of the Salmon River between Lower Stanley and Sunbeam. Elevations in the drainage vary from 9,100 feet at McGowen Peak to 6,200 feet at the Salmon River. Basin Creek has numerous tributaries including Kelly Creek, Little Basin Creek, Sunday Creek, Duffy Creek, Hay Creek, East Basin Creek, and Coal Creek. Stream gradients vary from as high as 16% in headwaters reaches to 2% in lower reaches (USDA FS, 1998). Flows are typical of central Idaho mountain streams with high flows in May and June from snowmelt runoff and low flows in winter, with occasional flashy responses to summer thunderstorms.

Bull trout were observed in upper Basin Creek, East Basin Creek, Coal Creek, Kelly Creek, and Little Basin Creek and Sunday Creek in 1998 (SNRA, 1999c). Other species such as chinook salmon, steelhead trout, westslope cutthroat trout, mountain whitefish and sculpin are known to exist in the Basin Creek drainage although little is known about their populations (USDA FS 1998).

Water quality and aquatic habitat appear to be in good condition (USDA FS, 1998). Fines at depth averaged between 13.5 to 33% and pool quality is moderate (USDA FS, 2001). Declines in condition resulting from historic uses are recovering. Temperature data taken in 1994 showed water temperatures in excess of 15°C in lower Basin Creek during the summer (SNRA, 1999c). However, subsequent temperature monitoring in 1997 showed only one week of water temperatures over 15°C. The 7-day running average of daily maximum temperature was 20 ^{o}C at the SNRA S-C forest boundary. There is known geothermal inflow into lower Basin Creek.

Currently, cattle have grazed the watershed every other year since 1996. There is evidence of past mining activity throughout the area, and there is currently an active suction dredge proposal in review for use of a portable dredge (USDA FS, 1998). There are approximately 86 miles of road in the sub-watersheds. Primary roads are in the Coal Creek, East Basin Creek and lower Basin Creek areas. Large scale timber harvesting began in the 1960's. Since that time 3,351 acres have been harvested within the sub-watersheds (USDA FS, 1998).

Valley Creek

The Valley Creek drainage is divided among three sub-watersheds, Valley Creek, Upper Valley Creek, and Iron-Stanley. Valley Creek sub-watershed includes that portion of Valley Creek roughly from Elk Creek to its headwaters at Valley Creek Lake. Tributaries within the Valley Creek sub-watershed include Summit Creek, Prospect Creek, Hanna Creek, and possibly McGown and Thompson Creeks.

Valley Creek originates in Valley Creek Lake at an elevation near 8,800 feet in the Salmon River Mountains. The lower end of the sub-watershed, near the mouths of Trap Creek and Elk Creek is dominated by wet meadows characteristic of the entire lower portion of Valley Creek. The sub-watershed contains critical habitat for chinook salmon and steelhead trout (SNRA, 1999a). Additionally, the area is known to contain bull trout and westslope cutthroat trout. Brook trout are the most prominent salmonid in the sub-watershed.

Lower Valley Creek, from Trap Creek to the Salmon River, is dominated by large wet meadows originating from valley bottom glaciation (SNRA, 1999a). Valley Creek valley was carved by glaciers, which left large depressions in the valley floor. These impressions filled with glacial melt water as well as outwash gravels and fine lakebed-type sediments. These numerous lakes eventually filled in with thick vegetation and accumulated organic matter to become wet meadows. Much of this land is privately held

and used for pasturing livestock. Irrigation diversions have been developed to maintain forage vegetation throughout the valley.

The majority of the sub-watershed is in the Salmon-Challis National Forest with the bottom quarter in the Sawtooth National Recreation Area (SNRA). Lower tributaries such as Hanna Creek, McGown Creek and Thompson Creek are within the SNRA. The primary uses in the sub-watershed are grazing and recreation. There are a number of small mining claims spread throughout the drainage, but none are active (SNRA, 1999a). Road densities are generally low (0.8 mi/mi^2 or less), and there have been very few timber cuts. Private lands exist on lower Valley Creek within this sub-watershed, most of which is used for irrigated pasture for livestock grazing. Irrigation diversions exist on many of the lower tributaries including Hanna Creek, McGown Creek, and Thompson Creek. Fish migration connections to Valley Creek have been lost from these tributaries (SNRA, 1999a). Forest Service habitat assessment data show that Valley Creek in this sub-watershed has surface fine sediment in excess of 30% (1992-1993 data) and streambank stability is less than 80% in 10 out of 13 reaches assessed (SNRA, 1999a).

Upper Valley Creek

The Upper Valley Creek sub-watershed includes those tributaries on the west side of Valley Creek above Stanley Lake Creek including Trap Creek, Elk Creek, and Meadow Creek (between Trap and Elk Creeks). These tributaries originate high in the Sawtooth Mountains north of the Sawtooth Wilderness. This sub-watershed is entirely within the SNRA. A population of bull trout were observed in the headwaters of Trap Creek in 1992 (SNRA, 1999a). Other salmonids (Chinook salmon, steelhead trout, cutthroat trout) are believed to be present or were present historically.

Livestock grazing was excluded from this area after 1993 (SNRA, 1999a). Elk Creek near its mouth is diverted in two places for private land use. Road density is very low at 0.1 mi/mi^2. Elk Creek has surface fines generally greater than 20% (1990 data), and Meadow Creek and Trap Creek have surface fines between 26% and 29% (1992-1993 data) (SNRA, 1999a). Bank stability ratings were less than 80% for half the assessed reaches on Elk Creek (1985 data), but were between 80-90% stable on Meadow and Trap Creeks.

Iron-Stanley

The Iron-Stanley sub-watershed includes the lower portion of Valley Creek and its tributaries Iron Creek, Stanley Creek, and Stanley Lake Creek. Additional tributaries include Crooked Creek, Goat Creek, and Meadow Creek (near Stanley). Tributaries on the south side of Valley Creek originate high (near 10,000 feet) in the Sawtooth Mountains within the Sawtooth Wilderness. Many of them contain alpine lakes such as Sawtooth Lake on Iron Creek, Goat Lake on Goat Creek, and McGown Lakes on Stanley Lake Creek.

Stanley Lake Creek is known to contain westslope cutthroat trout above Stanley Lake, and chinook and steelhead below the lake (SNRA, 1999a). Brook trout are found throughout the stream. Chinook and steelhead are commonly seen near the mouths of other tributaries including Iron Creek, Goat Creek, Stanley Creek and Crooked Creek. Bull trout and cutthroat trout are rarely observed in these streams (SNRA, 1999a).

In Stanley Lake Creek, surface fines are generally less than 20% in reaches below Stanley Lake (1992 data) (SNRA, 1999a). Above the lake, sediment levels are apparently very high which results in part from natural conditions. Bank stability was rated as 80-90%, but generally in good condition (SNRA, 1999a). No cattle grazing since 1992 in the watershed and the road density is low at 0.6 mi/mi^2. In other tributaries sediment levels are considered moderate to high. Some of this sediment is from natural sources, although Stanley Creek and Valley Creek itself have been more affected by activities. Lower Valley Creek in the town of Stanley has experienced substantial residential and commercial growth in recent years. There are numerous irrigation diversions on tributaries. Meadow Creek, Goat Creek, and Iron Creek may be dewatered each year (SNRA, 1999a).

Redfish Lake Creek

The Redfish Lake Creek sub-watershed includes Redfish Lake Creek and its major tributary Fishhook Creek, as well as Redfish Lake and Little Redfish Lake. Redfish Lake Creek originates high (10,000 feet) in the Sawtooth Wilderness in a number of alpine lakes including the Upper Redfish Lakes and the Cramer Lakes (Upper, Middle, Lower).

Chinook, steelhead, bull trout, and cutthroat trout have all been observed in Redfish Lake Creek below the lake (SNRA, 1999b). Bull trout are also present in Fishhook Creek as possibly one of two strong populations in the Sawtooth Valley. Redfish Lake remains the only location with returning sockeye salmon, and re-introductions of sockeye to Redfish Lake are on-going.

Sediment, although naturally high due to granitic geology, and bank stability are believed to be within normal parameters (SNRA, 1999b). The primary use within the sub-watershed is recreation. There are extensive developed recreation sites in and around Redfish Lake. An ongoing issue discovered in 2001 is a leaking underground gasoline storage tank near the Redfish Lake Lodge just upgradient from Redfish Lake Creek below the outlet on USDA FS land. This leaking tank has the potential to affect groundwater and surface water as well as migrating Redfish Lake sockeye salmon listed as an endangered species.

Huckleberry-Fisher

The Huckleberry-Fisher sub-watershed includes the Salmon River and a conglomeration of streams tributary to the Salmon River from above Redfish Lake Creek to below Fourth of July Creek. This stretch of the Salmon River includes tributaries such as Huckleberry

Creek/Decker Creek on the west side, and Cleveland Creek, Gold Creek, Williams Creek, and Fisher Creek on the east side.

Snorkel data in 1996 revealed only two cutthroat trout among many brook trout in Fisher Creek (SNRA, 1999b). Chinook and steelhead, and a few bull trout and cutthroat trout have been observed in Gold Creek and Williams Creek.

Fisher Creek appears to have fine surface sediments in excess of 30% in assessed reaches (SNRA, 1999b). Little data is available for Gold Creek and Williams Creek, although lower reaches on private land are believed to have elevated fine sediment and reduced streambank stability (SNRA, 1999b).

Uses in the sub-watershed include historic mining, grazing, residence and recreational homes and outdoor recreation. Gold Creek, Williams Creek, and the last mile of Fisher Creek are dewatered in most years by agricultural diversions (SNRA, 1999b). There are unscreened diversions on Cleveland Creek and Boundary Creek as well.

Hell Roaring-Fourth of July (Lost Creek 303d listed for unknown)

The Hell Roaring-Fourth of July sub-watershed includes the Salmon River, and Hell Roaring Creek and Mays Creek on the western side of the Salmon River, and Champion Creek and Fourth of July Creek on the eastern side. Hell Roaring Creek originates in alpine lakes high in the Sawtooth Wilderness. Champion Creek and Fourth of July Creek originate in alpine lakes high in the Boulder-White Cloud Mountains.

Chinook, steelhead, bull trout, and cutthroat trout have all been consistently observed in the lower reaches of Fourth of July Creek (SNRA, 1999b). Bull trout and cutthroat trout have also been observed in middle reaches as well, however, little is know about the fish in upper reaches of Fourth of July Creek. A few chinook, steelhead, and cutthroat have been observed in Champion Creek, but no bull trout (SNRA, 1999b). Cutthroat trout were the only trout observed in the South Fork Champion Creek. Use of Hell Roaring Creek by sensitive salmonids is unknown (SNRA, 1999b).

Champion Creek and Fourth of July Creek appear to be functioning normally regarding temperature, sediment, and streambank condition, except for the lowest reaches, which appear to have less than 80% streambank stability (SNRA, 1999b). Sediment conditions in Fourth of July Creek may be functioning at risk (26-29% surface fines) in spawning areas due to past mining, grazing and roads in the watershed. Hell Roaring Creek appears to be functioning normally regarding sediment and streambank conditions (SNRA, 1999b). Streambank conditions for the Salmon River in this sub-watershed may be less than 80% stable (SNRA, 1999b).

The lowest reaches of Champion Creek and Fourth of July Creek are in private lands and State lands. There are seven diversions for private land irrigation on Champion Creek and three diversions on Fourth of July Creek. Both creeks are dewatered in lower reaches

in most years (SNRA, 1999b). The primary uses of the Champion Creek watershed are recreation and grazing.

Water temperatures measured in 1994 in the Salmon River and a number of tributaries south of Obsidian in the SNRA produced temperatures in excess of 15°C for several weeks in the summer (SNRA, 1999b). Maximum temperatures exceeded 9°C into September or October of that year. This was apparently a very warm summer which produced warmer than average water temperatures. However, no other temperature data were found for the SNRA portion of the subbasin.

Alturas Lake Creek

The Alturas Lake Creek sub-watershed includes Alturas Lake, Pettit Lake, and Yellow Belly Lake and their associated watersheds. These drainages originate in high elevation, alpine cirque lakes in the Sawtooth Mountains. The drainages above Pettit Lake and Yellow Belly Lake are within the Sawtooth Wilderness. Alpine Creek, a tributary to upper Alturas Lake Creek, is also in the wilderness area.

Sheep grazing and recreation are the predominant present-day land uses in this sub-watershed. Camping and boating are important around Alturas Lake where a number of developed recreational facilities exist including campgrounds, picnic areas, a lodge, and a number of private organization camps. Lower Alturas Lake Creek has several pieces of private land especially at the mouths of Pettit Lake Creek and Yellow Belly Lake Creek.

Alturas Lake Creek is an important seasonal migratory corridor for endangered sockeye salmon and federally protected bull trout and cutthroat trout. Outmigrating sockeye have been observed in this creek since 1980 (SNRA, 1999b). Numerous Chinook salmon and steelhead trout have also been observed near the mouths of Alturas Lake Creek, Pettit Lake Creek, and Yellow Belly Creek. Bull trout and cutthroat trout have been observed in Pettit Lake Creek. There may be an adfluvial population of bull trout in Pettit Lake (SNRA, 1999b). A very important adfluvial bull trout population has been known to exist in Alturus Lake. Numerous cutthroat trout have been observed near the mouth of Yellow Belly Creek, but no bull trout were observed. It is believed that some bull trout may exist above Yellow Belly Lake. The lake itself is managed as a cutthroat fishery (SNRA, 1999b).

Alturas Lake Creek appears to meet Forest Service thresholds for sediment (<20% surface fines) and bank stability (>90%) (SNRA, 1999b). Sediment loads are naturally high in the Pettit Lake Creek and Yellow Belly Lake Creek systems due to granitic geology, but sediment loads and streambank stability are probably functioning normally because of the largely unaltered drainages.

Upper Salmon River

The Upper Salmon River sub-watershed includes the headwaters of the Salmon River, Frenchman Creek, Smiley Creek, and Beaver Creek all originating in the Smokey

Mountains to the south, and Pole Creek originating in the Boulder-White Cloud Mountains to the east. Elevations range from 10,225 feet at Bromaghin Peak to 7,000 feet. Frenchman Creek, Smiley Creek, Beaver Creek and the headwaters of the Salmon River are all parallel drainages running south to north. Pole Creek is a large drainage that runs east to west from the Germania Creek watershed divide.

The Smokey Mountains and Sawtooth Mountains are underlain by granite (Idaho batholith) while the Boulder-White Clouds are a mixture of granitic, sedimentary, and volcanic rocks, creating different soil parent materials between the two sides of the drainage (SNRA, 1999b). In the high elevations cirque lakes feed high gradient headwater streams. Valley bottoms at the north end of this sub-watershed show the U-shaped glacial troughs typical of the Sawtooth valley.

Currently, the most prominent uses in this sub-watershed are recreation and grazing. Cattle, sheep and horse grazing are the primary uses of private land in the Sawtooth Valley at the mouths of these tributaries. Private land is irrigated by diversions from these streams and lower Smiley Creek is dewatered during some years. Past mining activities are evident especially at the headwaters of Smiley Creek (Vienna area) and the Silver King and Pilgrim Mines near the headwaters of Beaver Creek. There are no active mining operations at this time (SNRA, 1999b). Access roads to the Vienna mine are deteriorating and are producing significant amounts of sediment that are ultimately transported by runoff into Smiley Creek. Road densities are generally less than 1.0 mi/mi^2. Timber harvest on public land has been limited, however, on private parcels, access roads and associated harvest activities have increased erosion and sediment delivery to Smiley Creek.

Fish surveys have revealed numerous chinook and steelhead. Bull trout and cutthroat trout are present within the Salmon River, Frenchman Creek, Smiley Creek, Beaver Creek, and Pole Creek (SNRA, 1999b). Numerous brook trout were observed in Pole Creek in 1998, and brook trout are present throughout the upper Salmon River watershed.

Sediment in the Salmon River headwaters, Frenchman Creek, and Pole Creek were rated as “functioning at risk” or between 26 and 29% surface fines due to primarily legacy affects of past grazing and road development (SNRA, 1999b). Bank stability on the Salmon River has been compromised on federal and private land, and is believed to be less than 80% in places (SNRA, 1999b). The Headwaters reach of the Salmon River on SNRA lands above the confluence of Frenchman Creek also exhibits streambank stability less than 80% over some segments. Surface fines were apparently greater than 30% in assessed reaches of Smiley Creek and Beaver Creek due to past grazing, road erosion and mining activities, however, bank stability ratings were greater than 90% on some reaches of Smiley Creek and variable on Beaver Creek (SNRA, 1999b). There is significant aggradation of the stream channel on the middle to upper reach of Smiley Creek, primarily from road erosion on the private in-holdings associated with the Vienna Mine. Aggradation of the Smiley Creek channel will eventually create reduced streambank stability over much of Smiley Creek. Of particular note is the occurrence of a high intensity thunderstorm on July 27, 1998, which delivered considerable amounts of

sediment to the western tributaries of Smiley Creek. This sediment has continued to transport into Smiley Creek. Embeddedness values exceeded 30% in Smiley Creek and Pole Creek in 1985 (SNRA, 1999b).

East Fork Salmon River Sub-watersheds

Spar Canyon

The Spar Canyon sub-watershed is the first major drainage on the east side of the East Fork Salmon River traveling upstream from its mouth. Ninety-six percent of the 23,059 acres in this sub-watershed are administered by the BLM (BLM, 1999a). The State of Idaho owns an additional 892 acres (3.8%), and the remaining 90 acres (0.4%) are private.

Spar Canyon has no perennial tributary streams (BLM, 1999a). Spar Canyon itself is 10 miles of deeply incised ephemeral stream channel that only contains water during spring runoff and during occasional summer thunderstorms. Spar Canyon has a number of ephemeral tributaries and springs including Bear Wallow, Tub Spring, Gossi Spring, White Colt Spring, Grey Stud Spring, and Sorrel Spring. It is likely that Spar Canyon has the potential to contribute significant amounts of sediment to the East Fork of the Salmon River during extreme hydrologic events. The East Fork of the Salmon River would likely ultimately benefit from erosion control measures on Spar Canyon, though the East Fork is not currently §303(d) listed for sediment.

Spar Canyon is used primarily for grazing and secondarily for dispersed recreation. The Spar Canyon road is used to access the lower East Fork of the Salmon River from Highway 93 during all but the winter months.

Big Lake-East Fork Salmon River

The Big Lake-East Fork Salmon sub-watershed includes the East Fork Salmon River from its confluence with the Salmon River to, but not including Big Boulder Creek. This sub-watershed contains Big Lake Creek and a number of smaller drainages, including Joe Jump Basin, Cherry Gulch, Marco Creek, and Bluett Creek on the northwest side of the East Fork Salmon River, and Dry Hollow, McDonald Creek, Fox Creek, Pine Creek, and Baker Creek on the southeast side of the East Fork Salmon River. Big Lake Creek headwaters in the White Cloud Mountains at about 9,800 feet elevation and descends to about 5,800 feet at the mouth.

The East Fork Salmon River descends from about 6,000 feet in elevation near Big Boulder Creek to 5,500 feet at the Salmon River. Historic stream flow records (Appendix G) show annual peak flows from 1,200 cfs to 3,500 cfs. Baker Creek, Pine Creek, and McDonald Creek are perennial streams, Marco Creek, Bluett Creek, and Dry Hollow are intermittent streams, and Cherry Gulch, Joe Jump Basin, and Dry Gulch are ephemeral water bodies (BLM, 1999a). The East Fork Salmon River is known to contain bull trout (BLM, 1999a). Rainbow trout and cutthroat trout are found in Big Lake Creek

above Jimmy Smith Lake, westslope cutthroat trout are found in McDonald Creek, and Pine Creek, however bull trout are absent in McDonald and Pine Creek (USDA FS 2000).

The Big Lake Creek watershed includes 12,818 acres of Forest Service land, 3,654 acres of BLM land, 222 acres of State of Idaho land, and six acres of private land (BLM, 1999a). Perennial water bodies in the watershed include Big Lake Creek, Jimmy Smith Lake, Jimmy Smith Creek, and Corral Creek. Jimmy Smith Lake is a 450 acre natural lake at the confluence of Big Lake Creek and Jimmy Smith Creek. The outlet from the lake has been modified slightly to control lake water levels (BLM, 1999a). Jimmy Smith Lake is a popular recreation spot in summer and is used for ice fishing in winter with rainbow trout the target species.

The sub-watershed is primarily in federal ownership (BLM and Forest Service) with a few State land sections and private land along the river. Land surrounding Jimmy Smith Lake is State owned and managed for recreation (BLM, 1999a). The primary access road parallels the East Fork Salmon River for most of its length, and is paved to about Big Lake Creek. The primary uses in the sub-watershed are grazing and recreation on public lands and agricultural uses on private lands. There are a number of water diversions for irrigated agriculture. The floodplain of the East Fork Salmon River has been highly altered to maintain cultivated lands. Some riparian meadows (e.g. Corral Creek) have been heavily grazed in the past (BLM, 1999a). The area between Marco Creek and Cherry Gulch is maintained as a Bighorn Sheep wintering range, and is excluded from livestock grazing.

Horse Basin Creek (Road Creek 303d listed for unknown)

Horse Basin Creek is a tributary to Road Creek. The sub-watershed should be more appropriately named the Road Creek sub-watershed. The Road Creek drainage, including Horse Basin Creek, contains 50,606 acres of BLM land, 2,911 acres of State land, 409 acres of private ground, and no Forest Service land (BLM, 1999a). Land within the sub-watershed is steep to rolling with narrow valleys, and primarily sagebrush country. Elevations range from 8,400 feet to about 5,400 feet (BLM, 1999a). Tributaries to Road Creek include Horse Basin Creek, Bear Creek, Sand Hollow, and Mosquito Creek, as well as numerous unnamed intermittent and ephemeral tributaries. Sand Hollow is an intermittent stream excluded from livestock grazing because of the erodible volcanic soils in that area (BLM, 1999a). Corral Basin Creek is a tributary to Horse Basin Creek. Rainbow trout and cutthroat trout are present in the sub-watershed, however, no bull trout are known to be present (BLM, 1999a).

Road Creek is paralleled by a gravel road for most of its length. The road is primarily in the 100-year flood plain of Road Creek and makes several creek crossings. There has been very little timber and mining activity in the sub-watershed (BLM, 1999a). The lower three miles of Road Creek is surrounded by private land that is used for irrigated agriculture and grazing. Irrigation diversions dewater Road Creek for much of the irrigation season. Dewatering occurs from the irrigation diversions above the upper boundary of the small lower parcel of BLM lands that the Creek flows through. This is

about 4,800 feet above the confluence with the Salmon and coincides with the western edge of section 19 at N 44º 11.275' W114º 16.339'. Most of the remainder of the sub-watershed is managed for livestock grazing (BLM, 1999a).

BLM reported that water temperatures often exceed state standards in Road Creek, Horse Basin Creek, Bear Creek, and Mosquito Creek (BLM, 1999a). However, maximum water temperature data for 1995 through 1999 showed Horse Basin Creek and Road Creek slightly exceeding 22°C only in 1996, but not in other years (BLM, 1999b, see Appendix C). Thermograph data for 1999 showed that Road Creek did not exceed state standards for temperature. Daily average water temperature in Road Creek below Horse Basin Creek varied between 12° and 14°C from July 8, 1999 to about August 29, 1999. After August 29, 1999 daily average water temperatures drop to 7-10°C. Maximum water temperatures rarely exceeded 19°C at that location in 1999. Riparian condition over all but the dewatered private segment appears to be at full potential. BLM may have been referring to state standards for bull trout as the context was within their biological assessment for bull trout. However, they report no known bull trout populations within the Road Creek sub-watershed.

Herd Creek

The Herd Creek sub-watershed is a large watershed (74,496 acres) located on the south side of East Fork Salmon River. The principle tributaries to Herd Creek include Lake Creek, East and West Fork Herd Creek, East Pass Creek, and Middle Canyon. The majority of the sub-watershed is in the Salmon-Challis National Forest (72% of the drainage basin) with the lowest 4-5 miles of Herd Creek in BLM (24% of the drainage basin), State (3% of the drainage basin) and private ground (1% of the drainage basin).

Elevations in the Herd Creek sub-watershed vary from 10,000 feet to 5,700 feet with an average gradient of 4.2% (USDA FS, 1997a). Herd Creek has mean annual flow of 53 cfs with an average peak of 412 cfs (1983) and a low of 10 cfs. The 96 miles of perennial streams are (91%) source-type channels with gradients greater than 4% (Rosgen A, Aa). The remaining stream channels (6%) are transport-type (Rosgen B, and G gradient = 1.5-4%) and 3% response-type (Rosgen C with F inclusions, gradient <1.5%). Twenty-acre Herd Lake, a popular fishing and camping area, is located on upper Lake Creek at the end of the only major road in the sub-watershed.

Herd Creek is known to contain chinook salmon, steelhead trout, cutthroat trout, bull trout, whitefish, resident rainbow trout, brook trout and sculpin (USDA FS, 1997a). Bull trout are known to be in Herd Creek, West Fork Herd Creek, , and East Pass Creek (BLM, 1999a). Fish passage is blocked 0.5 miles above the confluence of Lake Creek with Herd Creek.

The Forest Service watershed analysis describes Herd Creek as carrying excess sediment. Percent fine sediment in spawning gravel was between 20% and 35%. In 2001 fine sediment at depth in East Pass Creek ranged from 27.1 to 38.3 % and Herd Creek below E. Pass Creek confluence ranged from 28.4 to 32.5% (USDA FS 2001). The range for

the West Fork of Herd Creek was between 20.4 and 27.2% depth fines. The Forest Service standard for fine sediment less than 6.35mm at depth in the Challis zone of the Salmon-Challis National Forest is 30%.

From TSS data it was calculated that Herd Creek can carry 222 tons/day sediment at bankfull and 14.5 tons/day at low flow (USDA FS, 1997a). The watershed analysis (USDA FS, 1997a) rated 65% of the stream reaches as functioning properly, while 27% were functioning at risk but with an upward trend. Only 7% were rated non-functional. Water temperatures in Herd Creek and Lake Creek measured at several locations from 1993 to 1996 show that maximum temperatures rarely exceed 22°C, and often exceed 13°C during the summer months (USDA FS, 1997a). Temperatures varied between sample years with 1994 being the warmest and 1995 the coolest (Appendix C). For example, lower Herd Creek maximum water temperature was 22.4^{o}C in 1994 and 15.5^{o}C in 1995. In other years, maximum temperatures at the same site were intermediate at 16.4^{o}C and 16.5^{o}C for 1993 and 1996, respectively. In 2001 the maximum 7 day average of daily maximum temperature in upper Herd Creek and East Pass Creek was 14.4^{o}C

There are 12 miles of public road, 5.8 miles of abandoned road, 2.4 miles of jeep trails, and 21 miles of non-motorized trails in the sub-watershed (USDA FS, 1997a). There are 246 acres of irrigated agricultural lands with two diversions (five diversion points (USDA FS, 1997a)) totaling 5.48 cfs flow (BLM, 1999a). Grazing is the dominant use in the sub-watershed, followed by recreation.

Sheep-Boulder

The Sheep-Boulder sub-watershed includes the Boulder Creek, Little Boulder Creek, and Wickiup Creek watersheds on the west side of the East Fork Salmon River, and the Sheep Creek and Deer Creek watersheds on the eastern side. Boulder Creek and Little Boulder Creek originate in a complex of high mountain lakes called the Boulder Chain Lakes in the White Cloud Mountains.

The majority of these two watersheds are in the SNRA. The lowest portion of all watersheds extends onto BLM and private ground in the East Fork Salmon River valley. Sheep Creek and Deer Creek extend into Salmon-Challis National Forest. Bull trout are known to exist in Big Boulder Creek and Little Boulder Creek as well as Bowery Creek.

There is one road that travels up Big Boulder Creek and its tributary Jim Creek to access the Livingston Mine area at the headwaters of Jim Creek. Big Boulder Creek has experienced severe “blowouts” of sediment due to activities at the Livingston Mine (BLM, 1999a). Restoration of the degraded stream channel was completed in 1997. These areas were restored through the efforts of the Shoshone-Bannock Tribes and the Bonneville Power Administration. An old dam built on Big Boulder Creek in 1925 was removed in 1991. Private lands used primarily for irrigated agriculture and grazing are found along the East Fork Salmon River. The remainder of the sub-watershed is used for dispersed recreation, with Little Boulder Creek campground near the mouth of Little Boulder Creek being the only developed recreation facility. The Sheep Creek watershed

is also used for livestock grazing. There is an irrigation diversion on Wickiup Creek (BLM, 1999a)

Upper EF Salmon River

The Upper East Fork Salmon River sub-watershed includes the headwaters of the East Fork above Germania Creek. Tributaries to the East Fork Salmon River include Bowery Creek, West Pass Creek, Ibex Creek, and South Fork East Fork Salmon River on the east side of the river, and West Fork East Fork Salmon River on the west side. This sub-watershed originates high (11,700 feet elevation) in the Boulder Mountains from numerous springs and descends northward to about 6,400 feet (BLM, 1999a). Bull trout are known to be present in West Pass Creek, Ibex Creek, South Fork East Fork, West Fork East Fork, and the East Fork Salmon River itself (BLM, 1999a).

The sub-watershed is almost entirely managed by the Forest Service (62,426 acres), with 177 acres of private ground and one acre of State land (BLM, 1999a). Most of this area is within the Sawtooth National Forest and the Sawtooth Natioanl Recreation Area, however, the Bowery Creek drainage is Sawtooth National Forest land administered by the Salmon-Challis National Forest. The entire drainage is used primarily for dispersed recreation. There is one developed recreational facility. There are two private inholdings used for grazing and other agricultural purposes. There are three irrigation diversions at the mouth of West Pass Creek, and one diversion on Bowery Creek. The diversion on Bowery Creek may preclude fish migration in most years (BLM, 1999a). There is one historic mining site in the headwaters of West Pass Creek. There is one road up the East Fork to the Bowery Guard Station site, and another up the West Pass Creek drainage which is apparently washed out, not to be replaced (BLM, 1999a).

Germania Creek

The Germania Creek sub-watershed includes the entire Germania Creek drainage from its headwaters in the Boulder-White Cloud Mountains to the East Fork Salmon River. Elevations range from 11,800 feet to 6,400 feet (BLM, 1999a). The entire 32,000 acre sub-watershed is administered by the SNRA with 100 acres of private inholdings. Tributaries to Germania Creek include Chamberlain Creek, Washington Creek/ Washington Lake Creek, Three Cabins Creek, Galena Gulch, Deer Creek, MacRae Creek, and Alta Creek. Chamberlain Creek, Washington Creek, and Deer Creek all originate in high mountain lakes. Bull trout are known to be present in Germania Creek and Chamberlain Creek (BLM, 1999a).

The upper Washington Creek and Three Cabin Creek drainages, areas known as Washington Basin and Germania Basin, have received considerable mining activity. A road to this region comes across the divide from Pole Creek and extends down Germania Creek to Three Cabin Creek where the road accesses the mining region. The remainder of the sub-watershed is used primarily for dispersed recreation.

WATER QUALITY CONCERNS AND STATUS

Water Quality-limited Waters

In 1998, DEQ established a new 303(d) list based on assessments performed through the Beneficial Use Reconnaissance Project (BURP) and other pertinent material regarding beneficial use status and water quality standards violations. The 1998 303(d) list included eleven (11) water body segments in the Upper Salmon subbasin (Figure 7 and Table 3). The EPA approved that list in May 2000, but has proposed to add to the list for the Upper Salmon subbasin one water body (Squaw Creek) listed for temperature pollution. Figure 7, which is an official 303d GIS coverage, depicts Garden Creek as a U-shaped stream. The eastern half of that U-shape appears to be in error as that is part of a canal system coming off the Salmon River. On topographic maps, Garden Creek appears to terminate at Hanna Slough and does not directly intercept the Salmon River.

Table 3. 1998 303(d) listed stream segments for the Upper Salmon (17060201) subbasin.

Stream	Boundaries	Stream Miles	Pollutant(s)
Salmon River	Redfish Lake Creek to East Fork Salmon River	44.45	Sediment, temperature
Salmon River	Hellroaring Creek to Redfish Lake Creek	13.34	Sediment
Challis Creek	Forest boundary to Salmon River	9.35	Sediment, nutrient, flow alteration
Garden Creek	Forest boundary to Salmon R.	14.39	Sediment, nutrient
Warm Spring Cr.	Headwaters to sink	21.56	Sediment, nutrient
Thompson Creek	Scheelite Jim mill to Salmon R.	1.02	Sediment, metals
Yankee Fork	Jordan Creek to Salmon River	9.0	Sediment, habitat alteration
Yankee Fork	4th of July Creek to Jordan Creek	2.92	Sediment, habitat alteration
Lost Creek	Headwaters to sink	4.45	Unknown
Kinnikinic Creek	Sawmill Cr. to Salmon R.	2.99	Unknown
Road Creek	Headwaters to EF Salmon R.	15.77	Unknown
Added by EPA, January 2001			
Squaw Creek	Headwaters to mouth	unknown	Temperature

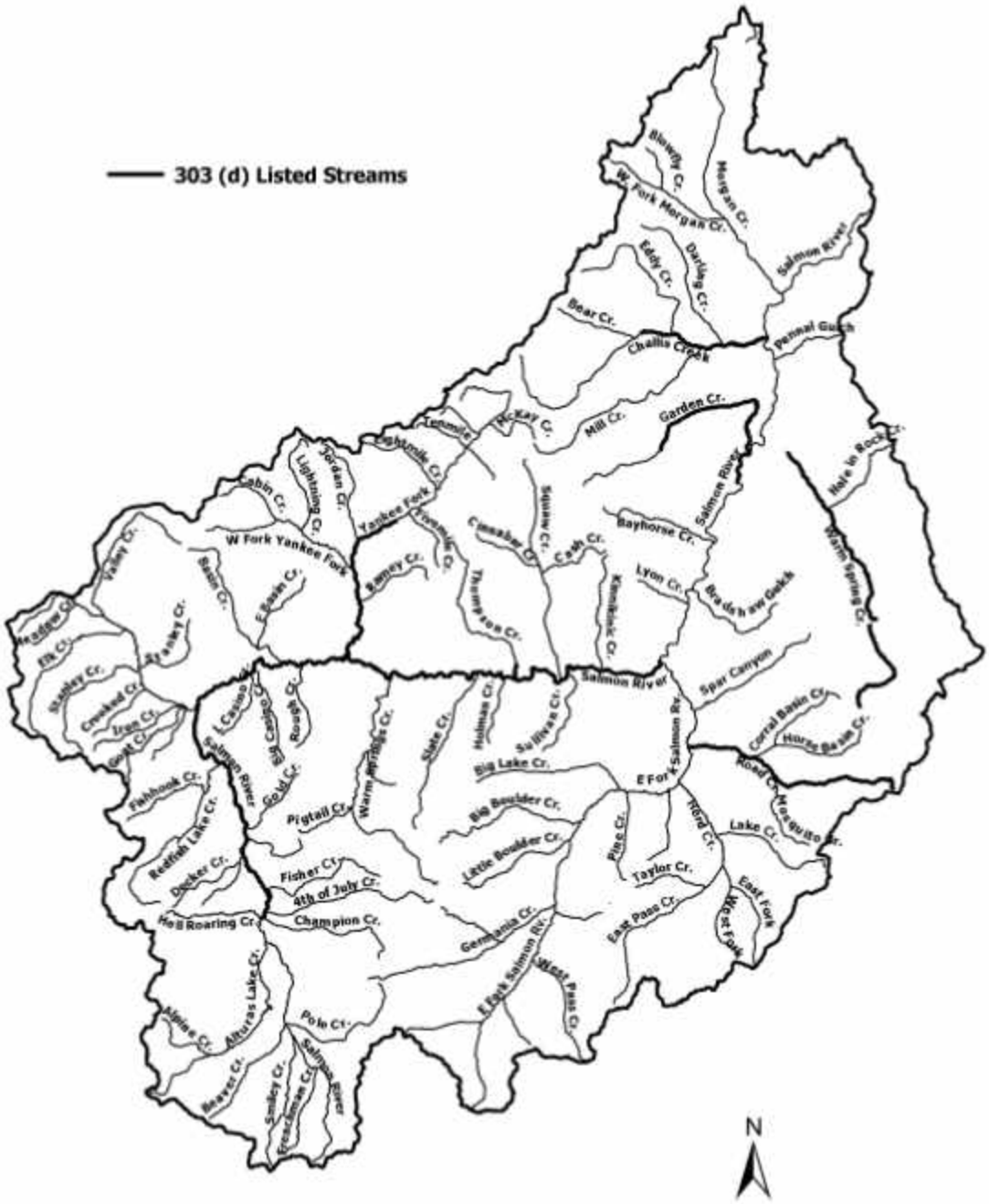

Figure 7. Upper Salmon River Subbasin 303d Listed Stream Segments.

Water Quality Standards

Water Quality Standards are legally enforceable rules and consist of three parts: the designated uses of waters, the numeric or narrative criteria to protect those uses, and an antidegradation policy. Water quality criteria used to protect these beneficial uses include narrative Afree form@ criteria applicable to all waters (IDAPA 58.01.02.200), and numerical criteria which vary according to beneficial uses (IDAPA 58.01.02.250, 251, & 252). Typical numeric criteria include bacteriological criteria for recreational uses, physical and chemical criteria for aquatic life (e.g. pH, temperature, dissolved oxygen (DO), ammonia, toxics, etc), and toxics and turbidity criteria for water supplies. Idaho=s water quality standards are published in the state=s rules at *IDAPA 58.01.02* B *Water Quality Standards and Wastewater Treatment Requirements*. Designated beneficial uses for waters in the Upper Salmon subbasin are listed in Table 4.

Table 4. Waters with designated beneficial uses in the Idaho Water Quality Standards.

Map Code	Water Body	Designated Uses
S-1, S-14, S-16, S-19, S-26, S-28, S-44, S-60, S-65, S-69, S-70, S-78	Salmon River – 12 water body units from Pahsimeroi River to the Salmon River's source	Domestic Water Supply, Cold Water Biota, Salmonid Spawning, Primary Contact Recreation, Special Resource Water
S-21, S-23	Squaw Creek – two water body units from mouth to confluence of Aspen and Cinnabar Creeks	Cold Water Biota, Salmonid Spawning, Secondary Contact Recreation
S-27	Thompson Creek – mouth to source	Cold Water Biota, Salmonid Spawning, Secondary Contact Recreation
S-29, S-31	Yankee Fork – two water body units from mouth to source	Domestic Water Supply, Cold Water Biota, Salmonid Spawning, Primary Contact Recreation, Special Resource Water
S-99, S-100, S-107	East Fork Salmon River – three water body units from mouth to confluence of South and West Forks of Salmon River	Domestic Water Supply, Cold Water Biota, Salmonid Spawning, Primary Contact Recreation, Special Resource Water

Waters not specifically designated in the Idaho water quality standards are Undesignated Waters (IDAPA 58.01.02.101), which are generally protected for Cold Water aquatic life use and Primary or Secondary Contact Recreation until designated. Additionally, all waters of the state are designated for Agricultural and Industrial Water Supplies, Wildlife and Aesthetics.

Of particular importance regarding listed water bodies in this subbasin are the criteria for sediment, temperature, nutrients, and metals. The narrative criterion for sediment is as follows:

- ASediment shall not exceed quantities specified in Section 250, or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determination of impairment shall be based on water quality monitoring and surveillance and the information utilized in Section 350.02.b.@

Quantities specified in Section 250 refer to turbidity criteria identified for cold water biota use and small public domestic water supplies. Turbidity must be measured upstream and downstream from a sediment input in order to determine violation of criteria. The quantitative criterion for turbidity is as follows:

- "Turbidity, below any applicable mixing zone set by the Department, shall not exceed background turbidity by more than fifty (50) NTU instantaneously or more than twenty-five (25) NTU for more than ten (10) consecutive days.

Indirectly, specific sediment criteria also include intergravel dissolved oxygen measures for salmonid spawning uses. Intergravels filled with sediment can=t hold enough dissolved oxygen for successful incubation. Intergravel dissolved oxygen measurement requires the placement of special apparatus in spawning gravels. Turbidity and intergravel DO are rarely measured as part of routine reconnaissance-level monitoring and assessment. These measurements are usually conducted in special cases during higher-level investigations of potential problems. Because of access difficulty, such techniques are rarely used in the back-country settings comprising most of this subbasin. The quantitative criterion for intergravel dissolved oxygen are as follows:

- "(a) One (1) day minimum of not less than five point zero (5.0) mg/l. (b) Seven (7) day average mean of not less than six point zero (6.0) mg/l.

Because of the lack of specific numerical criteria for sediment, surrogate measures are often used as a mechanism to reflect potential sediment problems. Often the percentage of depth fine sediments found in spawning gravels is used as an indicator of sediment problems that will affect salmonid species. Generally, depth fines greater than 28% are considered unhealthful for spawning gravels. Bank stability can be another indicator of sediment problems in streams. When bank stability falls below 80%, these banks may be contributing unhealthy levels of sediment to aquatic habitats. There are other surrogate measures for sediment, however, caution is advised as specific levels can be highly variable depending on stream morphology and geology of the area, and it may be difficult to pinpoint levels that are universally acceptable.

The narrative criterion for Nutrients is as follows:

- AExcess Nutrients. Surface Waters of the State shall be free from excess nutrients that can cause visible slime growth or other nuisance aquatic growths impairing designated beneficial uses.@

The measures for excess nutrients that are often examined are total nitrogen (TN), total phosphorus (TP), chlorophyll-a, and turbidity. Although there is no maximum level specified by law, it is often recommended that total phosphorus as phosphorus should not exceed 50 micrograms per liter (ug/l) at the point where the stream enters a lake or reservoir, nor 25 ug/l within the lake or reservoir (EPA Goldbook, 1986). The desired goal associated with these limits is to prevent eutrophication or nuisance algal growths in the waterbody. In some cases where phosphorus is not the limiting nutrient, total nitrogen values may give an indication of overall nutrient enrichment. Chlorophyll-a and turbidity measures relate to how much algae growth is occurring and causing cloudiness in the water.

Arsenic and copper are examples of metals of concern in this subbasin. Below are the criteria for these two metals. Other metals criteria are similarly derived.

- The numeric criteria for arsenic are incorporated into the state=s standards by reference from 40CFR131.36, as 360 ug/l for acute toxicity and 190 ug/l for chronic exposure, both expressed as dissolved concentrations. If dissolved (0.45 micron filtered) arsenic levels in the surface water exceed the 190 ug/l standard, the stream may be in violation of the required standard.

- The nummeric criteria for copper are also incorporated by reference from 40CFR131.36, and presented as an equation based on stream water hardness. The acute criterion is:

  $$(0.96)e^{(0.9422(\ln H)-1.464)}$$

  and the chronic criterion equation is:

  $$(0.96)e^{(0.8545(\ln H)-1.465)}$$

where AlnH@ equals the natural log of the surface water=s hardness. The hardness of the waterbody is measured as milligrams of $CaCO^3$ and put into the equation for H. The standard for copper is calculated based on the hardness number entered and is expressed as a dissolved concentration. If dissolved (0.45 micron filtered) copper levels in the surface water exceed the calculated standard, the stream may be in violation of the required standard.

- Hydrogen Ion Concentration (pH) criteria (IDAPA 58.01.02.250) states that values must be within the range of six point five (6.5) to nine point zero (9.0).

- Narrative criteria (IDAPA 58.01.02.200) that might also apply to metals include hazardous materials (01.), toxic substances (02.), deleterious materials (03.), and floating, suspended or submerged matter (05.).

The criteria for temperature are dependent upon the aquatic life residing in the waters in question. For the waters in this subbasin, temperature criteria for cold water aquatic life, salmonid spawning, and bull trout spawning and rearing are likely to apply.

The temperature criteria (values not to be exceeded) for cold water use are:

- 22°C as a daily maximum and 19°C as a daily average.

The temperature criteria for salmonid spawning use are:

- 13°C as a daily maximum and 9°C as a daily average.

These criteria apply to waters where salmonid spawning occurs, and only during the time periods when the particular species of salmonids inhabiting the waters normally spawn. Critical periods for spawning are typically September and October for fall spawners and May and June for spring spawners.

The state temperature criteria for bull trout spawning and rearing are:

- 13°C as a Maximum Weekly Mean Temperature during June, July and August for juvenile bull trout rearing, and

- 9°C as a Maximum Daily Mean Temperature during September and October for bull trout spawning.

These criteria apply to all tributary waters, not 5th order mainstem rivers, above 1400 meters (4593 feet) elevation in the bull trout key watersheds in the Salmon River basin. Additionally, the federal (EPA) criterion for bull trout is 10°C as a seven-day moving average of the daily maximum water temperatures. Biological assessments produced by BLM, Challis Resource Area and the Salmon-Challis National Forest indicate that critical water temperatures for bull trout require that spawning temperatures be reached sometime during the September-October spawning window for bull trout, and that summer time rearing temperatures stay below a maximum of 15°C (BLM, 1999a; USDA FS, 1999a; USDA FS 1999b).

Water Body Assessments

Many waters in the Upper Salmon subbasin have been monitored through the Beneficial Use Reconnaissance Project (BURP) process (see Appendix A for list of BURP sites). Some streams have been monitored in more than one location and in more than one year. Data gathered prior to 1997 were used in the assessment of beneficial use status for the 1998 303(d) list. Data from those sites sampled in 1997 and later have not been used to

determine the status of beneficial uses of these waters. Below are the macroinvertebrate biotic index (MBI) scores, a primary tool for assessing aquatic life use status, for the 303d listed waters in this subbasin. In general, MBI scores are considered adequate if they exceed 3.5, and are poor if they are below 2.5. MBI scores between 3.5 and 2.5 are marginal and referred to as in "need of verification." Adequate habitat scores vary depending on the ecoregion the site is located in, but generally should be greater than 70.

Garden Creek

Two of the five BURP sampling efforts on Garden Creek resulted in low MBI scores (Table 5). The first site was a headwaters location with very low flow, probably an intermittent or ephemeral stream segment. Data collected from streams with flow less than 1 cfs is not used to characterize segments of the stream with regard to beneficial use support. Narrative water quality standards are not applied to waters with less than 1 cfs flow.

The second site was at the low end of Garden Creek just within the city limits of Challis. This site was slightly below the Full Support threshold of 3.5 and received a needs verification assessment status because of low MBI and habitat scores, and because of a reduction in the number of age classes of fish observed at this site. Higher elevation sites had sculpin and multiple age classes of brook and cutthroat trout. The lower elevation site had sculpin and limited numbers of cutthroat trout. Garden Creek was 303(d) listed from the Forest Boundary to its mouth because of this lower site. The majority of this land appears to be in private ownership. The 1993 sites were not assessed due to the lack of information collected and changes in techniques in that first year of BURP.

Based on the above information, the impacted segment of this stream is likely to begin at the Challis city limits. Further investigation shows that Garden Creek is often dewatered within the city limits, and instream habitat is greatly reduced by stream channelization and stream banks that have been armored with riprap adjacent to residences within the city. Garden Creek will be listed for habitat and flow alteration from the City limits downstream to the confluence with the Salmon River as a result of the Subbasin Assessment. A TMDL will not be prepared for Garden Creek to address this purturbance. Flow and habitat alteration are not recognized pollutants.

Table 5. Garden Creek BURP Assessment

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
Headwaters above Buster Lake (2609m)	*NA*	1.91	*NA*	0.1	1993
Downstream from Buster Lake (2487m)	Full Support CWB, SS	3.59	101	21.7	1995
Below Keystone Gulch (2011m)	Full Support CWB, SS	4.54	96	67	1995
Within Challis city limits (1646m)	Need Verification	3.42	65	62.4	1995
Outside Challis city limits (1597m)	*NA*	3.64	*NA*	3.3	1993

Road Creek

Road Creek had two low scoring sampling events in 1995 (Table 6). Samples were collected in the upper watershed, near the headwaters and the lower watershed, just above the confluence with the East Fork of the Salmon River. Both of these sites were dry in 1994 and the highest elevation site had flow less than 1 cfs (0.5 cfs) when it was sampled in 1995. Dewatering from irrigation diversions impacts the lower site. The 1998 303(d) listing of Road Creek is based on the 1995 assessments as the 1997 data had not yet been assessed. Sample sites with flow less than 1 cfs are not currently used to characterize water body support status.

There were two high scoring samples in 1997 (Table 6) at middle elevations that experience better flow conditions. These data suggest the upper and lower reaches of the stream may be impacted by low flow conditions in low water years. However, the low elevation site in 1995 had abundant flow, but macroinvertebrate scores were low due to previous extended dewatering.

Further analysis of macroinvertebrates (Clark, 2000) indicated that low scoring sites were impacted by fine sediments, but not temperature (see Appendix F). It is not clear if the interpretation of macroinvertebrate samples collected in reaches that are frequently dewatered mimic interpretation of samples collected in reaches with sediment impacts, but this is likely.

Mid-elevation reaches may be in reasonably good shape when there is sufficient flow, whereas dewatering from irrigation likely impacts low elevation reaches. Site visits in 2000 and 2001 showed that the stream channel was dry well above the lower BURP site (located at 1722 m elevation). The bulk of the water quality issues related to beneficial use support are likely due to dewatering of the stream channel well below Horse Basin Creek. Data collected from streams with flow less than 1 cfs are not used to characterize segments of the stream with regard to beneficial use support and narrative criteria do not apply.

Road Creek supports good populations of Westslope cutthroat and rainbow trout. Multiple age classes of both species have been sampled by BLM (IDEQ 1999a). In a 100 meter transect 12 fish were collected which included 7 salmonids in 4 age classes plus young of the year as well as 5 sculpin in various age classes. Electrofishing conducted by IDEQ in 1998 produced multiple age classes of sculpin as well.

Although, as the name implies, Road Creek is paralleled by a road for almost its entire length, and there may be cumulative effects on downstream reaches, the greatest impacts are from irrigation related dewatering over the lower reaches and the ephemeral nature of the headwaters reach. Observation associated with field data collection shows that riparian areas are in good condition above the private ground near the mouth of Road Creek. BLM has been actively pursuing riparian protection and restoration in this watershed (Kate Forster, BLM, personal communication) through grazing plan improvements and Interagency Implementation Team inspections and monitoring.

A small band of BLM ground separates two private ground sections in the lower reach, just above the confluence with the East Fork Salmon River. This reach has observable head cutting and bank erosion and is very narrow and impinged by the road. The lower BURP site (1722 meters) in 1995 was in this location. This section is not representative of Road Creek above this location. The private ground above this reach is used for irrigated hay production and pasturing of livestock. Diversion structure impacts in this section may be contributing to the headcutting occurring below.

Road Creek will be listed for flow alteration from the upper private land/BLM boundary of this small parcel, downstream to the confluence with the East Fork Salmon River as a result of the Subbasin Assessment. Dewatering occurs from the irrigation diversions above the upper boundary of the small lower parcel of BLM lands that the Creek flows through. This boundary is about 4,800 feet above the confluence with the East Fork of the Salmon River and coincides with the western edge of section 19 at N 44º 11.275' W114º 16.339'. A TMDL will not be prepared for Road Creek to address this purturbance. Flow and habitat alterations are not recognized pollutants.

Table 6. Road Creek BURP Assessment

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
Below Douglas Springs (2194m)	*NA – dry channel*			Dry	1994
Below Douglas Springs (2194m)	Not Full Support (CWB)	1.68	60	0.5	1995
Below Bear Creek (1987m)	NA	4.29	*NA*	1.1	1997
Above Horse Basin Creek (1923m)	NA	4.89	*NA*	5.1	1997
Above bridge near mouth (1722m)	Not Full Support (CWB)	2.79	99	14.5	1995
Above bridge near mouth (1712m)	*NA – dry channel*			Dry	1994

Challis Creek

Challis Creek received four BURP sampling events from 1993 to 1998 (Table 7). Only one site, at the lowest elevation, produced a low MBI score. Three cutthroat trout and four brook trout representing multiple size classes were collected in upper Challis Creek in June of 1994. Further downstream (above White Valley Creek) 33 sculpin and six rainbow/steelhead trout (one size class) were collected at the same time. The highest elevation site (above Mosquito Flat Reservoir) was sampled in 1998 and data have not been assessed from this site. However, it produced the highest macroinvertebrate score.

The next site downstream below the reservoir sampled in 1995 was assessed as fully supporting aquatic life uses. Also below Mosquito Flat Reservoir was a site sampled in 1993 (above Lodgepole Creek). Data from that site were not used in the 1998 303(d) list assessment, however, its macroinvertebrate score is very comparable to the 1995 site of similar location. The lowest elevation site (above Mill Creek) produced the only low macroinvertebrate score and was assessed as needs verification status. Based on these data, the impacted portion of Challis Creek would appear to be at least from Mill Creek downstream. Although the area of impact may extend upstream to Lodgepole Creek, the 1998 303(d) listing extends upstream to the Forest Boundary just below Pats Creek (about half way between Mill Creek and Lodgepole Creek). Most of this land is in private ownership.

Sampling conducted by Environmental Science & Research Foundation (ESRF) showed McNeil Core sediment sampling of depth fines above 40% (41% and 44% at upper and lower sampling sites respectively). Stream bank erosion rate estimates and road erosion estimates were also made by ESRF. Challis Creek had one slightly eroding reach, three moderately eroding reaches and one severely eroding reach. DEQ supplemented the estimates with additional road and stream bank erosion estimates, based on existing land use, to aid in development of a Total Maximum Daily Load allocation (TMDL) for sediment. The streambank erosion inventory was repeated on the upper reach during

May, 2002 to validate the estimates, and a large landslide below Mosquito Flats Reservoir was identified as a significant sediment source.

There were no indications of deleterious levels of aquatic plants or nuisance levels of algae observed in Challis Creek along inventoried reaches. The sediment load allocation is developed in greater detail in the TMDL section of this document.

Recommendations from the USDA FS Challis Creek Watershed Analysis (USDA FS 1997b) regarding the issue of hydrologic conditions and biotic communities identify the need for further monitoring to establish inventories of systemic base data, presence/absence and macroinvertebrate trends, and causes of channel aggradation over the lower reach of Challis Creek. The analysis states that "No new project activities (e.g., timber sales, road construction) should proceed in the watershed until base level aquatic inventories are completed in that portion of the watershed that would be immediately impacted by the proposed activity."

Implementation recommended in the analysis focus on reducing the amount of eroded material from the road entering streams by reducing the amount of water flowing down the roads. Recommendations associated with human uses include purchase and installation of appropriate signs that identifying open and closed routes to motorized vehicles to reduce travel plan infractions.

A Total Maximum Daily Load has been developed within this document based on data accumulated through the Subbasin Assessment and the following Field season. The Challis Creek TMDL for sediment should act to further formalize and facilitate additional evaluation of sediment issues on Challis Creek by the USDA FS.

Table 7. Challis Creek BURP Assessment

BURP Site	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
Above Mosquito Flat Reservoir	*NA*	5.53	*NA*	6.1	1998
Below Mosquito Flat Reservoir	Full Support (CWB, SS)	3.92	98	48.8	1995
Above Lodgepole Creek	*NA*	3.89	*NA*	11	1993
Above Mill Creek	Needs Verification (CWB)	3.17	66	28.8	1995

Thompson Creek

Thompson Creek was sampled in two locations in 1994 and approximately the same locations again in 1995 (Table 8). The downstream location in 1995 produced the only

low MBI score. The upper locations were above the discharge for the Thompson Creek Mine. IDFG collected five cutthroat trout (two age classes), one rainbow/steelhead, and 31 sculpin above the mine discharge in 1994. Below the mine discharge in 1994, IDFG snorkeling data showed young-of-year chinook, three bull trout, and multiple age classes of steelhead.

Although originally proposed for delisting in 1998, as a result of public comment DEQ 303(d) listed a limited portion of Thompson Creek from the Scheelite Mill site to mouth (DEQ, 1998). This area did produce one "needs verification" assessment because of low macroinvertebrate scores. The probable cause of the lower MBI score was identified as the armoring of the substrate due to iron hydroxide coating. However, the 1998 303(d) listing record also indicates that there is no evidence of a declining biological community and chemical data are inconclusive. Sediment and metals sensitive fish were well represented in all surveys. These data suggest that the basis for impairment is the iron hydroxide armoring of the stream substrate. Although there are no specific numeric criteria for iron, the beneficial use impairment may have been caused by hazardous or deleterious materials, or possibly submerged matter defined in narrative criteria.

The USDA FS completed restoration best management practices in 1992 to eliminate the problem with iron hydroxide precipitate deposition at and below the Scheelite Jim Mill site. Tailings reclamation included the installation of an earthen cap on the Mill Site and contouring the tailings to drain into a series of constructed wetland buffer ponds above the stream. The wetland ponds were isolated from Thompson Creek with an earthen burm. This reclamation activity has eliminated iron hydroxide discharge into the stream below the Mill site. Deposited iron hydroxide is being removed through natural bedload transport.

The USDA FS has stated that they have conducted monitoring that shows steady improvement in macroinvertebrate diversity and abundance since the flushing flows of spring runoff that were experienced in 1997 and 1998 (Marvin Granroth, USDA FS 2001, Personal Communication). A site evaluation conducted by DEQ with the USDA FS in October of 2001 affirmed the elimination of iron hydroxide deposition below the reclaimed mill site. Only slight deposition remains over several feet of the near stream bank adjacent to the lower pond (pond #7), and that is expected to further diminish as the wetland buffer becomes more established and matures. Monitoring by the Challis Ranger District of the Forest Service has shown that monthly instantaneous stream temperature related to cold water use (excluding salmonid spawning), and pH are within water quality criteria above and below the mill site (Table 9) (USDA FS 2002). Forest service water temperature monitoring was not adequate to interpret daily or weekly averages to evaluate salmonid spawning temperature criteria compliance. Full implementation of the appropriate best management practices prior to 303(d) listing of the limited reach of Thompson Creek precludes the need for development of a TMDL for Thompson Creek for metals or sediment. Particularly since upstream sites show strong full support of beneficial uses. Continuing BURP and USDA FS monitoring will be conducted to follow water quality and beneficial use support.

Table 8. Thompson Creek BURP Assessment

BURP Site	Assessment	MBI Score	Habitat	Flow (cfs)	Year
Above Basin Creek (2145m)	Full Support (CWB, SS)	4.98	99	0.6	1994
Above Basin Creek (2145m)	Full Support (CWB, SS)	5.12	104	2.2	1995
Near mouth (1719m)	Needs Verification	3.35	80	7.7	1995
Near mouth (1694m)	Full Support (CWB, SS)	4.44	89	2.1	1994

The USEPA 2002 Integrated Water Quality Monitoring and Assessment Report Guidance Memorandum (EPA 2001) describes the requirements for states reporting to EPA the water quality standard attainment status of Assessment Units of water bodies. Each Assessment Unit should be placed in only one of five unique assessment categories. Monitoring required to validate water quality management strategies for assessment units is conducted at appropriate intervals for each category. The categories are: 1) Attaining the water quality standard and no [beneficial] use is threatened; 2) Attaining some of the designated uses; no use is threatened; and insufficient or no data and information is available to determine if the remaining uses are attained or threatened. 3) Insufficient or no data and information to determine if any designated use is attained. 4) Impaired or threatened for one or more designated uses but does not require the development of a TMDL: a) TMDL has been Completed or b) Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future. 5) Beneficial uses are limited and a TMDL is Required. The listed reach of Thompson Creek falls under category 4.b of this guidance. Implementation of Best Management Practices are complete, and as wetland vegetation in the ponds mature water, water quality will improve. Monitoring will be on-going by USDA FS.

Table 9. Thompson Creek monitoring results at Scheelite Jim Mill site

Site 1: 200 ft below wetlands			Site 2: 60 ft below wetlands		Site 3: yellow boy Area		Site 5: 300 ft above wetlands	
Date	**pH**	Conductivity	**pH**	Conductivity	**pH**	Conductivity	**pH**	Conductivity
1/3/90	7.8				6.8		8.2	
2/15/90	8.3				7.0		8.4	
4/3/90	8.3				7.3		7.7	
8/6/90	7.3				6.7		8.3	
4/25/94	7.5				6.9		7.6	
7/26/94	8.2				7.4		8.5	
10/7/94	7.1		7.2		7.1		7.2	
12/2/94	7.92		7.8		7.9		8.16	
12/30/94	7.63		7.76		8.05		8.08	
1/27/95	7.81		7.94		7.61		8.0	
2/28/95	7.85		7.59		7.6		7.98	
4/4/95	8.15		7.83		8.21		8.39	
4/28/95	7.96		7.86		8.04		8.34	
5/31/95	7.5		7.47		7.39		7.71	
6/30/95	7.25	46.1	7.13		7.24	45.4	7.47	33.8
7/31/95	7.69	44.7	7.4		7.86	34.6	8.0	27
9/7/95	7.75	43	7.71	44	7.65	49.5	8.04	26.3
9/29/95	8.39	159	8.33	182	8.44	132	8.58	78
10/31/95	8.13	40	8.17	38	8.34	29.3	8.33	29.8
11/30/95	7.37	83.7	7.35	83.1	7.55	73.3	8.18	41.6
1/9/96	7.61	72	7.61	72	7.8	61.6	7.97	52.6
1/31/96	7.27		6.99	102.7	7.47	79.3	8.11	46.3
2/29/96	7.74	75	7.64	82.1	7.92	65.2	8.12	56.4
4/1/96	7.74	74.3	7.55	85.4	7.88	66.4	8.1	54.7
5/1/96	7.96	57.9	8.01	56.6	8.09	51.1	8.2	45
5/31/96	7.57	79.4	7.63	77.5	7.61	77.8	7.93	60.9
7/2/96	7.68	72.4	7.65	74.3	7.62	75.9	7.84	63.1
8/2/96	8.2	50.3	8.16	52	8.17	51.1	8.41	39.8
8/30/96	8.52	33.7	8.44	38.1	8.1	30.6	8.67	25.6
10/1/96	7.93	55.6	7.78	64.7	8.11	49.5	8.42	29.8
10/31/96	7.76		7.66		8.11		8.2	
12/2/96	7.76	67.5	7.78	67.3	7.78	65.5	7.97	54.8
1/2/97	7.62	75.9	7.65	73.7	7.74	68.2	7.99	55.4
2/3/97	7.87	63.4	7.89	63.1	8.02	55.4	8.3	40.8
3/3/97	7.83	62.2	7.55	77.3	7.98	53.6	8.14	48.5
4/1/97	7.65	76.1	7.53	83.1	7.67	75.4	8.13	51.1
5/7/97	7.8	60.9	7.78	62.1	7.77	62.8	8.05	47.7
6/2/97	7.39		7.26	92.9	7.53	77.3	7.78	63.3
7/3/97	7.6	67.6	7.43	75.2	7.39	77.2	8.16	34.6
8/1/97	7.93	53.5	7.81	61.3	7.48	76.6	8.28	35.1
9/3/97	7.57	67.8	7.42	76.2	7.53	124.4	8.29	27.6
10/10/97	7.37	71	7.33	73.7	7.68	60.2	8.1	59.1
11/4/97	7.64	63.4	7.5	69.4	7.6	91.5	8.21	32.3
12/11/97	7.7	61.7	7.78		7.58	70.4	8.28	32.2
2/5/98	8.5	150	8.46	160		240	8.82	160
3/13/98	7.3		7.21		6.83		7.32	
4/16/98	8.7	260	8.62	280	6.77	320	8.8	270
5/15/98	7.9	260	7.7	260	7.57	100	8.11	270
6/24/98	8.0		8.5		7.74		8.14	
5/1/99	7.4		7.43				7.52	
5/18/99	7.4	150	7.37			90	7.52	275
5/10/00	8.0				7.96		8.2	
5/25/01	7.7	290	8.4	130	**6.24**	240	7.76	130
8/29/01	7.4	260	7.1	320	6.8	340	8.11	310

Warm Spring Creek

The DEQ water body assessment shows that the source of Warm Spring Creek is natural Hot Springs. This condition precludes attainment of cold water biota criteria throughout the year. The perennial portion of the stream flows approximately 100 yards in its natural channel before it is diverted in its entirety into an aquaculture facility, which has raised tilapia and other tropical warm water fish. The effluent from the hatchery then flows into a ditch that follows the elevation contour at its diversion to supply a hydroelectric project several miles away. Outflow from the hydroelectric project continues in a ditch system that does not return water to the natural stream channel. The natural stream channel remains dry throughout the year. Historically flow in Warm Spring Creek naturally infiltrated prior to reaching the Salmon River.

The low macroinvertebrate scores obtained in 1995 at the streams source and from the diversion ditch resulted in the stream being 303d listed (Table 10). However, caution should be used in determining that aquatic life use and consequently support is appropriate for geothermal water in a manmade diversion. At the time of assessment, fish data were not available and it was assumed that the stream was unlikely to support salmonids in the absence of water. The dewatered natural stream channel, located several hundred meters to the east, is heavily impacted by previous seismic events that resulted in severe downcutting prior to complete dewatering throughout the year.

Water flows only in a manmade channel to provide water to a hydroelectric project and then the water is consumed by irrigation. There is no flow in the natural channel.

- The Ditch does not flow into an identifiable water of the U.S. and there is not a listed stream segment as its receiving water.
- The ditch has not been identified as a point source of a particular pollutant that is discharged into an identifiable water of the U.S. or the state.

Combined with the known geothermal source of this stream and the fact that the flow is isolated from other full support or 303(d) listed water bodies there will not be a TMDL developed for this system.

Narrative water quality criteria are generally assessed by determining if aquatic life uses are supported. In the case of aquatic life, multimetric indexes for macroinvertebrates, fish, or algae have been developed to determine aquatic life use support (Grafe et al. 2002). However, multimetric biological indexes such as the SMI are not appropriate to apply to intermittent [or dewatered] streams. This is because these indexes were developed based on community composition and function typical of an expected reference condition. Reference conditions are persistent aquatic habitats that allow full development of aquatic communities. Temporary waters will never have similar composition and function as perennial waters (Grafe et al. 2002, IDEQ 1999b). Therefore SMI scores are not used to assess aquatic life uses on Warm Spring Creek.

In the case of intermettent waters, numeric criteria apply only at times above "optimal" flows of >1cfs (WQS §70). Warm Spring Creek is listed for nutrients and sediment;

neither of which have numeric criteria. Delisting of the stream is recommended since pollutants are not the limiting factor for aquatic life uses.

Table 10. Warm Spring Creek BURP Assessment

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
North of Grand View Canyon (1748m) At Source	Not Fully Supporting (aquatic life)	2.0	52	1.6	1995
Below Ingrams Pond (1618m) In Ditch	Not Fully Supporting (aquatic life)	2.76	76	3.5	1995

Yankee Fork

All four sampling events on the Yankee Fork produced high MBI scores suggesting that at elevations above 1922 meters cold water biota use is fully supported (Table 11). The upper Yankee Fork fish surveys produced bull trout (two year classes), cutthroat trout (three year classes), numerous young-of-year chinook, steelhead, mountain whitefish, and mottled sculpin. Below Jordan Creek, only mountain whitefish and mottled sculpin were collected.

Dredge mining has severely altered riparian and instream habitat and historically has increased sediment load in this section below Jordan Creek. Numerous projects have been underway since the late 1980's to restore habitat and stream channel characteristics. McNeil sediment core depth fines sampling in spawning habitat has shown significant decreases in two of 5 sites sampled, one site remained static, and two sites had significant increases over a five year period. The two increasing sites, however, averaged 22 % and 17% fines depth less than 6.35 mm, which is well below the target level of 28% set by DEQ for streams requiring restoration of salmonid spawning. The maximum observed fines during the period 1995 through 1999 at the two sites identified as having increased depth fines was 29.1 and 29.5 % fines less than 6.35 mm. These values are close to target values for subsurface fine sediment, and are within the range of standard error for the target.

High macroinvertebrate scores and salmonid populations indicate that water quality supports beneficial uses. Low habitat scores indicate that habitat is compromised as a result of large scale dredge mining.

The major tributary on the listed reach of the Yankee Fork of the Salmon River is Jordan Creek. BURP Sampling shows that Jordan Creek is in full support of coldwater biota and salmonid spawning. Jordan Creek is not on the §303(d) list of impaired water bodies (Table 12). As mentioned earlier there is an Administrative Order of Consent between EPA and the USDA FS to eliminate water quality impacts to Jordan Creek from leaking tailings ponds and mine discharge. Plans are in development to control the discharge of cyanide. Monitoring for pH has been conducted in Jordan Creek and the data does not

indicate that the water quality criteria are significantly exceeded. Sample dates that show exceedances accrue less than 4% of samples (Table 13).

As a result the Yankee Fork will be listed solely for Habitat Alteration and will continue to be monitored for changes in beneficial use support. A TMDL for sediment is not warranted at this time for the Yankee Fork.

Table 11. Yankee Fork BURP Assessment

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
Above McKay Creek (2280m)	*NA*	4.91	*NA*	21.1	1998
Below McKay Creek (2255m)	Full Support (CWB, SS)	4.88	92	20.2	1995
Below Adair Creek (1962m)	Not Fully Supporting (SS)*	5.65	52	61.4	1995
Below Bonanza (1922m)	Nt Fully Supporting (SS)*	5.61	56	58.8	1995

Table 12. Jordan Creek BURP Assessment

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
½ mile above Condlurence with Yankee Fork (1969m)	Full Support (CWB SS)	4.76	75	79.37	1995
1.2 miles above mine turnoff (2275m)	Full Support (CWB SS	5.75	103	41.75	1995

Table 13. Jordan Creek monitoring data at North Access Bridge

Sample Date	pH, Lab (SU)	pH, Field (SU)	**Sample Date**	pH, Lab (SU)	pH, Field (SU)
3/29/99	6.6	7.95	3/5/01		7.4
5/13/99	7.37	8.1	3/12/01		7.5
6/2/99		7.9	3/19/01		7.4
5/5/00	**5.3**	**5.22**	3/26/01		7.6
5/8/00	**5.4**	6.52	4/2/01		7.4
5/9/00	7.4	**5.73**	4/9/01		7.5
5/22/00		7.59	4/16/01		7.4
5/25/00		7.59	4/23/01		7.3
5/30/00		7.7	4/30/01		7.0
6/6/00		7.43	5/7/01		7.0
6/12/00		8.2	5/14/01		6.9
6/19/00		7.65	5/21/01		6.9
6/26/00		6.82	5/29/01		7.1
7/5/00		7.68	6/4/01		6.8
7/10/00		7.49	6/11/01		7.0
7/17/00		7.75	6/18/01		7.1
7/24/00		7.58	6/25/01		6.9
7/31/00		7.69	7/2/01		6.7
8/7/00	7.5	7.64	7/9/01		7.1
8/14/00		7.85	7/16/01		7.1
8/21/00		7.62	7/23/01		7.1
8/28/00		7.71	7/30/01		6.6
9/06/00		7.92	8/6/01	6.8	7.5
9/11/00		7.8	8/13/01		8.0
9/18/00		7.68	8/20/01		6.8
9/25/00		7.76	8/27/01		6.8
10/2/00	6.8	7.74	9/4/01		7.3
10/9/00		7.6	9/10/01		6.7
10/16/00		7.74	9/17/01		6.6
10/23/00		7.54	9/24/01		7.2
10/30/00		7.62	10/1/01		7.1
11/6/00	6.6	7.56	10/8/01		7.1
11/13/00		7.2	10/15/01		7.0
11/20/00		7.42	10/22/01		6.8
11/27/00		7.2	10/29/01		7.5
12/4/00		7.4	11/5/01		6.9
12/11/00		7.56	11/12/01		7.1
12/18/00		7.26	11/19/01		6.9
12/26/00		7.45	11/26/01		7.3
1/2/01		7.33	12/3/01		7.2
1/8/01		7.42	12/10/01		7.4
1/15/01		7.32	1/2/02		6.8
1/22/01		7.24	2/4/02		7.8
1/29/01		7.27	3/4/02		8.1
2/5/01	6.5	7.8	4/1/02		7.3
2/12/01		7.6	5/6/02		7.1
2/19/01		7.6	6/3/02		**6.1**
2/26/01		7.5	7/08/02		6.8
Criteria Exceedences are in **BOLD**					

Kinnikinic Creek

The low elevation BURP site on Kinnikinic Creek produced the only low MBI score (Table 12). The lower segment of Kinnikinic Creek below Sawmill Creek was 303(d) listed presumably as a result of impacts from the Clayton Silver Mine site. Further analysis of macroinvertebrate data (Clark, 2000) suggested that the lower site is impacted by fine sediment, but not temperature (see Appendix F). Fish surveyed by DEQ in 1998 below Broken Ridge Creek produced 15 cutthroat trout (multiple size classes). At the lowest site near Clayton six cutthroat trout (multiple size classes) were surveyed in 1998. The lower BURP site is located below the hydroelectric diversion. It is likely that impacts from flow alteration have had a greater effect on beneficial use support than any other perturbence to Kinnikinic Creek.

Prior to remediation the hydroelectric diversion fed water into a pipe that parallels the creek channel to the turbine site just above the confluence with the Salmon River. This diversion often dewatered the creek from the diversion to the return flow near Clayton. Beneficial Use Reconnaissance Project field notes indicate that there were "large deposits of sand + mine tailings all throughout the BURP sample reach." The field notes go on to say that "There are many old mine timbers, pieces of old barrels, 5 gallon metal cans, and rags. There are also old coil springs and other assorted debris."

As a result of full implementation of a Removal Action that was completed by the EPA and the US Coast Guard in October 2001 Kinnikinic Creek was isolated from contact with the tailings pile. The tailings pile was capped and stabilized to eliminate fugitive dust and migration of tailings into the creek from stream bank cutting and erosion (See Summary of Pollution Control Efforts).

The stream was constrained between the roadbed and bedrock below the Clayton Silver Mine, for most of its approximately 1 mile run, to the Salmon River. Remediation activities included rebuilding the stream channel to provide a wider flood plane than before. The roadbed is constructed of rock riprap adjacent to the stream, and is not a source of sediment. Full Implementation of the corrective Removal Action has eliminated the source of sediment to Kinnikinic Creek, reduced zinc loading to below water quality criteria and increased flow to move sediment out of the creek. No further implementation action should be required to reduce sediment and zinc loading to Kinnikinic Creek. It is expected that sediment will be transported out of the system and will not pose a threat to receiving waters.

Metals sampling was conducted by DEQ during base flow prior to completion of the remediation action. Dissolved zinc and cadmium levels were elevated above background levels but were below EPA Goldbook criteria at 100 ppm CaCo3 hardness. All previous metals sampling data collected and reported by EPA, BLM and DEQ assumed 100 ppm CaCo3 hardness. Hardness sampling conducted by BLM shows that hardness below the mine site in September 2000 was 297 mg/l CaCO3 and 97 mg/l CaCO3 at the mouth of Kinnikinic Creek. Sampling conducted by DEQ in September 2002 showed hardness at 104 mg/l CaCO3 at the mouth.

Table 14. Kinnikinic Creek Metals Assessment, 1999

Location	Date/Time Sampled	Cadmium (ug/l)*	Lead (ug/l)*	Zinc (ug/l)*
Upgradient (Mine)	04/07/99 @ 11:47 A	<1	<5	<5
Downgradient (Tailings)	04/07/99 @ 11:57 A	<1	<5	225
Mouth of Kinnikinic	04/07/99 @ 12:10 P	<1	<5	34
Upgradient (Mine)	04/11/02 @ 2:04 P	<1	<5	<2
Downgradient (Tailings)	04/11/02 @ 3:21 P	<1	<5	34
Mouth of Kinnikinic	04/11/02 @ 3:27 P	<1	<5	62

***EPA Gold Book Standards (ug/l) for 100 ppm CaCo3 eq hardness**

	Acute	Chronic
Cadmium:	3.9	1.1
Lead:	82	3.2
Zinc:	117	106

A streambank erosion inventory was conducted in May 2002 above and below the Clayton Silver Mine and showed streambanks to be 81% stable below the Clayton Silver Mine with only slight streambank erosion. The upper reach was estimated to produce 18 tons per mile per year, while the lower reach estimate was for 12 tons per mile per year.

The hydroelectric diversion was likely having a significant impact on the aquatic life forms in Kinnikinic Creek prior to remediation. The affect was the combination of dewatering and the resulting elevated concentration of zinc at lower flows along the tailings. In April, 2002, three samples were collected along Kinnikinic Creek to evaluate the effect of the remediation project during base flow conditions, when metals loading would be expected to be highest. Samples were collected synoptically starting at a background site above the mine/mill and working to the mouth. All samples were filtered through a .45 micron filter and acidified with nitric acid and chilled to 4º C. Samples were sent to the Idaho State Laboratory for analysis. Results indicate that dissolved arsenic, cadmium, lead, and silver were below the detection limit of 5,1,5,5, and 1 ppb respectively for all sample sites. Dissolved zinc values ranged from <2ppb for the up gradient (background sample) to 34 ppb below the mine/mill site to 62 ppb at the mouth of Kinnikinic Creek. These values are still well below the aquatic life chronic criteria of 106 ppb (assuming hardness of 100 ppm CaCo3). It appears that some of the past zinc and cadmium concentrations have been reduced to levels below water quality criteria. As flow conditions change so may metal concentrations, though it is likely that at higher flows metals concentrations will be less. It does not appear that a TMDL for metals or sediment loading is not necessary for Kinnikinic Creek at this time. Elimination of unnatural flow alteration, eliminating sediment and metals loading from tailings piles, and maintaining current streambank stability conditions will likely improve conditions in the lower portion of Kinnikinic Creek to fully support beneficial uses.

Table 15. Kinnikinic Creek BURP Assessment

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
Above Cabin Creek (2310m)	Full Support (CWB,SS)	4.86	94	2.5	1996
Below Broken Ridge Creek (2206m)	Full Support (CWB,SS)	4.59	94	6.1	1996
Above Clayton near mouth (1706m)	Not Fully Supporting (CWB)	2.52	61	5.2	1996

Metals sampling will continue as part of the Removal Action, and DEQ will continue to sample metals concentrations to evaluate the loading response to remediation as well.

The USEPA 2002 Integrated Water Quality Monitoring and Assessment Report Guidance Memorandum (EPA 2001) describes the requirements for states reporting to EPA the water quality standard attainment status of Assessment Units of water bodies. Each Assessment Unit should be placed in only one of five unique assessment categories. Monitoring required to validate water quality management strategies for assessment units is conducted at appropriate intervals for each category. The categories are: 1) Attaining the water quality standard and no [beneficial] use is threatened; 2) Attaining some of the designated uses; no use is threatened; and insufficient or no data and information is available to determine if the remaining uses are attained or threatened. 3) Insufficient or no data and information to determine if any designated use is attained. 4) Impaired or threatened for one or more designated uses but does not require the development of a TMDL [because]: a) TMDL has been Completed or b) Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future. 5) [beneficial] uses are limited and a TMDL is Required. The listed reach of Kinnikinic Creek falls under category 4.b of this guidance. Implementation of Best Management Practices are complete, and as riparian vegetation along the project reach mature and this reach is exposed to natural flow conditions water quality will continue to improve. Additionally, the impact of increased flow will improve habitat, macroinvertebrate and fisheries conditions.

Lost Creek

Lost Creek is a small stream, possibly intermittent at times, near the headwaters of the Salmon River. The stream was sampled once near its mouth below a road bridge, which may not be representative of the condition of the entire stream (Table 12). Further analysis of macroinvertebrates (Clark, 2000) suggested that fine sediment (not temperature) may have impacted the aquatic community (see Appendix F), however, low flow (0.6 cfs) at the time of sampling may have also contributed to the low MBI score. DEQ conducted flow measurements during June of 2000 and June 2001, when other area streams were experiencing peak runoff. The flow measurement conducted above the Salmon Valley Road crossing of Lost Creek showed that the flow was less than 1 cfs (0.06cfs and 0.12 cfs) respectively. It is currently DEQ policy to not develop TMDLs for

streams with average flow less than 1 cfs for sediment or temperature. There is no indication of flow alteration above the sampling point, and the source of flow from Lost Creek has been determined to be a spring not far above the road crossing. The combination of low gradient and low flow reduce the potential for transporting sediment and the result would be accumulation of sediment. Lost Creek infiltrates long before connecting with the Salmon River, approximately 500 m below the road crossing. No TMDL for sediment or temperature will be prepared for Lost Creek.

Table 16. Lost Creek BURP Assessment

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
Below Valley Road (2115m)	Not Fully Supporting (CWB)	1.22	81	0.6	1996

Salmon River

The BURP process for wadable streams applied to the headwaters area of the Salmon River produced two good scoring sites and two low scoring sites (Table 13). The two sites from 1998 have not been assessed yet. Sites sampled on the Salmon River suggest that different channel types may produce different MBI scores. Both C-type channels produced low scores where as other channel types (A, G) produced good scores. The 1993 and 1994 snorkeling data revealed young-of-year and yearling chinook, abundant steelhead, mountain whitefish, and cutthroat trout. In 1998, DEQ collected 17 brook trout (multiple size classes) and 18 sculpin from the lower (2304m) headwater site. The highest headwaters site (2383m) produced 10 cutthroat trout (multiple size classes) and two brook trout. This headwater area was deemed to fully support its uses and was not 303d listed in 1998. Two other sections of the Salmon River from Hell Roaring Creek downstream to the East Fork Salmon River were retained on the 1998 303d list from EPA's 1994 listing because of a lack of information at that time.

Recently, the Large River BURP process has sampled three sites on the Salmon River in the vicinity of this subbasin. The Salmon River at the Yankee Fork near Clayton and the Salmon River at the Pahsimeroi River near Challis produced some of the highest Fish River IBI (Index of Biotic Integrity) scores (95 and 93, respectively), and are considered of reference quality for large rivers (Christopher Mebane, personal communication). The Salmon River at Obsidian produced a slightly lower IBI of 87, though still considered a number that indicates full support of fisheries values. The Salmon River sites consistently had the highest number of cold water indicator species (5-6), high numbers of sculpin age classes (4-5), high sculpin percentages (28-54), highest percentage of cold water indicators (77-100), and high numbers of salmonid age classes (2-4).

Sediment monitoring completed by Environmental Science and Research Foundation at two sites on the Upper Salmon River show elevated depth fine sediment on the §303(d) listed reach below the confluence of Hell Roaring Creek and below the confluence of

Redfish Lake Creek. The percentage of depth fines less than 6.35 mm was recorded as 42% and 51% at the upper and lower sites respectively.

The primary overall source of fine sediment is considered to be stream bank erosion associated with winter ice damming and natural stream channel migration across the low gradient reach that extends across Decker Flat, from the confluence of Alturus Lake Creek downstream to the confluence of Williams Creek. Site specific activities just above depth fine and stream bank erosion inventory sites include activities associated with recreation and Streambank erosion inventories show that streambank erosion is slight over two reaches and moderate over one reach. Historic Land management along these reaches has been predominantly livestock grazing, however, improved land management techniques including riparian fencing and managed grazing prior to the listing of this reach has eliminated or greatly reduced the impacts to stream banks from grazing.

The Salmon River makes its transition to a medium sized river over this reach and the associated changes in channel characteristics affiliated with the observed gradient would include increased width to depth and increased deposition.

Additional fish sampling data collected by DEQ shows high index scores. Data was collected as part of the Large River BURP process. The §303(d) listed reaches of the Salmon River below Hell Roaring Creek (to Redfish Lake Creek), and from Redfish Lake Creek to the East Fork Salmon River are considered to be in Full Support of Aquatic Life Beneficial Uses. The Upper Salmon River does not require having a TMDL developed for sediment or temperature at this time because it is in full support of its beneficial uses.

Table 17. Salmon River BURP Assessment

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
Headwaters above Frenchman Creek (2304m)	Full Support (CWB,SS)	5.02	111	17.1	1995
Between Alturas Lake Creek and Hwy 93 (2081m)	Full Support (CWB,SS)	3.13	69	125.1	1995
Highest headwaters site (2383m)	*NA*	5.29	*NA*	17.9	1998
Headwaters above Frenchman Creek (2313m)	*NA*	2.48	*NA*	32.6	1998

<u>Squaw Creek</u>

Squaw Creek was originally determined to be in full support of its existing beneficial uses and was not put on the 1998 303d list (Table 16). Subsequently, EPA indicated that

Squaw Creek should be added to the 1998 303d list because of concerns with water temperature. EPA references DEQ's BURP data as the source of temperature data for Squaw Creek. DEQ BURP field crews routinely collect an instantaneous measurement of water temperature while performing other sampling. These measures may occur at anytime during the day depending on when the crew is at the site. The instantaneous measurements taken at the four BURP sites vary from 12°C to 18°C. The temperatures collected in BURP surveys do not indicate exceedance of state cold water aquatic life or bull trout temperature criteria.

Continuously recorded thermographs were reviewed (1999 data) for lower Squaw Creek (BLM, 1999b). These data show daily averages in addition to daily maximums and 7-day average maximums. No stream sampled exceeded a daily average water temperature of 19°C in 1999. In fact, most streams had daily averages from 12° to 14°C through the summer months (July and August), dropping below a daily average of 12°C by August 30, 1999. The daily average water temperature for Squaw Creek varied from 10° to 13.5^{o}C during July and August. In September, the daily average for Squaw Creek drops to 8° to 10°C. The 7-day average maximum water temperature for Squaw Creek varies from 15.5^{o} to 18°C during July and August, drops to about 13.5^{o}C around the 1st of September, and then drops below 10°C before September 25, 1999.

Squaw Creek was monitored by USDA FS for temperature in two places (upper and middle), as well as in five of its tributaries (precise locations were not provided by the Forest Service) (Table 20). Upper and middle Squaw Creek reached peak maximum water temperatures of 16.8^{o} and 17.5^{o}C, respectively. The highest 7-day average maximum water temperatures were 15° and 16.1^{o}C for upper and middle Squaw Creek. In middle Squaw Creek, the 7-day average maximum fell below 13°C after August 31, 1999 and below 12°C by September 21, 1999. Upper Squaw Creek fell below 12°C 7-day average maximum after August 31, 1999. Water temperatures for the five tributaries of Squaw Creek are listed in Table 20 (and Appendix D). Data for Squaw Creek are very consistent with BLM data for lower Squaw Creek discussed previously. These streams appear to meet cold water biota temperature criteria throughout the summer of 1999 and met state salmonid spawning criteria by September 1, 1999 (currently 13° C as a daily maximum and 9 ^{o}C as a daily average). Because daily averages were not calculated, it is unknown if these streams met the state's bull trout temperature criterion of 12°C (the criteria at the time of compilations) daily average on Forest Service land. Current state temperature criteria for bull trout rearing is 13°C Maximum Weekly Mean Temperature during June, July and August, and 9°C Maximum Daily Mean Temperature during September and October.

Temperature data collected by USDA FS and BLM and shown in Table 20 and Appendix D do not indicate exceedance of cold water aquatic life criteria. The data provided is not adequate to determine if there is exceedance of the state water quality criteria for bull trout because the data shows only the 7-day average of daily maximum temperatures and daily maximum temperature. Raw data was not provided for evaluation. State criteria are based on weekly and daily mean temperatures. Bull trout are not known to historically spawn or rear near the lower reaches of Squaw Creek.

A juvenile steelhead acclimation pond has been constructed approximately one mile upstream of the mouth. The acclimation pond was a cooperative project between IDFG, BLM and Thompson Creek Mine. Water to the pond is provided from Squaw Creek and effluent from the pond is returned to the Creek. Since construction of the pond in 1999 there has not been any indication of thermal stress to the steelhead smolts or residualized smolts held after volitional release.

Macroinvertebrate data for these sites were further analyzed to determine if the aquatic community shows any signs of temperature impacts (Clark, 2000, see Appendix F). Clark (2000) indicated that there were no apparent impacts from temperature reflected in the macroinvertebrate data.

In upper Squaw Creek, 14 sculpin (multiple size classes), five rainbow trout (three size classes), and two cutthroat trout were collected by DEQ in 1998. Five rainbow (two year classes), one mountain whitefish, and eight sculpin were collected by IDFG in 1994. Below the Thompson Creek Mine, one rainbow/steelhead and 22 sculpin were collected in 1994 by IDFG. Mountain whitefish, sculpin, and multiple year classes of rainbow trout were collected in 1991 during mine studies.

There is some potential that the lower portion of Squaw Creek is influenced by geothermal activity based on discussions with local management agency personnel, though this has not been documented. Elevated stream temperature can result from the combined effect of flow alteration and geothermal inflow.

There is not adequate indication that a TMDL is warranted for the lower reach of Squaw Creek. Cold water aquatic life appears to be fully supported, and bull trout spawning and rearing do not occur on the lower mile of Squaw Creek. Due to the lack of definitive temperature data, and the fact that Squaw Creek was not originally listed as impaired on the 1998 §303(d) list a TMDL for temperature will not be prepared at this time. Monitoring for beneficial uses will continue and the potential for future TMDL development will be evaluated based on future monitoring results. Available data show full support of existing beneficial uses.

Table 18. Squaw Creek BURP Assessment

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
Below Martin Creek (1962m)	Full Support (CWB, SS)	4.76	78	15.2	1995
Below Cinnabar Creek (1865m)	Full Support* (CWB, SS)	3.35	85	2.7	1994
Below Boundary Creek (1804m)	Full Support (CWB, SS)	4.25	89	27.8	1995
Below Bruno Creek (1731m)	Full Support (CWB, SS)	4.54	82	4.0	1994

*Needs verification status was upgraded to full support because of fish data.

Abandoned Mines and Mill Sites and NPDES Discharges

Recently, DEQ surveyed a number of major abandoned mine and mill sites in the Upper Salmon subbasin. Table 15 lists those sites visited and any possible concerns noted. In most cases, elevated metals levels are based on a single grab sample of discharge or drainage water. These samples do not necessarily mean the receiving water will exceed water quality standards. More sampling is needed to ascertain any standards violations.

Van Gosen et al. (2000) sampled surface waters, stream sediments, soils, and waste rock materials for heavy metals at the abandoned Thompson Creek tungsten mine site near Basin Creek. Surface water samples were taken upstream from the mine site, downstream from the mine, and in a mine drainage pool coming from the adit.

Table 19. Abandoned mine and mill sites visited by DEQ in 1998 (Modroo, 1999).

Facility Name	Water Body	Comments
Hoodoo Mine/Mill	Slate Creek	No apparent water quality problems
Clayton Silver Mine/Mill	Kinnikinic Creek	Single sample in 1998 showed tailings high in As, Pb, Ag, Zn. 1994-1995 sampling showed high levels of dissolved Pb and Zn below tailings. Sb and Cd may also be of concern.
Silver King Mine/Mill	Beaver Creek	Arsenic has exceeded 50 ug/l in discharge water.
Valley Creek Mine/Mill	Valley Creek	No apparent problems
Livingston Mill	Big Boulder Creek Jim Creek	Possible increased levels of dissolved copper, cadmium, and zinc.

These samples were analyzed for dissolved and total metals at levels sufficient to detect below water quality standards values. None of these samples showed metals exceeding Idaho water quality standards except for zinc in the mine drainage pool. Zinc was reported as 190 ug/l in this pool, whereas the dissolved chronic criterion for zinc at the hardness reported for the pool (100 mg/l as $CaCO^3$) is 104 ug/l. The pH in all three water samples (upstream = 5.5, downstream = 5.8, and adit pool = 5.7; Van Gosen et al., 2000) were below Idaho water quality standards of 6.5 to 9.0. Acid mine drainage may be a problem in this area.

Stream sediment samples taken upstream and downstream of the Thompson Creek tungsten mine (Van Gosen et al., 2000) site showed values for chromium, copper, lead, and zinc in excess of Idaho water quality standards. However, these two media may not be directly comparable, especially since water column values were not exceeding water quality standards.

There are potentially seven NPDES discharges associated with five facilities in the Upper Salmon subbasin (Table 16). All of these outfalls discharge to 1998 303(d) listed and

proposed streams or their tributaries. Jordan Creek is tributary to Yankee Fork, Buckskin and Pat Hughes Creeks are tributary to Thompson Creek, Bruno Creek is tributary to Squaw Creek, and Valley Creek is tributary to the Salmon River. It would be expected that each outfall would have specific monitoring requirements for their respective receiving streams. The Stanley Sewer Association has proposed to discontinue stream discharge and to route wastewater to Forest Service lagoons for eventual land application of treated effluent (Domingo, 2000). It was not determined if Epicenter Aquaculture has an active discharge or what is the receiving stream. Based on the address provided in EPA's online Permit Compliance System, Epicenter Aquaculture would likely discharge to Warm Springs Creek or the Salmon River near Challis.

Table 20. NPDES Discharge Outfalls in the Upper Salmon Subbasin.

Facility	Outfall Points
Epicenter Aquaculture #000009911198	Warm Springs Tilapia Facility – outfall unknown
Sawtooth Fish Hatchery #ID0000487660	Salmon River (outfall 001)
Hecla Mining Co. Grouse Creek Unit #IDD000643254	Jordan Creek (outfall 001)
Thompson Creek Mining Co. #IDD000756874	Buckskin Creek (outfall 001) Pat Hughes Creek (outfall 002) Bruno Creek (outfall 003)
Stanley Sewer Association #ID0000496349	Valley Creek (outfall 001) (proposed to be discontinued, Domingo, 2000)

Bureau of Land Management and Forest Service Assessments

The Salmon-Challis National Forest has monitored substrate conditions on a number of streams in the subbasin through core sediment sampling (SCNF, 1999). These data are presented in Table 18. Although not 303(d) listed in the National Forest, Challis and Garden Creeks have a significant decreasing trend in core sampled sediment since 1995. Thompson Creek and the Yankee Fork are 303(d) listed for sediment within Forest boundaries. The one sampling site on Thompson Creek has shown a significant decreasing trend in core sampled sediment. It is unknown if the site sampled is above or within the listed segment. Two sites on the Yankee Fork show a significant increasing trend and two sites show a significant decreasing trend. A fifth site has remained relatively stable with regard to core sampled sediment trends. Most sites on 303d listed streams in 1999 are below a core sampled sediment mean value of 28 %. One site on the Yankee Fork (4A) has had values slightly in excess of 28% mean core sampled sediment. Other streams (not 303d listed) with high sediment values include Morgan Creek (3A), East Pass Creek (1A), Herd Creek, and Tenmile Creek. It is assumed that data in Table 18 are from spawning gravel locations in these streams. However, locations have not been verified.

The Challis Field Office of the Bureau of Land Management (BLM) collected streamflow and water quality data on selected streams in 1999 and 2000 (Appendix B). These data

show total dissolved solids (TDS in ppm), turbidity (NTU), and water temperature (^{o}C) values for Kinnikinic Creek, Road Creek, Garden Creek, and Challis Creek among others.

Table 21. Salmon-Challis National Forest Core Sampling Sediment Data (SCNF, 1999)

Core Sampling Sediment Trends - 1995 to 1999 - Mean Percent (%) Fines					
Stream/Station	1995	1996	1997	1998	1999
Morgan Cr.1A	38.5	34.3	29.3	22.8	24.8*
Morgan Cr.2A	34.4	34.5	31.7	22.0	23.8*
Morgan Cr.3A	42.3	27.7	41.3	31.4	39.4
WFMorgan Cr.	36.2	33.0	23.4	11.4	25.6*
Challis Cr.1A	44.1	41.1	17.4	13.0	21.3*
Challis Cr.2A	-	-	29.2	-	22.0
Garden Cr.1A	22.4	-	19.0	12.3	18.0*
E. Pass Cr.1A	27.1	31.9	31.2	37.9	38.8#
Herd Cr.	30.1	31.0	32.5	28.4	30.7
WF Herd Cr.1A	20.4	27.2	27.2	27.2	25.2#
Squaw Cr.1A	25.9	24.2	27.4	23.5	30.5#
Trail Cr.1A	-	27.0	-	-	-
Thompson Cr.1A	25.1	20.2	25.4	16.5	-*
Yankee Fork 1A	27.1	20.5	19.6	27.8	24.1
Yankee Fork 2A	15.6	29.5	14.9	22.6	27.5#
Yankee Fork 3A	13.2	29.1	5.3	14.7	24.2#
Yankee Fork 4A	40.6	36.1	27.4	25.2	32.7*
Yankee Fork 5A	31.5	29.7	23.6	21.0	15.7*
WF Yankee Fork	21.9	-	27.5	18.1	25.1
Jordan Cr.0A	26.2	32.1	18.4	13.9	15.3*
Jordan Cr.1A	17.6	-	-	-	-
Jordan Cr.2A	16.0	22.5	18.0	17.5	21.1#
Jordan Cr.3A	14.3	23.5	16.7	10.9	23.1#
Jordan Cr.4A	13.5	-	-	-	-
Fivemile Cr.1A	14.3	-	20.8	28.8	11.7
Tenmile Cr.1A	32.3	-	36.9	28.5	33.7
McKay Cr.1A	19.0	-	29.3	33.2	30.1#
Basin Cr.1A	33.3	28.5	22.3	13.5	32.4
Valley Cr.1A	41.1	-	-	-	-

*Significant decrease over the five-year period (1995-1999).
#Significant increase over the five-year period (1995-1999).
Streams in **bold** are 303(d) listed for sediment.

The sampling site on Kinnikinic Creek is reported to be above the Clayton Silver Mine tailings. Kinnikinic Creek, measured on September 1, 1999, showed 50ppm TDS and a clear NTU at 9°C. The Road Creek sampling site produced a TDS of 160ppm and 6.55 NTU at 15°C on August 19, 1999. Garden Creek produced a TDS of 80ppm and 0.92

NTU at 6.5^{o}C on October 13, 1999. Two sites on Challis Creek, one sampled on August 16, 1999 and the other on October 5, 1999, showed TDS values of 40ppm for both, 2.51 and 3.47 NTU at 17° and 10°C, respectively.

The Challis Field Office of BLM has recorded water temperatures in several streams throughout the subbasin using continuous recording HOBO-type thermographs (BLM, 1999b). Within the East Fork Salmon River drainage, Bear, Big Boulder, Big Lake, Herd, Horse Basin, Lake, Little Boulder, Mosquito, and Road Creeks have been measured every year since 1995 (Appendix C). Elsewhere in the subbasin, Bayhorse, Morgan, WF Morgan, Squaw, and Thompson Creek have been measured since 1995. Data reviewed for this assessment includes the highest recorded maximum temperature for all years and the highest recorded 7-day average maximum temperature for 1998 and 1999. Additionally, thermographs for the entire 1999 sampling season were reviewed. In 1996, two streams exceeded 22°C with the highest recorded maximum water temperature (BLM, 1999b). Lower Horse Basin Creek and Road Creek below Horse Basin Creek had maximum temperatures of 23.6^{o}C and 22.9^{o}C in 1996. These two streams did not achieve these high temperatures in any other year sampled. In 1998, Big Lake Creek and Morgan Creek exceeded 22°C (22.9^{o} and 22.5^{o}C, respectively) maximum water temperature. Squaw Creek is proposed for 303(d) listing by EPA for alleged temperature problems. These BLM data show maximum water temperatures for Squaw Creek ranging from 19.6^{o} to 20.4^{o}C (1997 and 1998, respectively).

Continuously recorded thermographs were reviewed (1999 data) for the above creeks (BLM, 1999b). These data show daily averages in addition to daily maximums and 7-day average maximums. No stream exceeded a daily average water temperature of 19°C in 1999. In fact, most streams had daily averages from 12° to 14°C through the summer months (July and August), dropping below a daily average of 12°C by August 30, 1999. The daily average water temperature for Squaw Creek varied from 10° to 13.5^{o}C during July and August. In September, the daily average for Squaw Creek drops to 8° to 10°C. The 7-day average maximum water temperature for Squaw Creek varies from 15.5^{o} to 18°C during July and August, drops to about 13.5^{o}C around the 1st of September, and then drops below 10°C before September 25, 1999.

The Salmon-Challis National Forest also provided 1999 thermograph data for various streams in the Yankee Fork Ranger District (see Appendix D). Only daily maximums and 7-day average maximums are presented, daily averages were not calculated. Of the 22 creeks surveyed, two creeks exceeded the 22°C maximum cold water biota criterion (Appendix D). Lower Basin Creek had a peak maximum water temperature of 23.3^{o}C and exceeded 22°C approximately 12 times from July 13 to August 31, 1999. Lower Knapp Creek had a peak maximum water temperature of 23.7^{o}C and exceeded 22°C approximately six times from July 6 to August 1, 1999. No other creeks exceeded 22°C maximum water temperature. Squaw Creek was monitored for temperature in two places (upper and middle), as well as in five of its tributaries. Upper and middle Squaw Creek reached peak maximum water temperatures of 16.8^{o} and 17.5^{o}C, respectively. The highest 7-day average maximum water temperatures were 15° and 16.1^{o}C for upper and middle Squaw Creek. In middle Squaw Creek, the 7-day average maximum fell below

13°C after August 31, 1999 and below 12°C by September 21, 1999. Upper Squaw Creek fell below 12°C 7-day average maximum after August 31, 1999. Water temperatures for the five tributaries of Squaw Creek are listed in Table 20 (and Appendix D). Data for Squaw Creek are very consistent with BLM data for lower Squaw Creek discussed previously. These streams appear to meet cold water biota temperature criteria throughout the summer of 1999 and meet salmonid spawning criteria by September 1, 1999. Because daily averages were not calculated, it is unknown if these streams meet the state's bull trout temperature criterion of 12°C (at the time of compilations) daily average on Forest Service land. This daily average was exceeded slightly (to 13.5°C) on BLM land during July and August.

Table 22. Maximum Water Temperatures Within the Squaw Creek Drainage.

Water Body	Highest Maximum (°C)	Highest 7-day Average Maximum (°C)
Aspen Creek	14.9	10.5
Cash Creek	17.9	16.9
Cinnabar Creek	13.4	8.3
Martin Creek	17.5	15.3
Trealor Creek	14	13
Upper Squaw Creek	16.8	15
Middle Squaw Creek	17.5	16.1

USGS Station Data

The US Geologic Service (USGS) has maintained water monitoring stations periodically throughout the subbasin. These data are in Appendix E. Suspended sediment was monitored at several locations on the Salmon River from 1971 to 1973. The Salmon River below Yankee Fork (Station # 13296500) had suspended sediment concentrations that varied from 1 mg/l to 41 mg/l. Only two of ten samples were greater than 30 mg/l (32 mg/l and 41 mg/l). At the Salmon River above the East Fork Salmon River (Station # 13297380) suspended sediment concentrations were from 2 mg/l to 109 mg/l. Again only two of nine samples were greater than 30 mg/l (49mg/l and 109 mg/l). In the Salmon River near Challis suspended sediment was between 2 mg/l and 172 mg/l. Three of ten samples were greater than 30 mg/l (56, 130, and 172 mg/l). Of all USGS sample sites reporting suspended sediment 30 mg/l or greater 20 out of 26 events occurred during the last two weeks of June, the period of peak runoff from snowmelt in most years. This is also a time when severe thunderstorms take place in the subbasin.

Maximum and minimum water temperatures were also monitored by USGS in the Salmon River above Redfish Lake Creek from 1978 to 1984 (Appendix E). Water temperatures never exceeded 20°C during those years, although it was not uncommon for water temperatures to be that high in July and August. In September maximum water temperatures in the Salmon River were occasionally as high as 16-17°C, especially during the first week of September. In most years, September water temperatures were frequently below a maximum of 13°C, and in October water temperatures exceeded 13°C only once during the monitoring period.

Environmental Science & Research Foundation Assessment

The Environmental Science & Research Foundation during the summer of 2000 sampled sediment and assessed stream erosion and road erosion at several sites on Warm Spring Creek, Challis Creek, Garden Creek, Road Creek, Slate Creek, and the upper Salmon River above Stanley (Blew, 2000). Warm Spring Creek was the only stream in this group to also receive nutrients and bacteria sampling. The one time sampling event on June 8, 2000 at two locations produced slightly elevated (above the EPA Goldbook (1986) recommendation of 50 ug/l) total phosphorus concentrations. One site, approximately 1 mile below the hatchery was 60 ug/l. The other site several miles below had 20 ug/l total phosphorus. Both samples taken from Warm Springs Creek water were from agricultural ditches. Fecal coliform bacteria samples were high at both sites on the same day (1300 and 2420 cfu/100ml). E. coli samples were above standards at only one site (1046 cfu/100ml) and below standards at the other site (45 cfu/100ml). Caution should be used in interpreting bacteria and nutrient results, as a single sample is insufficient to determine the nature and extent of any problems.

McNeil core sediment sampling took place at two sites on Challis Creek and two sites on Garden Creek, one above the Forest boundary and one below for each stream (Blew, 2000). Percent depth fines for the upper sites were 41% for Challis Creek and 38% for Garden Creek. Lower sites recorded 44% and 35% depth fines for Challis Creek and Garden Creek, respectively. Other streams receiving sediment sampling were one site on Road Creek (47% depth fines), one site on Slate Creek (30% depth fines) and two sites on upper Salmon River (42% and 51%). Most of these samples suggest an excess of fine sediment in these streams.

Blew (2000) also assessed stream erosion rates and road erosion at several locations along Challis Creek, Garden Creek, Road Creek, and Slate Creek. Stream erosion rates were also assessed at three reaches along the upper Salmon River. Challis Creek had one slight eroding reach, three moderately eroding reaches and one severely eroding reach. Garden Creek had one moderately eroding reach and one severe. Road Creek had three slightly erosion reaches and one moderately eroding reach. Slate Creek had one moderately eroding reach recorded. The Salmon River had two slightly eroding reaches and one moderate. Lateral recession rates and erosion rates were listed for all these locations in Blew (2000), however, measurement units were not included.

Assessment Data Gaps

Most listed streams lack sufficient data to perform TMDLs. Challis Creek, Garden Creek, and Warm Spring Creek are all listed for sediment and nutrients, however, these data are very limited for the listed portions of these streams (Table 19). Challis and Garden Creeks have limited sediment data above and below the Forest Service boundary. The lower portions of these streams, as well as most of Warm Spring Creek are on private ground for which there is little data. Road Creek was assessed using the R1/R4 stream procedure for aquatic habitat conditions. BLM indicated that instream fines were

above standards (probably Pacfish/Infish) and above natural conditions database (BLM, 1999a).

Thompson Creek, the Yankee Fork, and the Salmon River have some limited sediment data, core samples for all three and suspended sediment for the latter. However, it is unlikely that these data sufficiently characterize the stream to determine a TMDL, with the possible exception of the Yankee Fork, which has core samples from a number of sites.

Metals data exists for Thompson Creek however additional follow-up metals data are needed for Kinnikinic Creek to better characterize the effects of remediation activities and any additional leaching from tailings after remediation activities were completed in 2001.

Table 23. Data gaps for 303(d) listed water bodies.

1998 303(d) Listed Waters	Listed Pollutant	Data Gaps
Challis Creek	Sediment Nutrients	no nutrient data one sediment sample below FS boundary
Garden Creek	Sediment Nutrients	no nutrient data one sediment sample below FS boundary
Warm Spring Creek	Sediment Nutrients	two nutrient samples no sediment data
Road Creek	Unknown (sediment?)	BLM has aquatic habitat data based on R1/R4 procedures. One depth fine sample.
Kinnikinic Creek	Unknown (sediment, metals?)	Need follow-up monitoring of post remediation sediment and metals.
Thompson Creek	Sediment Metals	Some sediment data available Metals data from NPDES and USGS
Yankee Fork	Sediment Habitat alteration	Some sediment data available
Lost Creek	Unknown	No data
Salmon River	Sediment Temperature	Limited suspended sediment and Temperature data available. Two depth fine samples.

Pollutant Source Inventory

Pollution sources for the 303(d) listed segments of Challis Creek appear to be related to mass wasting, streambank erosion and road erosion. Further down stream, below Mill Creek flow alteration and streambank erosion are important. Pollution on Garden Creek, and Warm Spring Creek are agriculture-related activities on private ground with flow

alteration the significant primary perturbence. Sediment sources associated with Road Creek are likely agricultural activities on private ground on the lower reach, cattle grazing and associated riparian impacts, and road erosion. Flow alteration on the lower reach of Road Creek is the significant primary perturbence.

Pollution sources for the 303(d) listed portion of Thompson Creek appear to be the sources of the iron hydroxide deposits around the Scheelite Jim mill. Likewise, pollution sources for sediment and possibly metals in the listed portion of Kinnikinic Creek appear to have been associated with the Clayton Silver Mine and tailings piles along the creek. Sediment sources in the Yankee Fork are likely associated with the dredge mining operation and possible other mining activities in the vicinity.

Sediment sources for the Salmon River are bank erosion and inputs from tributary contributions.

Pollutant Source Data Gaps

No information is available on pollutant sources in Lost Creek, in the Upper Stanley Basin, however, it appears that natural low flow limits beneficial use support here.

Summary of Pollution Control Efforts

The Upper Salmon Basin Watershed Project (USBWP) (formerly known as the Idaho Model Watershed Project), was initiated in 1992 with funding from the Bonneville Power Administration. The USBWP has been working on various projects in the Lemhi River, Pahsimeroi River, and East Fork Salmon River, and the mainstem Salmon River to restore and maintain aquatic habitats for resident and anadromous fish (Seaberg, et al., 1997). The Project works with agencies and landowners on a cost share basis to accomplish goals. Work includes fencing riparian areas, restoring and protecting streambank stability, diversion structure screening and consolidations, and many other activities. For example, the Project participated with the Hannah Slough Project on the Salmon River near Challis involving riparian management and bank stabilization.

East Fork Salmon River

Additional projects include three miles of riparian corridor in Herd Creek, stabilizing 10,000 feet of streambank in Herd Creek, improving irrigation diversions in the East Fork drainage, and the East Fork Ten-Mile Project which involved a combination of bank barbs and fencing to improve habitat conditions. The Project has been investigating expansion of their activities into other parts of the Upper Salmon subbasin including participation with the Yankee Fork restoration and diversion consolidations in Valley Creek.

Road Creek

The Road Creek watershed is primarily impacted by grazing activities. Three riparian exclosures have been built by the BLM (Kate Forster, personal communication) on Road Creek and its tributaries to exclude livestock from riparian areas. One large exclosure

was built on Horse Basin Creek from the confluence with Corral Basin Creek to Road Creek. More than a mile of riparian habitat is protected with this exclosure. The other two exclosures, each about two acres in size, are located near Cow Camp (10N, 20E, sec. 35) and Boulevard Springs (9N, 20E, sec. 34).

Warm Spring Creek

Private lands surround the majority of Warm Spring Creek proper. There are only a few areas where public lands are adjacent to the creek. One such area near McGown Creek has a grazing exclosure on BLM land to protect the riparian area (Kate Forster, personal communication).

Kinnikinic Creek

Work was completed in October 2001 to reduce erosion from the tailings piles of the Clayton Silver Mine into Kinnikinic Creek. The tailings pile was reshaped and capped, the road was moved away from the creek to create a wider stream corridor, and tailings adjacent to the stream were ripraped to reduce erosion. A new flood plane was constructed for Kinnikinic adjacent to the tailings. Riparian rehabilitation is planned for 2002 and 2003 adjacent to the channel reconstruction. Dewatering of the stream channel has ended with elimination of the hydroelectric pipeline diversion at the Clayton Silver Mine.

The following is a scope of work for reducing erosion from the Clayton Silver Mine tailings piles into Kinnikinic Creek provided by Greg Weigel, EPA Region 10, Idaho Office:

CLAYTON SILVER MINE
REMOVAL ACTION
SCOPE-OF-WORK

OBJECTIVES

This scope-of-work (SOW) specifies required actions to fully implement a Removal Action (RA) at Clayton Silver Mine (CSM). This SOW is specific to a RA to isolate Kinnickinick Creek from contact with the tailings pile and reduce the potential for mass failure and erosion of the tailings, and continued release of tailings pile fines to the surrounding environment via wind and hydraulic erosion. There may be additional hazards to human health and the environment caused by other aspects of CSM, but they are not addressed herein. The specific goals of this SOW are:

1) Evaluate and, if necessary, mitigate the potential for slope failure of the tailings pile.
2) Isolate Kinnickinick Creek from contact with the toe of the tailings pile to prevent continued migration of tailings to the creek via streambank cutting and erosion of the tailings pile.
3) Stabilize the tailings pile from continued wind and hydraulic erosion using a cover of vegetation or other native material.

ALTERNATIVES ASSESSMENT

The following technologies have been identified as being potentially feasible. The initial assessment report shall include these as a minimum:

$ stream relocation away from toe of tailings;
$ modification of tailings slope;
$ armoring at toe of tailings;
$ engineered cover system using vegetation and/or native materials, and/or;
$ diverting run-on and run-off.

The following data gaps are known to exist and shall, at a minimum, be addressed in the initial assessment report:

$ chemical and physical properties of native and tailings pile soils, and;
$ detailed topographic mapping.

Thompson Creek

In 1996, barbs and streambank revetment structures were constructed to reduce sediment impacts from eroding banks (see Appendix H). In 1997, eight more barbs were constructed and riparian plantings occurred in an effort to further reduce the sediment impacts to aquatic habitat.

Livestock management plans to provide for better riparian condition and bank stability were improved in 1997 as well (Appendix H).

Restoration work at the Scheelite Jim mill site began in 1992 with the creation of a wetland to trap heavy metals and ARD from the site to improve water quality. Subsequent improvements to the wetland project have been ongoing (Appendix H).

Yankee Fork

In 1996 and 1997, phases one and two of Preacher's Cove reclamation project were implemented to remove hazardous materials and stabilize mill site to protect aquatic resources (Appendix H). The lower Jordan Creek wetlands and stream channel restoration was conducted by Hecla Mining from 1997 to 1999.

There are ongoing projects to reclaim dredge piles and to restore stream and active floodplain geomorphology as well as create off-channel fisheries habitat (Appendix H).

Other Projects

Problems in upper Alturas Lake Creek, where the creek has abandoned its channel to flow down a road, are planning to be addressed through restoration activities (Nourse, 2000). The creek will be rerouted back to its original channel and transportation systems will be corrected and rearranged to prevent further degradation of the resource. Implementation is slated for late fall 2000.

The Busterback Ranch irrigation project in the early 1990s was designed to reduce Salmon River diversions in the Alturas Lake Creek area by converting from overland flow irrigation to ground water-based sprinkler irrigation.

See Appendix H for list of other projects on non-303d listed streams within the subbasin.

SUMMARY

Challis Creek, Forest boundary to mouth; sediment, nutrients, flow alteration

The land surrounding Challis Creek below the Forest boundary is primary privately owned and is in agricultural/grazing use. The stream is apparently often dewatered in these lower reaches for irrigation use. No data are available on nutrient conditions in this lower section of the creek. One sediment sample suggests high depth fines. The impacted area includes a portion of National Forest land immediately upstream of the Forest boundary. Forest Service data suggests that sediment amounts, once high in Challis Creek, are improving. During fieldwork conducted by DEQ no evidence of nuisance levels of aquatic plants or algae growth were observed to indicate that a nutrient TMDL is warranted. A sediment TMDL is developed in this document to assist ongoing and planned restoration work to reduce sediment inputs and improve anadromous and resident fisheries.

Garden Creek, Forest boundary to mouth; sediment, nutrients

Like Challis Creek, Garden Creek below the Forest boundary is surrounded by private agricultural/grazing ground. The creek is also used as the municipal water supply for the City of Challis during periods of high flow in the spring. Dewatering of the stream channel is the most pervasive perturbence to aquatic beneficial uses. Monitoring and observations suggest that the only impacted portions of the creek are within the lower

private land reaches particularly within the City of Challis. No nutrient data are available for this portion of the creek. One sediment sample suggests high depth fines. Garden Creek will be listed for flow and habitat alteration only from the upstream City limit to its confluence with Hannah Slough. Above the city boundary Garden Creek fully supports beneficial aquatic life uses. No sediment TMDL will be prepared for Garden Creek.

Warm Spring Creek, headwaters to sink; sediment, nutrients
Warm Spring Creek, by virtue of its diversion from its natural stream channel into a constructed channel that conveys water from a hatchery to a hydroelectric plant over the course of its flow, and its lack of connectivity to other surface waters, does not warrant a TMDL. The temperature regime of Warm Spring Creek is naturally elevated beyond state water quality criteria for cold water and altering the temperature regime is not possible or advisable. The diversion ditch that carries Warm Spring Creek's entire flow is stable and non-erosible. However, no sediment data are available for the ditch and one time nutrient sampling is inconclusive. Nuisance levels of aquatic plants or algae have not been observed in the diversion ditch. Warm Spring Creek is geothermally influenced and at most could be considered artificial warm water/neotropical fish habitat.

Road Creek, headwaters to mouth; unknown
Road Creek has had a number of impacts over the years because it is a drainage that is almost entirely used for grazing. Improvements in grazing management have been made and response is noted in the fishery. Multiple year classes of cutthroat and rainbow trout are found in Road Creek. Road Creek is a spring creek system that is not exposed to high magnitude hydrologic peak flow during snowmelt. Spring creeks typically exhibit higher percentages of fine sediment. The lower reaches are also dewatered and used for private land irrigation. A road parallels the creek for most of its length and is often in the limited floodplain. Macroinvertebrate analyses indicate that the stream may be impacted by fine sediment, however the greater impact to the lower sample site is dewatering of the stream channel. Sediment core sample data suggests that fine sediments are elevated in this stream, however, fisheries data suggest that Road Creek is in full support of beneficial uses above the dewatered reach of the stream. Spring source creeks often show elevated fine sediment due to limitations in sediment transport capability related to low peak flows. Problem areas are restricted to lower reaches that are dewatered and headwater reaches that are ephemeral. Temperature does not appear to be a problem. Road Creek will be listed for flow alteration only from the lower BLM boundary, approximately 1 mile above its confluence with the East Fork Salmon River to its confluence.

Thompson Creek, Scheelite Jim Mill to mouth; sediment, metals
Thompson Creek below the Scheelite Jim mill site has probably been affected by historic iron oxide (FeOx) and manganese oxide (MnOx) deposits that have previously armored the substrate and turned the sediments to a yellow color from the mill site to the confluence with the Salmon River. This appears to be the only historically impacted area on this stream. There has been significant reclamation work associated with this mill site, since 1992, prior to its §303(d) listing, and significant improvements in fisheries and macroinvertebrates have accrued to restore full support to the listed reach (IDEQ 1999a, Marvin Granroth, USDA FS, personal communication) . No mining related problems

were discovered in other portions of Thompson Creek. A TMDL is not warranted for any pollutants in Thompson Creek. Thompson Creek will be listed into category 4b of the EPA 2002 Integrated Water Quality Monitoring and Assessment Report Guidance. The stream's beneficial use support has been threatened, but does not require the development of a TMDL because other pollution control management practices are reasonably expected to result in the attainment of state water quality standards in the near future.

Yankee Fork, 4th of July Creek to mouth; sediment, habitat alteration
The Yankee Fork from Fourth of July Creek to mouth has had habitat severely altered by dredge mining. Forest Service core sediment data show that one monitoring site has elevated average depth fine sediment, though monitoring during several monitoring years have been below target levels. Habitat restoration has been a priority for the ShoBan Tribes and state and federal agencies and has attracted the attention of the Idaho Model Watershed Project. Many improvements have been implemented with others planned. The Yankee Fork of the Salmon River is in full support of beneficial uses and will not have a TMDL developed for sediment or metals.

Kinnikinic Creek, Sawmill Creek to mouth; unknown
Kinnikinic Creek below Sawmill Creek has historically been affected by the proximity of tailings from the Clayton silver mine. Sediment and metals may have been a problem based on the erosional nature and position of those deposits in relation to the stream channel. Restoration activities have been completed to stabilize these tailings piles which were subject to substantial wind and water erosion. The stream channel has been reconstructed to move the creek away from the tailings and to prevent further contact. This activity has been shown to reduce metals loading to levels that comply with state water quality standards. An implementation monitoring plan has been developed as part of the remedial activities and will serve to track BMP effectiveness. BURP monitoring will continue to show beneficial use support status or the need for further implementation.

Lost Creek, headwaters to sink; unknown
Very little is known about the condition of Lost Creek. One BURP site at very low flow (less than 1 cfs) may have been insufficient to characterize the quality of this stream. The source of Lost Creek is a spring that may have geothermal features with less than 1 cfs flow. Lost Creek creates a palustrine emergent wetland above the Valley Road and the outlet is through a road culvert at the road crossing. The flow from Lost Creek infiltrates into alluvium within a mile of crossing the Valley Road. It does not make its confluence with the Salmon River. Due to its small watershed area it does not experience a hydrologic peak that allows for a significant increase in flow above its base flow. Follow up flow measurement during peak runoff of area streams showed flow in Lost Creek much below 1 cfs (0.06 cfs). Lost Creek will be removed from the §303(d) list as it was listed in error. A TMDL for Lost Creek is not warranted.

Salmon River, Hell Roaring Creek to Redfish Lake Creek; sediment
Some sections of the upper Salmon River have reduced streambank stability (<80% stable banks) associated with ice scouring on private ground. This condition may have

been exacerbated by historic grazing practices, however improvements in grazing management have been made that have improved the potential for recovery. Depth fines measured at two locations were elevated above targets for wadable streams (40-50%). Stream bank erosion rates have been quantified for several locations along the river that show slight to low-moderate streambank erosion. The Salmon River increases its flow and width to depth ratio upstream of the listed reach and falls into the assessment category of Large River BURP over the listed reach. Fisheries data show that the listed reach is in full support of beneficial uses. A TMDL for the Upper Salmon River reach from Hell Roaring Creek to Redfish Lake Creek is not warranted at this time.

Salmon River, Redfish Lake Creek to EF Salmon River; sediment, temperature
Available data suggests that there is not a temperature problem in the Salmon River. Maximum water temperatures did not exceed 20°C in the few measurements reported. It is not known if spawning temperatures are exceeded or even applicable, although early (before 1984) USGS data shows September temperatures were often below 13°C. Large river BURP and wadable stream BURP sites on the Salmon River throughout the subbasin show aquatic life uses fully supported. No current information is available on sediment loading to the Salmon River over this reach. Sediment inputs over this reach do not appear to be impairing beneficial uses. Greater stream energy to transport sediment and armoring of the streambank along Highway 75, make it unlikely that sediment sources along the Salmon River are limiting beneficial uses. Fisheries data show that this reach of the Salmon River is in full support of aquatic life beneficial uses and a TMDL for this reach is not warranted.

Squaw Creek, headwaters to mouth; temperature (EPA new addition)
Macroinvertebrate data show no signs of temperature impacts at BURP sites on Squaw Creek. Thermograph data show that the stream can reach maximum temperatures near 18°C in lower reaches in the summer time. However, the stream meets state standards for cold water biota and salmonid spawning. The state's bull trout criterion of 12°C as a daily average was exceeded by 1.5^{o} during the summer. The federal standard of 10°C as a 7-day moving average of daily maximums was considerably exceeded in much of Squaw Creek. The BLM and Salmon-Challis National Forest target temperature of 15°C for bull trout streams in the summer was exceeded as much as three degrees in lower reaches and one degree in middle reaches. Further evaluation of the potential for geothermal influence is warranted. Squaw Creek will be further evaluated for temperature criteria exceedances. A temperature TMDL may not be appropriate for Squaw Creek and will not be developed at this time pending further evaluation of conditions that influence the observed temperature regime.

Challis Creek TMDL

Loading Capacities and Targets

The current state of science does not allow specification of a sediment load or load capacity to meet the narrative criteria for sediment and to fully support beneficial uses for coldwater biota and salmonid spawning. All that can be said is that the load capacity lies somewhere between current loading and levels that relate to natural stream bank erosion

levels. We presume that beneficial uses were or would be fully supported at natural background sediment loading rates that are assumed to equate to the 80% bank stability regimes required to meet state water quality standards.

Beneficial uses may be fully supported at higher rates of sediment loading. The strategy is to establish a declining trend in sediment load indicator targets, and to regularly monitor water quality and beneficial use support status. If it is established that full support of beneficial uses is achieved at intermediate sediment loads above natural background levels, and that narrative sediment standards are being met the TMDL will be revised accordingly.

Sediment Target

To improve the quality of spawning substrate and rearing habitat in Challis Creek, it is necessary to reduce the component of subsurface fine sediment less than 6.35 mm to below 28%. Reducing stream bank erosion to a rate associated with 80% stream bank stablility could effect this.

Loading Summary

Existing Sediment Sources

The primary source of sediment to Challis Creek has been identified as stream bank and road erosion. The DEQ conducted stream bank erosion inventories from approximately 1 mile above the confluence of Lodgepole Creek to 1 mile above the confluence with the Salmon River to estimate the amount of sediment loading to Challis Creek from stream bank and road erosion. Erosion inventory reaches are shown in Figure 8 a and 8b.

Historic overgrazing has dramatically changed the character of streambank vegetation creating the potential for accelerated stream bank erosion. Riparian management has been implemented in some areas resulting in improved conditions over limited areas, though increased stream bank erosion from livestock use within the riparian vegetation zone remains a significant source of sediment to Challis Creek. The stream bank erosion inventory conducted on Challis Creek shows that the primary source of sediment from stream bank erosion occurs over the upper and lower evaluation reaches. Stream bank erosion over the upper-middle reach is also significant, though occurring at a lower rate, particularly because of the lower gradient of the river over this reach. The upper segment may have been historically impacted by periodic heavy releases of water from Mosquito Flat Reservoir and/or downcutting from the road culvert. This condition, combined with grazing impacts, is often exacerbated by diversion of water for irrigation, which reduces the streams capacity to move sediment. During periods of peak flow the sediment from the upper reach that accumulates is transported and deposited along lower gradient reaches with

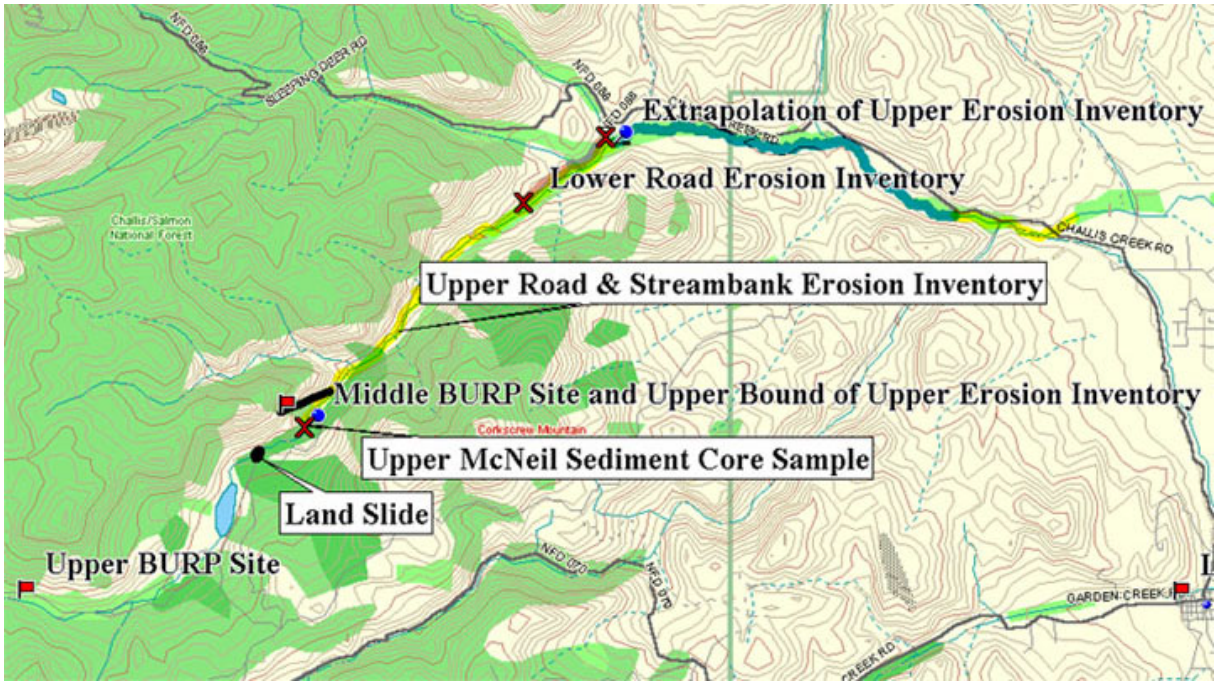

Figure 8a. Upper Challis Creek sample locations below Mosquito Flat Reservoir.

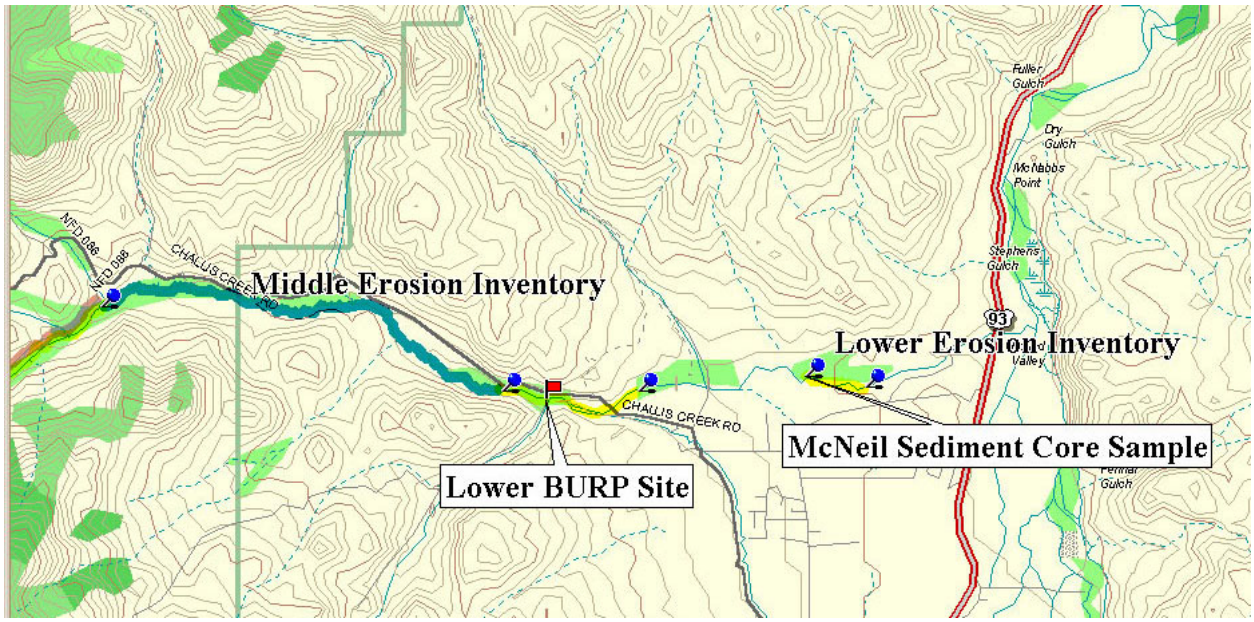

Figure 8b. Lower Challis Creek sample locations below Mill Creek.

reduced flow. The erosive action of high water on unstable stream banks during peak flow also acts to increase erosion and transport of sediment to depositional reaches.

Reduction of stream bank erosion prescribed within this TMDL is directly linked to the improvement of riparian vegetation density, vigor 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 would be necessary to re-establish a functional flood plain that

would subsequently be colonized with stabilizing riparian vegetation. This process could take many years. It is also expected that improvement of riparian vegetation density and structure would reduce the potential for temperature and bacteria loading in the future.

Estimates of Existing Load

Based on estimates from stream bank and road erosion inventories on Challis Creek the existing accumulated stream bank erosion rate for the 4 inventory reaches including extrapolated reaches and 2 road erosion inventory reaches over the current 303(d) listed segment is 816 tons per year. The inventory reaches are distributed from 1 mile above the confluence of Lodgepole Creek to approximately 1 mile above the confluence with the Salmon River.

Waste Load Allocation

There are no permitted point source discharges in the Challis Creek watershed.

Load Allocation

Using water quality targets identified in this TMDL sediment load allocations and sediment load reductions are outlined in this section. Because the primary chronic source of sediment loading to Challis Creek is stream bank erosion and surface erosion from the Challis Creek Road above Eddy Creek, quantitative allocations have been developed. These sediment load reductions are designed to meet the established instream water quality target of 28% or less fine sediment (<6.35 mm indiameter) in 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 allocation is based upon the assumption that natural background sediment production from stream banks equates to 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. Based on the existing sediment load from stream bank and road erosion on Challis Creek an overall reduction of 36% is recommended. Individual load reductions by reach range from 49% to 0%. Challis Creek stream bank and road erosion load allocations are broken down by individual inventory segment in Table 21. Appendix F contains stream bank erosion inventory data for each of the inventory reaches as well as maps.

Margin of Safety

The Margin of Safety (MOS) factored into load allocations for Challis Creek is implicit. The MOS includes the conservative assumptions used to develop existing sediment loads. Conservative assumptions made as part of the sediment loading analysis include: 1) desired bank erosion rates are representative of assumed natural background conditions; 2) water quality targets for percent depth fines are consistent with values measured and

set by local land management agencies based on established literature values and incorporate an adequate level of fry survival to provide for stable salmonid production.

Table 24. Sediment load allocations/reductions by erosion inventory reach.

Reach Number (from downstream to upstream)	Existing Erosion Rate (t/mi/y)	Total Erosion Rate (t/y)	Proposed Erosion Rate (t/mi/y)	Load Allocations (t/y)	Erosion Rate Percent Reduction	Percent of Total Erosion
Landslide	N/A	195	N/A	146	25	19
Upper	71	318	36	159	49	31
3 (Upper Middle)	10	46	6	28.5	40	5
2 (Middle)	5	6	6	8	0	<1
1 (Lower)	96	422	71	313	26	42
5 Road	9	24	5	14	44	2
Totals	**----------**	**1011**		**668**	**34**	**100**

Seasonal Variation and Critical Time Periods of Sediment Loading

To qualify the seasonal and annual variability and critical timing of sediment loading, climate and hydrology must be considered. This sediment analysis characterizes sediment loads using average annual rates determined from empirical characteristics that developed 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.

Annual erosion and sediment delivery are functions of a climate where wet water years typically produce the highest sediment loads. Additionally, the annual average sediment load is not distributed equally throughout the year. Erosion typically occurs during a few critical months. For example, in the Challis Creek watershed, most stream bank and road erosion occurs during spring runoff.

This 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. Finally, it is assumed that the accumulation of sediment within dry channels is continuous until flow resumes and the accumulated sediment is transported and deposited.

Public Participation

The Challis Experimental Stewardship Group is the approved Watershed Advisory Group for the Upper Salmon and Pahsimeroi watersheds. The Challis Experimental Stewardship

Group is a cooperative group consisting of citizens and agency representatives involved in issues relating to improving land management practices to enhance range conditions and associated water quality wihile protectoing the cultural heritage and economics of the local community.

Upon completion of the Subbasin Assessment for the Upper Salmon River it was distributed to persons who expressed interest in receiving and reviewing it at the January 2001 Upper Salmon Basin WAG meeting. The Subbasin Assessment was also reviewed at the Custer County Soil and Water Conservation District Board meeting in December, 2000. On April 27th, 2001 a meeting was held in Challis, Idaho to further discuss the Subbasin Assessment and TMDL for the Pahsimeroi River and Upper Salmon River. The Upper Salmon River TMDL was reviewed with the Challis Experimental Stewardship Group on January 17th, 2002. A 30 day public comment period began January 31st and will continue through March 1st, 2002.

Public Comments and Responses

The public comment period for the Upper Salmon River Subbasin Assessment and TMDL was held during February 2002. Comments received from agencies and the public during the comment period are included with responses. Response to comments are in bold print following the individual comment when possible, or, if the comment was in letter or memo format, following the narrative.

Comments from Anthony Gammache (response in bold print)

February 26, 2002

Dear Sir,
I am writing this letter to comment on your January 2002 report on the Upper Salmon River Subbasin Assessment and TMDL.

I would like to make a few observations on the lower section of Challis Creek. I have lived there for more than 30 years. I would like to suggest some other causes for the sediment on the lower 1/3 of Challis Creek.

1) I have noticed that to the north of the creek a steep large body of granular unstable volcanic ash that is highly erodable. Even a small shower will move large quantities of soil. This is true in Darling Creek on down to the Salmon River.
2) In past years there have been many log jams and increased beaver activity, which has contributed greatly to the stream bank erosion. Most of us try to prevent the jams, but in high water this is sometimes impossible.
3) Because the grade on the lower 1/3 is much less than the upper part, it is expected that more sediment would settle out in that section.
4) As a comparison to Challis Creek, I suggest you consider Warm Spring Creek on the other side to Twin Peaks. It is basically the same Challis Volcanics as this side. There has been no human activity on the west side of Twin Peaks to speak of. However, there are large sections of very drastic erosion.

In conclusion I would like to make two suggestions. 1) You could analyze the fine sediments on the lower Challis Creek to see if much of it is coming from the hills to the north. 2) You could find an old stream channel that is not active. If you would dig down in it and carbon date it to prehuman activity you would get a base line to see the true potential of sediment load.

Yours truly,
Anthony Gammache

Response:
The types of land features you discuss in your comment can present opportunities to reduce sediment. It also increases the importance of managing riparian areas to reduce sediment inputs because of naturally elevated levels. Particularly if the feature you describe is natural, because historically, fish have been adapted to survive in this system, and excessive anthropogenic sediment sources can certainly tip the scale to make conditions less tolerable for the native and listed species in Challis Creek. Additionally, it may be that lower gradient reaches are primarily rearing habitat and not spawning habitat. In that case it is important to note that the TMDL targets for fine sediment at depth apply to spawning habitat. Spawning habitat is primarily found in pool tail-outs, and if the channel morphology is within normal limits then depth fines are typically below 30 percent even in watersheds with primarily volcanic geology.

While conducting fieldwork to complete the Challis Creek TMDL it was noted that above the area of beaver dams there were a number of log jams as well. Many of the logs in these upper jams were noted to have sawed edges, not beaver cut. It was apparent that at some time in the past, a number of trees were cut in such a way that they ended up in the stream resulting in an increase in the size and number of log jams. In some cases log jams are put in as a mechanism to improve fisheries habitat. In streams with heavy sediment loads this can change channel dynamics and create channel instability if debris dams occur. Through the development of the TMDL Implementation Plan, developed after the TMDL Load Allocation, it may be identified that water quality may benefit from management activities related to beaver density and large woody debris recruitment.

Warm Spring Creek does appear to have some similarity to Challis Creek, particularly with geology. A couple important differences seem to be that Warm Spring Creek appears to have a higher drainage density with a north west aspect, and that it is on the more precipitous side of Twin Peaks at a higher average elevation with a predominantly north west aspect. It makes its confluence at approximately 6,000 ft, where the Challis Creek confluence is at about 4800 ft. The TMDL for the hydrologic unit that contains Warm Springs Creek will be due in 2005. It will be interesting to compare them in greater detail. Perhaps the greatest difference is that Challis Creek is on the 303(d) list and Warm Springs Creek is not.

Your suggestion to perform a microscopic examination of the sediments of the lower channel to identify sources may be useful to identifying potential reductions in the implementation plan, and may also identify the potential for additional sediment reductions. Neither DEQ or EPA has a protocol for carbon dating organic material from ancient abandoned stream channels to evaluate sediment loads, but perhaps there is some literature that will describe such a strategy so that it can be evaluated for future incorporation into the Water Body Assessment Guidance. The Water Body Assessment Guidance is a document put together by DEQ to evaluate the beneficial use support status of surface waters in Idaho.

Comments from BLM: Challis Field Office (response in bold print)

BLM Challis Field Office Comments

Following are comments regarding the January 2002 draft of the Upper Salmon River Subbasin Assessment and TMDL:

- Supporting data is needed for the comment on page 13 that"…most rainbow trout surveyed are likely residents isolated by irrigation diversion structures."

Many tributaries to the Salmon River are disconnected through much of the year by dewatering from diversion. Many of the disconnected tributaries have salmonid populations above dewatered sections that may periodically have access to the mainstem Salmon River but are considered isolated during critical life history stages such as spawning or during times when tributaries would provide thermal refuge to adults and young. This condition is well recognized by fisheries professionals working in the Upper Salmon basin and is described in numerous publications.

The context of the sentence that you partially quote is to distinguish between wild steelhead and resident rainbow trout collected in surveys. The intent is to show that most surveys do not distinguish between juvenile steelhead and rainbow, and that rainbow populations are often isolated. We will clarify this by inserting "…potentially isolated by irrigation diversion structures."

- Pine Creek in the East Fork Salmon is not "known to contain bull trout" by the BLM (page 32).

This section will be edited to incorporate this change.

- The locations of irrigation diversions in Road Creek need to be clarified.

A description will be included that identifies the lower private/BLM boundary. The boundary in question is 4,800 feet above the confluence of Road Creek with the Salmon River. This is the point where the western edge of section 19 intersects Road Creek. From this point to the confluence will be listed for flow alteration. Above this boundary is where the diversions are.

- Characterization of Kinnickinic Creek should to be updated throughout the document to include reference to the EPA remediation completed in October 2001.

DEQ has requested a narrative description of this remediation project several times directly from EPA and BLM on site, and during follow-up discussions. At this time no summary of this project has been received beyond that included in the document. DEQ has conducted follow-up monitoring in April 2002 and found that there has been a net reduction in zinc loading to below criteria and the zinc TMDL will be removed from the Upper Salmon Subbasin Assessment and TMDL.

- Note should be made that the Kinnickinic Creek hydro power plant was modified in 2001 such that it no longer dewaters the stream.

Recent site visits by DEQ in April and May 2002 does show that the diversion has been modified, and it appears that it is no longer possible to divert water or to dewater the stream. It is evident that the stream will have increased flow. Additional water column samples, collected for zinc, show that during base flow, when zinc loading would be expected to be the highest, zinc levels are below acute and chronic water quality criteria. The subbasin Assessment will be updated to reflect this new information and the TMDL will be removed for Kinnikinic Creek.

- Characterization of Kinnickinic Creek should be clarified to note that the TMDL for zinc was assigned after the EPA corrective action was taken.

It should be noted that the corrective action was designed to isolate Kinnikinic Creek from contact with the tailings pile and reduce the potential for mass failure and erosion of the tailings and continued release of tailings pile fines to the surrounding environment via wind and hydraulic erosion. The design did not incorporate specific features to reduce or eliminate metals loading into Kinnikinic Creek, though a reduction in metals loading appears to have accrued. It may be that the additional flow that results from decommissioning the hydroelectric diversion has helped as much as the remediation project. The additional flow is expected to benefit fisheries and coldwater biota as well.

- The Kinnikinic Creek sampling site mentioned in paragraph 1 page 56 is above the Clayton Silver Mine Tailings site.

This section will be edited to incorporate this addition.

- Big Boulder Creek restoration by the Shoshone-Bannock Tribes and Bonneville Power Administration was completed in 1997 (page 35).

This section will be edited to incorporate this addition.

- On Page 44, it is stated "Road Creek will be listed for flow alteration from the lower private/BLM boundary downstream to the confluence with the Salmon River…" This appears to be an error, and should be "Road Creek will be listed for flow alteration from the lower private/BLM boundary downstream to the confluence with the East Fork Salmon River…".

This section will be edited to incorporate this change.

- The characterization of many sub-watersheds reviewed in the document focuses on National Forest lands and privately-held lands, and offers substantially less description of lands administered by the Bureau of Land Management. In sub-watersheds where the BLM is a major land holder, such characterization tends to give a skewed critique of the sub-watershed as a whole. Generally, lowlands and lowland waterways need greater detail of characterization in the document.

The Subbasin Assessment and TMDL are based on materials submitted to DEQ as a result of written request from DEQ to land and resource management agencies in the Upper Salmon River Watershed for any and all data that pertains to water quality within the Upper Salmon River watershed for use in developing the Subbasin Assessment and TMDL. There are several documents that have been accumulated as a result of this request for data. The Forest Service wrote some, some were written by BLM, and some were developed by committees that incorporated representatives from many agencies. All of the pertinent materials submitted were incorporated by DEQ Technical Services in development of the document. Additionally, through land and resource management agencies participation in the Challis Experimental Stewardship Group, the Watershed Advisory Group for the Upper Salmon River watershed, requests for materials were made repeatedly. Updates on the development of the document were provided to the group, and the draft Subbasin Assessment was provided to BLM a full year before the draft TMDL was added to the document for public review. During that year no additional description of BLM land or water quality data was received, nor was any concern voiced that BLM land management was under represented in the Subbasin Assessment.

- Maps of sub-watersheds are needed, especially in instances where stream reaches are described by location relative to named stream tributaries.

Watershed maps are included on page 10, 16, and 38. Additional watershed maps will be developed for streams that have had TMDLs prepared.

Challis Field Office of the BLM is in the process of identifying additional data sources that DEQ may find useful for the TMDL. Specific data are:

- Functionality reviews in the Ellis Creek sub-watershed.
- Temperature data from 2000 and 2001 for Squaw Creek.

- Clarification of the Horse Basin Creek and Road Creek stream temperature data and standards (page 33) as discussed in BLM's Biological Assessment for the East Fork Salmon River Section 7 watershed.

Thank you for this opportunity for involvement in the Upper Salmon River Subbasin Assessment and TMDL process.

No additional data has been received by DEQ up to the time the final document was submitted to EPA.

Comments by Challis and Yankee Fork Ranger Districts (response in bold print)

02-28-02
USDA Forest Service COMMENTS to

DRAFT Upper Salmon River Subbasin Assessment and TMDL

General Comments:

1) We would like to see this document used as a framework for fixing problems, rather than exposing any entity or land user to blame. Some of the phrasing and selected quotations appear to focus on the latter.
2) We see a need to include percentage of road, or roadless area and any wilderness acreage in descriptions of subwatersheds, rather than miles of road.
3) Discussions concerning grazing are inconsistent. You have used site specific examples for certain watersheds but not for others. A more general approach is needed due to the fact that we now have PacFish standards to adhere to. You should cite the PacFish Implementation Monitoring Report. Also, there is a need to mention that trends exist and historic abuses are lessening.
4) You need to include more mention of the influence of wildfire. For example, the Rankin overburn of the earlier E. Basin Burn has affected sediment delivery to streams in the Yankee Fork watershed, at least intermittently.
5) Cross-referencing of problems in the document could be better tracked between various sections.

Response to General Comments

The intent of the Upper Salmon River Subbasin Assessment and TMDL is to assess the condition of the Upper Salmon River Subbasin based on existing data submitted to DEQ from the request for water quality related data that was sent to the Salmon-Challis National Forest early in 2000. The breakdown of road and grazing data reflects the data submitted to DEQ based on the request. Data that shows the percentage of roaded and roadless areas by subwatershed would be useful, however DEQ did not receive this data with the requested water quality data.

DEQ discussed the development of the Subbasin Assessment and TMDL at

Challis Experimental Stewardship Group meetings during 2000 and 2001, and repeatedly requested updated water quality information from land management agencies. To date no data or information has been received regarding specific fire related water quality monitoring data.

The TMDL will be reviewed with your comments in mind, and where ever possible edits will be made to incorporate your suggestions. It should be noted by the Salmon-Challis National Forest, however that the State of Idaho

is preparing TMDLs on a court ordered timeline and delaying the schedule to incorporate data that has not been provided to DEQ in a timely manner is not an option.

Comments pertaining to specific pages : (*Note : suggested added wording is italicised.*)

Executive Summary :
1st Paragraph, 2nd Sentence ,should include "cumulative effects of mining, warm season grazing, ***grazing over-utilization of riparian areas***, timber harvest and associated roads, ***where they have occurred in river bottoms***…"

The additions will be made to reflect grazing over-utilization of riparian areas, though the effect of sediment from roads is not always limited to roads that occur directly in river bottoms.

Parag 2, last sentence : need to add, at end of sentence :
"Challis Creek and Kinnikinic Creek watersheds , ***and virtually everywhere diversions exist within the subbasin***."

This paragraph relates to the lack of beneficial use support within these two particular creeks. Though, as you state, there may be sources of sediment at virtually every diversion within the subbasin, Challis Creek and Kinnikinic Creek are the two streams identified in the Subbasin Assessment as not fully supporting beneficial uses that will have a TMDL developed.

Page 1
Para 1, Sentence 5 : "The Eastern boundary runs along ***the north end of*** the Lost River Mountains, ***otherwise known as the Pahsimeroi Mountains***."

Sentence 6 will be changed to reflect that The Eastern boundary runs along the Pahsimeroi Mountains of the Lost River Range.

Page 4
Para 2, Sentence 2 should read "***The Challis Volcanics include a series of widespread lava eruptions beginning about 51 million years ago, followed by violent rhyolitic ash-flow eruptions from caldera complexes starting about 48 m.y.*** The volcanics overlie

much of the Precambrian and Paleozoic complexes within the subbasin***, and erupted from various calderas north and west of (and including) the Twin Peaks Caldera."***

Sentence 2 and 3 will be changed to incorporate this addition.

Para 3, 1st sentence should read "***Paleozoic complexes and minor Challis Volcanics*** dominate the Lost River Mountain Range (Pahsimeroi Mountains) along the eastern border of the subbasin."

Sentence 1 will be changed to incorporate this addition.

Page 5

First full paragraph : Sent. 2 : "The Salmon river….flows through narrow V-shaped valleys ***as well as intermittent open valleys***…"

Sentence 2 will be changed to incorporate this addition.

Page 8

Para 2, Sent 6 : Grouse Creek is no longer an active mine.
Para 3, Sent 6 : " …Allotment Management Plan administered by ***both*** the BLM ***and the USDA Forest Service***."

Sentence 2 will be changed to show that Grouse Creek is no longer active.
Sentence 6 will be changed to incorporate this addition.

Page 9

First full paragraph : " The East Fork of the Salmon River is the largest contibutor" **of what ??** "to the Salmon River within the subbasin."…Last Sentence should read : "***Many*** tributaries to the Salmon river are relatively small with steep gradients."

Sentence 1 will be changed to show that the East Fork is the largest tributary to the Salmon river in the Upper Salmon Subbasin. Sentence 3 will be changed to incorporate this addition.

Page 11

First Sentence **: "…**throughout the subbasin**, *but only two remain active*** during the high flow season…" (These are located at Thompson Creek and on the Salmon River below Yankee Fork). **Need to add data for Thompson Creek (ie tributary gages) to Table 1. Also please note : maximum flow listed in Table 1 for Salmon river below Valley Creek does not apparently match the values in USGS chart on pg 139 which portrays daily values for various stations.**

Sentence 1 will be updated to incorporate this change. Table 1 refers to data for the Salmon River and does not include tributaries. Data in Table 1 represents average annual, minimum average annual and maximum average annual flow and is not intended to reflect the chart on page 139.

Page 12

Para 1, Sent 6 : should read " ***mine activity and mine waste***": rather than "mine tailings".

Sentence 6 will be changed to include mine tailings and waste rock.

Para 3 under Fish : Sent. 4 should read "In the SNRA ***and Salmon-Challis NF***…"

Paragraph 4 Sentence 4 will be changed to incorporate this addition.

Page 14

1st partial Para, 2nd Sent. : Please note : We have records of sturgeon in the salmon River upstream as far as Clayton ca. 1996.

The sentence will be changed to reflect the presence of white sturgeon in the Salmon River as far upstream as Clayton, Idaho in 1996.

Second full Para., Last sentence : Need to quote more than just the SNRA document when listing campgorunds and rec sites ; need to include BLM's sites at the mouth of E. Fork and Bayhorse and Cottonwood Campground as well !

BLM Campgrounds will be added to this paragraph.

3rd full Para, Last sentence : should read **"…, and which is mainly derived from Challis Volcanic rhyolite or Idaho Batholith granitic material."**

The last sentence will be changed to incorporate this addition.

Page 15

1st Para, Sent. 2 **: "**Riparian and floodplain areas have been highly modified by ***the location of State Highway 75, as well as by*** agricultural activities and bank stability structures…"

State Highway 75 will be inserted to be more directily associated with bank stability structures.

Para 2, last sentence : should include peak flow data citations.

USGS citations will be added to the last sentence.

Page 17

Last Para, Sent. 2 : Could be modified to : "Challis Creek originates in near vertical headwall cirque basins ***carved out of Challis Volcanics*** at elevations near 10,000 feet."

Sentence 2 will be changed to incorporate this addition.

Page 18

Para 2, Last sent : should be modified to : "Observations by DEQ and affiliated contractors have noted significant ***past*** beaver activity just below the confluence of Bear Creek***, and current activity below the confluence of Lodgepole Creek***, that may be having an impact upon channel dynamics."

The last sentence will be changed to read :…significant beaver activity just below the confluence of Bear Creek and Lodgepole Creek that may be having an impact on channel dynamics as a result of heavy sediment and bedload deposition.

Page 19

Last Para, Sent. 7 : should read "…miles west of the ***mine*** site." since it just stated that the location of the mill site is unknown.

Sentence 7 will be changed to read : The mine is located at approximately 8,000 ft elevation approximately 0.3 miles west of Keystone Gulch.

Page 20

Para 3, Sent. 3 : why isn't Bayhorse on the list for flow alteration and/or possible metals contamination ?

Bayhorse Creek is listed as fully supporting beneficial uses at the sites that have been assessed. The USDA FS, 1999b citation indicates the possibility of heavy metal leaching exists, however no data has been provided to show that criteria violations have occurred, and if leaching does occur, apparently leaching above 6,760 ft elevation is not significant enough to alter beneficial use support.

Last Para : Has DEQ considered the mine drainage in lower Sullivan Creek for possible metals loading ? Workings are located immediate above the private land boundary.

Sullivan Creek does not have adequate flow to be evaluated by the BURP process. DEQ did not receive any water quality data to indicate that metals loading is a water quality issue on Sullivan Creek.

Page 21

1st full Para, Last Sent. : Inconsistency in the document, because on page 48, it says DEQ sampled and found cutthroat trout in Kinnickinic. According to USDA FS data, there are no bull trout in Kinnikinic Creek, on mainstream and tribs above the Forest boundary. Furthermore, it may be questioned whether or not Kinnickinc is a a bull-trout recovery opportunity at all, even after loading reduction is achieved, due to the enduring low-functionality of the channel dynamics and presence of tailings fines throughout the lower reach streambanks.

DEQ did collect cutthroat trout in Kinnikinic Creek as indicated on page 48.

The BLM Biological Assessment for Bull Trout in the Section 7 Subwatershed Lower Canyon East Fork Salmon River Through Peach Creek 1998, (BALCEF) states that : Five streams within the watershed have known bull trout populations : Slate, Holman, Kinnikinic, Squaw and Thompson Creeks. A majority of the occupied habitat is on land administered by the USDA FS, Salmon-Challis National Forest and Sawtooth National Forests. A citation to the Upper Salmon River Bull Trout Key Watershed Problem Assessment will be added to the text that states that bull trout are present in Kinnikinic Creek.

Additionally, follow-up sampling in May 2002 by DEQ shows that sediment from tailings deposition was incorporating into streambanks and streambanks were quite stable overall. Water column sampling during base flow conditions in April 2002 show that instream concentrations of zinc were below water quality criteria.

Page 22

Para 2, last Sent. : ("…Personal Communication, ***with reference to the Thompson Creek Mine/IDF&G temperature study"***).

The last sentence of paragraph 1 will be changed to incorporate this addition.

Para 4, Last Sent. : Should read " Thompson Creek contains bull trout (USDA FS,…), ***and all other known species in the area".***
Para 5, Sent. 2 : should read "grazing on a ***two-year*** cycle."

The last sentence of paragraph 3 will be changed to incorporate this addition.

Page 23

Para 3, 1st Sent. : "irrigation diversion…is no longer actively used." ***Please note that USDA FS personnel witnessed active backhoe maintenance of that diversion during the summer of 2000.***

On site visits in the fall and summer of 2001 it did not appear that the diversion has been used. DEQ will continue to monitor the use of this diversion and it's effect on flow at the confluence with the Salmon River.

Page 24

2nd full Para, Sent. 4 **:** Note that the lower mainstem Yankee Fork is NOT a braided channel.

Sentence 4 will be edited to incorporate this change.

3rd full Para., Sent 4 : should read **"**addressed through a consent agreement ***with USDA FS and EPA*** under the federal**…"**

Sentence 4 will be edited to read:"… addressed through a consent agreement between EPA and USDA FS…".

Page 25
Last sentence on page ***:*** This sentence is out of place and instead, it belongs in the section on the Yankee Fork, on previous page. HOWEVER, PLEASE NOTE: This sentence says « presumed » and it is just that, conjecture. It is a quote from an SNRA bull trout BA, but is not based upon data. It needs to be recognized in this subbasin TMDL assessment that occaisional sediment loading from Yankee Fork (and many other drainages) pulses through to the Salmon River immediately following localised intense precipitation. This sort of loading is not due to human causes, but is a regularly recurring natural characteristic of the local climate, geology, gradient and soemtimes wildfire.

This sentence would be better positioned in the Yankee Fork section. The context of the sentence written by the SNRA Forest Service Hydrologist in the bull trout Biological Assessment is to acknowledge that the purturbation of the Yankee Fork channel due to dredge mining has dramatically increased sediment delivery to the Salmon River from this system. You are surmizing that the sediment production of the Yankee Fork is not related to anthropogenic causes, but is comparable with other local drainages and is triggered by localized intense precipitation. While it is likely that localized intense precipitation causes increased sediment delivery to the Salmon River from the Yankee Fork and it's tributaries it is also likely that sediment delivery to the Salmon River is exacerbated by human causes and is related to snowmelt as well as localized intense precipitation. The SNRA statement should not be taken out of context. It is only meant as a qualitative characterization, not based on data, as stated. The last sentence will be moved to the Yankee Fork section.

Page 26
Para 2, Sentence 2 : Salmon and steelhead are known to be present.
Sentence 2 will be changed to incorporate this data.

Para 4 Sentence 2 : No dredge proposals are active except for possibly one. This would be for SMALL SCALE, local activity with a portable unit.

Sentence 4 will be changed to show that there is currently an active suction dredge proposal based on updated Forest Service information.

Para 4, Note 2 : Rather than just listing the miles of roads in Basin Creek or any other drainage, it would be more appropriate to report the **road DENSITY statistic(s**).

Road density data is included where it is available.

Page 32
Para 5, Sent. 4 Contrary to info in BLM reference 1999a, McDonald and Pine Creeks contain cutthroats, but NOT bull trout (Ken Rodgers, Pers. Communication).

Sentence 5 will be edited to incorporate this change.

Page 33

1st full Para, Sent. 7 : Question appropriateness of using Corral Creek of E. Fork as an exceptionally damaged area. The area referred to is a 10-foot bluegrass/willow bench, and may exhibit the same usage as every other bench in the entire Salmon subbasin. **BLM characterization of this riparian area in the subbasin assessment is as heavily grazed, not exceptionally damaged.**

Page 34

Para 3, Sent.4 : Percent fines standard for the Challis zone of the Salmon-Challis National Forest is **30%, and not 20%.**

Sentence 4 will be edited to incorporate this change.

Page 35

1st Para., Last Sent : Bull trout are known to exist in Bowery Creek as well.

Bowery Creek will be added to the last sentence.

Para 2 : 2nd to last sentence , re. Sheep Creek, probably the entire surounding area has been grazed, rather than just Sheep Creek.

Boulder Creek Watershed will be added to the 2nd to last sentence.

Page 37,

Table 3 : Need to clarify that this is an originally-proposed list and is not current.

The list is the current 1998 303(d) list from which the court ordered TMDL schedule was developed. That schedule pertains to the 1998 list through 2006.

Page 42

1st Para under Garden Creek : Would it be possible to perform nutrients testing somewhere above the city boundary when time/funds are available ? There are visual indicators (such as algae) of possible nutrient "exceedence" at various locations through the private lands.

DEQ Narrative Water Quality Standards are based on nuisance levels of nutrients, and no exceedence was observed in surveys. DEQ did not have access to private lands during the development of the Subbasin Assessment, however there was no indication that nuisance levels have accrued within the channel. Future sampling would depend upon access to private land.

Note : The Salmon-Challis National Forest Watershed and Fisheries Monitoring and Completion Report (2000), states : " …observed substrate capability levels on South Zone streams showed a noticeable improvement relative to 1999 levels, with 79 percent (37) of the 47 surveyed stations meeting the Challis National Forest LRMP sediment

standard of 30 percent fines at depth, compared to 64 percent of stations surveyed during 1999."

Noted.
Page 45
Para 2 : The Upper Salmon Subbasin and TMDL draft quotes from the USDA FS Challis Creek Watershed Analysis : "No new project activites…should proceed in the watershed until base level aquatic inventories are completed in that portion of the wateershed that would be immendiately impacted by the proposed activity." Please note that watershed analysis documents are not decision documents, but present recommendations to management.

Noted. DEQ supports that recommendation to USDA FS management with the Challis Creek TMDL, which is a decision document. DEQ has not received any data to indicate that the base level aquatic inventories have been initiated or completed.

From **page 44**, at Para 2, Sent 2 : "Core sampling of depth fines above 40%…" While you are quoting from the Challis Creek Watershed Analysis, you should note that on page V-2 of that document, under Recommendation #5 (bottom of page) it states **:**

> "Amend the Forest Plan to include a range of fines at depth that represent the geology and site conditions for the Forest… Management Objective : To have standards and guidelines that reflect a natural and achievable range for the forest. The Forest Plan standard and guideline to limit the amount of fine sediment at depth to 30% or less is not within the historic range of natural variability for the site on Challis Creek. It is recommended that the Forst Plan be amended to include a wide range of fines at depth(s) that represent the different geology and site conditions."

Another comment: Both decadent and current beaver dam complexes operate as traps for fine sediments on Challis Creek. These sediments are periodically released to be transported through hydrologic systems by natural occurrences such as rapid snowmelt, storm events or fires followed by storm events, besides any channel instability caused by human uses. Natural disturbances have a higher likelihood of occurrence where the parent geologic material and soils are unconsolidated such as they are in much of the Challis Volcanics surrounding the Twin Peaks caldera complex, at the headwaters of Challis Creek.

The literature on the effect of fine sediment on fish spawning and survival is significant and widely accepted by fisheries professionals. Anadromous and resident fish species have been historically present within the Challis Creek watershed and numerous other watersheds on the Salmon-Challis National Forest that are found in volcanic geology with beavers. The Objective of the TMDL is to restore beneficial use support for salmonid spawning and coldwater biota, which have historically been fully supported throughout the watershed. The TMDL target

for fine sediment at depth is 28% within spawning habitat for resident and anadromous fish.

The functions of beaver dams are well known, and it is intuitive that in watersheds where sediment production has increased as a result of management activities that mechanisms that naturally trap sediment may be perturbed. Sediment delivery pulses may not necessarily be a result of the beaver dam combined with climatic pulses, but perhaps the elevated sediment load that has accumulated above the impoundment.
For example, the Mosquito Flat landslide has been contributing large amounts of sediment to Challis Creek for many years, yet there has been no apparent effort to stabilize this feature or to reduce sediment production to the stream. This feature may well have been the source of the materials that are now observed choking beaver dams downstream.

Table 7. Challis Creek BURP Assessment indicates that the requirements of the Clean Water Act are being met in Challis Creek drainage at this time.

Table 7 indicates that Cold Water Biota is not fully supported in Challis Creek above Mill Creek, as described in the text for that section.

Page 49
Relative to Para 1 : There is also a fish migration barrier at the mouth of Kinnikinic Creek, where it enters the Salmon River. Even though BMP's have been accomplished for the channel, habitat alteration remains a problem.
Noted.

Page 52
Last Para, 1st Sent. : "based on USDA FS fieldwork" should instead read " ***based upon A Idaho Fish & Game study in coordination with Thompson Creek Mine."***

The 1st sentence will be removed because Fish and Game has not identified a directed study in coordination with Thompson Creek Mine, and has no knowledge of any such study.

Page 62
In section entitled **Yankee Fork**, mention should be made of the lower Jordan Creek wetlands and stream channel restoration undertaken by Hecla, 1997 to 1999.

This project will be mentioned.

Pages 66-67, 68
Water quality target of 28% fines sediment load allocation may be unrealistic, for reasons stated above.

See response to comment based on Page 44 above.

Page 160
" Lateral Recession Rate" We would like to see what "factors" were used to determine these critical values, used in your tons/year bank erosion calculations. You state that they are derived from NRCS, based upon Pfankuch, but do not cite a specific NRCS protocol document. This is critical to verifying that your method provides reproducible results, in order to track improvement from year to year. Also, it would be helpful to know which stream reaches of Challis Creek were used to make these determinations.

The factors are shown on page 156-157. The relationship between Pfankuch and the NRCS rating system is described on 157. It is not based on Pfankuch, however a cross-reference is provided. The NRCS has not has not identified a specific protocol document pertaining to the erosion inventory. Methodology is taken from an NRCS Memorandum describing estimation of streambank, road and gully erosion; adapted from the Channel Evaluation Workshop held in Ventura, California in 1983. This methodology was adopted for use in TMDLs where there is not existing data on sediment loads. It is intended to develop a gross allocation, which is permissible in developing TMDLs when better data does not exist and there is a strict timeline to do a load allocation. It is not intended to be a tool to monitor streambank condition on a yearly basis. The citation for the memo and Channel Evaluation Workshop will be added to the Literature Cited section.

1st Para, 1st Sent. under " Field Methods" : Usual McNeil depth fines protocol requires a 6-inch cylinder insertion depth in anadromous spawning gravels, and a 4-inch depth for resident population spawning sites. DEQ's crew used a 4-inch depth, but Challis Creek is historically an anadromous watershed.

The primary use of Challis Creek is currently by resident species. Existing USDA FS data also shows excessive depth fines to a depth of 6 inches. The Contract data was collected to a depth of 4 inches in order to index more sites throughout the watershed. The target of 28% fines less than 6.35 mm will be adequate to show an improving trend in fine sediment deposition. If the USDA FS attains their standard target at a depth of 6 inches, it is likely that the 4-inch target will also be attained. Beneficial use support of Salmonid Spawning and Coldwater Biota will likely be met at the stated target.

Supplemental USDA FS Comments

Page 24
Para 3, 5th sentence: Administrative Order of Consent (AOC) is with USDA FS and EPA Sentence should read as follows: Additionally, discharge from a leaking tailings impoundment is being addressed through a Administrative Order of Consent (AOC) for Time Critical Removal Action with USDA FS and EPA, under the federal Comprehensive Environmental Response, Compensation, and Liabilty Act (CERCLA), There is also an Consent Order with the State of Idaho, DEQ. The State has established that implementation of the AOC will fulfill the requirements of the State Consent Order.

This started off as time critical, but its current status is no longer time critical. Currently Hecla is conducting an Engineering Evaluation/Cost Analysis (EE/CA) under CERCLA.

Page 26
Para 2, 1st & 2nd sentences: need to add East Basin Creek, Coal Creek, Kelly Creek, and Little Basin Creek to the list of streams where bull trout were observed. Besides westslope cutthroat trout, mountain whitefish and sculpin are also known to occupy streams in the sub watershed. (USDA FS, 1998 in your reference list)

The streams and species in your comment will be added to the text.

Para 3: depth fines mean ranges from 13.5-33.3%, USDA FS, 2001, for 1995-2000, rather than 22-23%. Also, maximum 7-day running avg. temp (from 2001 field season) was 20 degrees C at the S-C/SNRA forest boundary.

The range of depth fines will be added to the stated average. Your statement about temperature will be added to the text.

Page 32
Para. 5, sentence 4: Additional reference for bull trout absence in McDonald and Pine Creek is Inland West Biotic Component Database (USDA FS 2000).

The BLM statement that bull trout are present in McDonald and Pine Creeks will be removed and your citation for absence will be added.

Page 34
Para 3, sentence 1: Brook trout present in Herd Creek (USDA FS 2000)
Sentences 2 & 3: bull trout are **not** present in East Fork Herd Creek, brook trout are **not** present in East Pass Creek (USDA FS, 1997a on pages 50-51).

Brook trout will be added to Herd Creek, bull trout will be removed from the East Fork of Herd Creek, brook trout will be removed from East Pass Creek.

Para 3, sentence 4: percent fines at depth for East Pass Creek ranged from 27.1 to 38.8 percent (USDA, 2001) and Herd Creek below E. Pass Creek confluence, range is 28.4 to 32.5%. West Fork Herd Creek: 20.4 to 27.2 depth fines.
These ranges of data will be worked into the text.

Para 3, sentence 8: maximum 7-day water temp in upper Herd Creek in 2001, upper Herd and E. Pass Creek was 14.4 degrees C. (USDA FS 2001).

These ranges of data will be worked into the text.

Pages 41-42

Please note that federal temp criteria for bull trout is listed as 10 degrees C as a 7-day MOVING AVERAGE, whereas the DEQ criteria is a DAILY MAXIMUM. This makes comparison difficult; suggest these need to be consistent in the document.

The current Idaho salmonid spawning and cold water aquatic life criteria are based on Daily Maximum (also referred to as instantaneous maximum) and Daily Average. The state criteria for bull trout spawning and rearing, howerver are based on Maximum *Weekly* Maximum Temperature (MWMT) and DAILY AVERAGE. The MWMT is the mean of daily maximum water temperatures measured over the annual warmest consecutive seven (7) day period occurring during a given year. The federal bull trout criterion is as a Seven-Day Moving Average of Daily Maximum Temperature.

Page 45
Table 7: supplemental comments to our initial response…why is a TMDL needed for Challis Creek if the BURP Assessment shows beneficial uses are fully supported?

As stated in the response to your initial comment: the BURP Assessment shows beneficial uses are not fully supported. With a macroinvertebrate score less than 3.5 the status becomes Needs Verification, which is less than Full Support, and requires a Total Maximum Daily Load to restore beneficial uses.

Page 58
Assessment Data Gaps:

What efforts will be taken to determine presence or extent of metals contamination occurring from mine drainage on Bayhorse and Sullivan Creeks? (see initial S-C National Forest Comments for Page 20 of the draft assessment and TMDL).

See DEQ response to initial S-C National Forrest Comments for Page 20 of the draft assessment ant TMDL.

Page 62
In continuation of discussion in section entitled **Thompson Creek**: In 1992 restoration work at Scheelite Jim millsite consisted of tailings isolation from the creek, streambank armoring, site cleanup and surface stabilization/revegetation. Creation of functional wetlands to trap heavy metals and ARD from the tailings site to further improve water quality occurred in 1999.

During an on-site visit with the Forest Service Mining Engineering Technician that had coordinated much of the restoration work DEQ was advised that the restoration work was begun in 1991 and 1992 and supplemental work was completed in 1999. A narrative summary of the project was received by DEQ in May 2002. The introduction states…"Ground work was started in the summer of 1991 by heavy equipment and operators from the Cyprus Mine, and work was completed in the fall of 1992. During the tailings reclamation in 1991 and 1992, seven wetland cells were

constructed along the east side and south end of the recontoured tailings. Twenty tons of old hay and straw were placed at the bottom of the cells to help create an organic growth medium for future wetland plant species." The delivery of this document to DEQ was delayed by your review. Your comment contradicts what is written in the document.

Section entitled **Yankee Fork:** correct date for wetland and stream channel restoration undertaken by Hecla on lower Jordan Creek is 1993 instead of 1997 to 1999 mentioned in our initial comments.

Noted.

Pages 65-68
Challis Creek TMDL

Discussions in this section emphasize attainment of a water quality target of 28% or less depth fines consistent with "…values measured and set by local land management agencies". What/who's standard or target is appropriate for the §303(d) listed reach which is identified as "Forest boundary to Salmon River" in the Executive Summary? This reach is almost entirely within private lands as the assessment acknowledges. The Salmon-Challis NF sediment depth fine standard of 30% or less has been questioned for appropriateness in our previous comments based on the geologic characteristics of the Challis Creek drainage. In addition the depth fines monitoring site utilized by the Forest may not be adequately describing the conditions and trend immediately upstream of the listed reach. Data suggest a significant decrease in depth fines from 1995 to 1999 (Table 18, page 55), but the Forest has reported the core sampling site as not representative of spawning gravels. The site is located within the stream reach containing beaver dam complexes and the Forest recommends adding a new monitoring site indicative of the beneficial use: salmonid spawning (USDA FS, 1997b, Chapter IV-2, Chapter V-2).

The TMDL will use the 28% target on the private land reach below public land as well. This target has been used by DEQ and approved by EPA within other similar watersheds with volcanic geology. As stated in the TMDL this target is applied to spawning habitat, not a general substrate condition over the entire reach. If naturally occurring spawning habitat diminishes progressively downstream then the target does not apply. Land management activities should reflect the sensitivity of the native geology and in-stream spawning habitat, particularly where threatened and endangered species listings are involved. It is felt that depth fines in spawning habitat can ultimately improve to within the range of the target, or to a level that allows for full support of beneficial uses.

If, as stated in your comment, a decreasing trend in fine sediment in spawning habitat has been observed within a beaver complex then the potential for improved conditions exists in other less depositional habitats. There is potential for spawning habitat within beaver dam systems, it is dynamic with the changing conditions of the

system. If you are not sampling spawning habitat for depth fines, then perhaps it would be best to not group that data with spawning habitat samples.
Attainment of 80% bank stability and associated rate of stream bank erosion for Challis Creek may be an appropriate goal based on natural condition database comparisons. The sediment load estimates and allocations presented in Table 21, page 67 and the assumptions, protocols and inventory techniques presented in Appendix I, pages 155-166 are items we wish to offer additional comment on (Please note that inclusion of the map of inventory reaches, road segments referenced on page 67 in the Draft Assessment and TMDL would have been of great help to reviewers):

Roads – The Forest acknowledges sediment contribution of roads as in the case where they parallel streams such as Challis Creek. The assumption of 32 inches annual precipitation used with the WEPP model in determining the existing erosion rate is unrealistic. An annual precip. Assumption of 16 inches would be generous in the instance of this location. We realize the rationale behind a margin of safety and need for conservative estimate of erosion load, but we also foresee the need for achievable targets for sediment reduction. Further application of standard BMP's and surfacing improvements are possible types of actions reasonable for the Forest to undertake. How do you propose quantifying actual reduction in sediment contribution from roads following changes or improvements?

A map will be included in the final document. Road inventories are intended to be gross allocations for comparison with streambank erosion. The contribution, even if it is over estimated, shows only 3 percent of the total load allocation for sediment. It is likely that if the proper BMPs for drainage, armoring and maintenance are in place on this road a significant reduction of sediment transport to Challis Creek will accrue. There are numerous road cuts and areas where the stream is eroding the road bed along the inventory reach. Reductions in sediment delivery will not be difficult to identify.

Ultimately improvements in sediment loading will be tracked through beneficial use support status. If Full Support is not attained, or if trends do not show improvement within a reasonable time then perhaps more vigorous implementation projects will be sought.

Stream banks - Existing and total erosion rate in Table 21 for the "Upper" Challis Creek stream reach is based on a short segment inventory (and subsequent projection to a much larger segment) which you have characterized as having 40% eroding bank. This stream reach is described generally as the portion of Challis Creek on the Forest from the road crossing below Mosquito Flat Reservoir downstream to the Forest boundary, minus the extensive beaver dam complexes within this reach. The subsequent worksheet calculation (page 164) results in this reach contributing 39% of the sediment loading for the Challis Creek TMDL (Table 21). This assessment is not supported by data gathered and analysis conducted by the Forest. Fish habitat surveys according to R1/R4 inventory protocols conducted by the Forest in 1993 on Challis Creek revealed a bank stability rating of 85% (USDA FS, 1994). Livestock use impacts, changes to riparian vegetation

indicative of declining conditions along Forest portions of Challis Creek have not been noted nor have any hydrologic events occurred in the ensuing period since the time of these habitat surveys.

The Challis Creek Watershed Analysis (USDA FS, 1997b) identifies the beaver dam complexes within this stream reach with braided channel, excessive bedload, high width to depth ratio and poorly developed floodplain as being a possible source of water quality impairment currently exiting this Forest portion of the subwatershed.

We suggest an on-site review of this reach of Challis Creek by DEQ and Forest personnel to resolve the discrepancies in our inventories and assessment of current conditions. Our mutual agreement on the source and extent of sediment related problems on National Forest portions of Challis Creek are essential to development of an accurate and realistic TMDL for this subwatershed by DEQ.

The inventoried reach is not extrapolated upstream above the Forest Service road crossing just above Lodgepole Creek. It does appear that streambank stability is higher above this road crossing and this is why a load allocation was not previously made above the road crossing. Additionally, as described in the inventory cross reference found in Appendix I, Forest Service bank stability ratings are different than that conducted in streambank erosion inventories. The overall sediment reduction in Challis Creek is small compared to many streams that have had sediment TMDLs prepared. Do not misconstrue 39% as an unrealistic allocation, the absolute difference in load reduction between 71 tons per mile per year and 36 tons per year is not unattainable. The differences between the erosion inventory and R1/R4 are not discrepancies, they are just different methodologies. Additionally, it may take many years after implementation of Best Management Practices to improve the conditions that the Forest Service sites in its Challis Creek Watershed Analysis. The conditions that are listed above are not typical of streams with beaver dam complexes in volcanic geology that are in balance with sediment load.

After reviewing your comments on the condition of streambanks on Challis Creek a third review of the upper contracted inventory reach was conducted and streambank stability was verified to be 45% unstable over the upper reach (55% bank stability). Additionally, evaluation of erosion conditions above the forest road crossing revealed the nature and extent of the Mosquito Flat Landslide. It appears that this is likely the primary source of sediment that has caused stream channel aggradation, and associated channel instability below the road crossing. It appears as though Challis Creek was able to transport the catastrophic sediment load to the depositional areas associated with the beaver complexes, which then resulted in channel aggradation and instability. It does not appear that there has been any effort to stabilize the landslide or to vegetate the erodable surface of the slide to reduce sedimentation of Challis Creek. It appears that there is some potential that the triggering mechanism could be related to placer mining activity that could have been exacerbated by occasional heavy releases from Mosquito Flat Reservoir, either

natural or management related. The net result is that the sediment load to Challis Creek will be increased to reflect the additional significant sediment sources that were not identified adequately in the Challis Creek Watershed Analysis.

Additional References Cited:

USDA FS. 1994. Chinook Salmon Biological Assessment for Ongoing and Proposed Activities within the Challis Section 7 Watershed on the Challis National Forest. Challis National Forest, Challis Ranger District.

USDA FS. 2000. Yankee Fork Ranger District Inland West Biotic Component – Fisheries Occurrence Database located at Rocky Research Station (http://fsweb.r4.fs.fed.us/unit/bpr/ iwwi.html#data_avail). Raw data is located at Salmon-Challis Nation Forest, Yankee Fork Ranger District.

USDA FS. 2001. Yankee Fork Ranger District Stream Temperature Graphs. Salmon-Challis National Forest, Yankee Fork Ranger District.

Comments by NMFS (response in bold)

The National Marine Fisheries Service (NMFS) would like to thank the Idaho Department of Environmental Quality (IDEQ) for this opportunity to provide comments on the Upper Salmon River subbasin assessment and Total Maximum Daily Load analysis (TMDL). NMFS would like to express special appreciation for IDEQ's extension of the comment period. The TMDL process, including subbasin assessments and locally authored implementation plans, provides a unique and vital opportunity to improve watershed health and speed recovery and delisting of ESA listed salmon and steelhead.

Federal agencies are required to consult with NMFS when their actions may adversely affect certain species listed under the Endangered Species Act (ESA). Federal actions subject to this examination include, but are not limited to, NEPA level projects, Federal approval of projects carried out by non-Federal agencies using Federal funds, and approval of non-Federal actions by federal agencies with regulatory oversight. This last category of Federal actions includes many Clean Water Act programs, such as discharge permits, 404(d) permitting, and TMDL approval. The United States Environmental Protection Agency is required, by federal law, to ensure that its discretionary approval of any TMDL will not jeopardize the existence of ESA listed species. These comments do not fulfill any obligation on the part of NMFS or the EPA regarding ESA consultation. They are intended only to communicate concerns the NMFS Boise field office has with the draft Upper Salmon River subbasin assessment and TMDL.

The Upper Salmon River Subbasin Assessment and Total Maximum Daily Load (TMDL) is not likely to adversely affect species listed under the Endangered Species Act.
NMFS has jurisdiction for three species of ESA listed salmon and steelhead in the Upper

Salmon River subbasin. Snake River sockeye salmon were listed as endangered under the ESA on November 20, 1991 (50 CFR § 224.101(a)). Critical habitat was designated on December 28, 1993 (50 USC § 226.205), and includes the Salmon River, Redfish, Alturas, Pettit, Yellow Belly, and Stanley lakes and their connecting tributaries. Snake River spring/summer chinook salmon were listed as threatened on April 22, 1992 (50 CFR § 223.102). Critical habitat was designated for this species on December 28, 1993 (50 USC § 226.205), and includes all reaches currently and historically accessible, excluding habitat above Hells Canyon and Grand Coulee dams. Snake River steelhead were listed as threatened on August 18, 1997 (50 CFR § 223.102). Critical habitat was designated on February 16, 2000 (50 CFR § 226.212), and includes all reaches currently and historically accessible, excluding habitat above Hells Canyon and Grand Coulee dams. The ESA is Federal legislation intended to protect and recover species in danger of extinction (endangered), or likely to become in danger of extinction (threatened). The ultimate goal of the ESA is to recover species to the point at which they no longer require protection under the ESA.

Each of these species has been in decline since before listing under the ESA. Analyses indicate significant gains must be made in early lifestage survival to reverse declining population trends. Perils faced by ESA listed salmon and steelhead in Idaho include: habitat destruction from development, agricultural and recreation use; water quality degradation from mining, road, and habitat alteration; lack of sufficient instream flows caused by water diversion; and loss of population integrity due to hatchery influence.

The TMDL as defined in the Clean Water Act is directed toward restoration of beneficial uses. The endpoint that TMDL targets and load allocations are directed toward is full support of beneficial uses including salmonid spawning and coldwater biota. Streams that demonstrate full support of designated or existing beneficial uses are removed from the 303(d) list and do not require development of TMDLs.

NMFS has commented on some of the proposed changes to the 303(d) status of reaches within this subbasin. Generally, it appears that a) data specific to salmon and steelhead habitat needs, such as substrate condition, are lacking, and b) the Beneficial Use Reconnaissance Program (BURP) does not adequately analyze habitat quality needed by ESA listed salmon and steelhead. These two issues are pervasive throughout the document, and form much of the basis for NMFS' concerns. NMFS also has specific data from Thompson Creek that may not have been available to IDEQ when preparing this document.

Aquatic habitat alteration is not a recognized pollutant for which a TMDL is prepared. The Subbasin Assessment is based on existing water quality data and supplemented, where possible, with additional data collected by DEQ. Issues that NMFS may have with the Beneficial Use Reconnaissance Program are programmatic issues that would be best dealt with through EPA.

Yankee Fork:

The Yankee Fork River was listed on the 1996 303(d) list for sediment and habitat alteration. This watershed assessment lists the Yankee Fork as being in "full support" of its designated uses, which include cold water aquatic life and salmonid spawning, and proposes the Yankee Fork be delisted. Habitat characteristics that influence salmon fry emergence, and therefore successful spawning, include dissolved oxygen, temperature, and percentage of fine sediment in spawning and incubation substrate. The physical impact of fine sediment is significant: fine sediment limits gravel interstitial space, removing available shelter and limiting oxygen saturation. Eggs and fry subjected to high fine sediment concentrations are literally suffocated. Emergent fry require interstitial space for shelter and feeding, space which is not available when fine sediment concentration increases.

The proposal is for the Yankee Fork to be listed for Habitat Alteration only. The biological signal is that the Yankee Fork is in Full Support of beneficial uses for coldwater biota and salmonid spawning. Full Support does not indicate that spawning habitat is in optimal condition. Purturbance of habitat is not a recognized pollutant for which a TMDL is prepared.

The watershed assessment cites % depth fines data prepared by the Salmon Challis National Forest, Yankee Fork Ranger District. Page 48 of the watershed assessment states that of five sampled sites, two had increasing fines trends, two had decreasing trends, and one site remained static. The authors point out that the increasing trend sites averaged 22 and 17 % over the five year sample period, and identify 27.5 and 24.2 as being the highest recorded percentages over that time period (although data presented on page 55 suggest 29.1 and 29.5 were the highest percentages sampled for those sites). Five year averages for each sample site are 23.8, 22, 17, 32.4, and 24.3% fines. Each surveyed site except Yankee Fork 5A contains fines at levels known to reduce chinook emergence. Spring/summer chinook emergence begins to be limited when fine concentrations reach 20%. Of the five areas sampled, all but one exceeds this number in both the five year average and most recent sample.

The text will be edited to show that 29.1 and 29.5 were the highest percentages sampled during 1996, and that most recently depth fines were below target levels. Target levels for fine sediment at depth are not intended to maximize spawning conditions, but to provide the potential for self sustaining production of salmonids. They are intended to meet the intent of the Clean Water Act, that waters of the United States be fishable and swimable. If water quality standards for 20% fines less than 6.35 mm are incorporated into state Water Quality Standards, or if beneficial use support is no longer used as a TMDL endpoint, a TMDL for the Yankee Fork of the Salmon River will be revisited. The potential does exist, however, for voluntary and cooperative projects among land and resource management agencies, and watershed stakeholders to improve water quality beyond that level required by the Clean Water Act.

According to the NMFS habitat matrix, substrate concentrations of 12 - 20% fines indicate an at risk watershed, and >20% indicate a not properly functioning watershed.

Recognizing that the Yankee Fork system has a very high natural background sediment contribution, the data provided still suggest impaired spawning habitat. Better characterization of the relationship between natural disturbance regimens and human disturbances should be made before these high concentrations of fine sediment can be discounted. Sediment "press" from human disturbance is a chronic problem in many sediment limited watersheds, halting or retarding overall improvement in sediment loads. The TMDL process can accurately identify what load reductions would be necessary to enhance beneficial use support (in this case, salmonid spawning), and promote identification of mechanisms to further reduce sediment loading and its subsequent adverse effects.

The NMFS habitat matrix is not currently incorporated into the state Water Quality Standards, or the Water Body Assessment Guidance. TMDLs are not currently prepared based on risk. They are intended to restore beneficial uses.

The evidence provided indicates the Yankee Fork River does not fully support salmonid spawning. BURP monitoring bases full support on the presence of fish from multiple size classes and macroinvertebrate biotic indices exceeding 3.5. Macroinvertebrate indices are able to detect changes in pollution and temperature at a gross scale. However, the finer and less evident effects of slight elevations in temperature on salmonid fish (e.g. reduced emergence) are not detectable through the relatively course filter of invertebrate indices. The BURP methodology does not directly assess the health or strength of salmonid populations, and thus cannot make definitive statements as to the level of support provided by a given stream. Gradual reductions in local populations are not detected by the BURP process, which provides more of a "population snapshot" rather than an assessment of population health. Salmon could continue to spawn, with less success, in impaired waters. Such a circumstance would not be identified through sole use of BURP findings. Full support for salmonid spawning would be more accurately demonstrated by assessing the quality of available spawning habitat and actual use of that habitat by juvenile and adult fish. Idaho water quality standards describe salmonid spawning beneficial use surface waters as "capable of supporting self-sustaining salmonid populations." Before sediment effects on spawning gravels can be discounted, IDEQ should examine spawning habitat and assess its quality. Then it can be determined whether available habitat is of sufficient quality to support "self-sustaining populations" and, if that habitat is not of sufficient quality, whether human pollutant contributions are responsible for the degradation.

Noted.

If such data are available to IDEQ, they should be presented in the watershed assessment. The data presented do not indicate the Yankee Fork River is in full support of salmonid spawning Data indicate the Yankee Fork remains sediment limited and would benefit from a TMDL. IDEQ identifies the Yankee Fork as a reach for which adequate data to evaluate pollutant loading do not exist. The BURP process does not adequately address the health of listed salmonid populations, and thus cannot provide assurance that the reach is in full support of its beneficial uses. IDEQ should retain this reach's 303(d)

listing until thorough data supporting its removal are available.

Thompson Creek:
Thompson Creek was listed for sediment and metals. The most impaired section of this creek is near the Scheelite Jim mill site, where acid rock drainage has contributed iron hydroxide loading to a significant section of the stream. The Salmon Challis National Forest has completed restoration activities at the mill site to mitigate the effect of mine tailings that contributed the probable pollutants.

The current subbasin watershed assessment provides no data addressing metals contamination. It is not clear from the current document if Thompson Creek is meeting water quality criteria for metals. BURP monitoring found communities of metals intolerant organisms. However, this is not an adequate substitute for direct measurement of dissolved or total metals in the water column.

NMFS also has concerns stemming from observations made at the reclamation site. A NMFS biologist and geochemist visited the Scheelite Jim mill site on August 28, 2001. Where tailings were removed as part of the cleanup effort, they observed an off-white precipitate on the surface of the ground at the same elevation as the road. In the depression between the covered tailings and the berm, water had pooled in a number of isolated ponds. It appeared there was no surface outlet for the pooled water to flow directly to Thompson Creek during dry periods. The pooled water in the depression had low pH (5.2 to 3.05), and red solid precipitates were seen within the various ponds. Red stains were found in the gravel in Thompson Creek and along its bank at several locations on the side of the creek adjacent to the reclaimed tailings. Also, a red stain line was observed on a large boulder about 0.6 m above the stream surface. This large boulder protruded from the bank on the side adjacent to the reclaimed tailings. The pH of Thompson Creek decreased by 0.5 pH (from 6.2 to 5.7) as it flowed past the floodplain containing the reclaimed tailings.

The observations that you are describing in your comment are the constructed wetlands that were developed by the Forest Service to contain the discharge of iron hydroxide and prevent it from reaching Thompson Creek.

It is likely that the red-precipitate and low pH in the ponds indicate the reclaimed tailings continue to generate acid-rock drainage (ARD). The pond water does not seem to be directly flowing into the Thompson Creek during low-flow conditions. However, the significant in the pH of Thompson Creek water flowing past the reclaimed tailings and the red precipitates within the creek bank on the side of the creek adjacent to the reclaimed area indicate that ARD is reaching Thompson Creek via groundwater flow beneath the constructed berm. The full extent of water quality degradation from this ARD will not be known until further sampling is conducted. Under Idaho's annual hydrologic cycle, the most significant releases of contaminants would probably occur during spring snow melt. The red-stain line 0.6m above the present low-flow water elevation may indicate even greater releases during high-flow conditions. In arid regions, interstitial waters in tailings containing high levels of dissolved solids can migrate to the

ground surface by capillary action. Upon evaporation of the water at the ground surface, the dissolved solids begin to precipitate. Depending on the mineralogy of the rock dissolved during the formation of ARD, the salts can range from $CaSO_4$ (gypsum) to $ZnSO_4$. Dissolution of the $ZnSO_4$ solid during the first rain event in the fall has led to massive fish kills in the Clarks Fork River. Collection and chemical analysis of the solid salts present at the elevation of the road prior to the fall rainy season may provide some insight into the nature of the chemical release from the reclaimed tailings. NMFS recommends IDEQ investigate these possible ARD problems. Reclamation activities implemented thus far may not be sufficient to protect water quality from periodic metals contamination episodes and pH impacts in this stretch.

It appears to be anticipated by the Forest Service that there will be continued ARD, and that the wetlands are intended to isolate ARD from the stream. The stains that you describe within the stream may also be from the period prior to the wetland construction. Changes in pH documented in Thompson Creek by the Forest Service at 5 sample sites above and below the reclaimed mill site appear to be within the range of the state water quality criteria for pH of 6.5 to 9.0 (IDAPA 58.01.02-250.01.a. Surface Water Quality Criteria for Aquatic Life Use Designations). The Scheelite Jim Wetlands PHASE II report is available from the Yankee Fork Ranger District.

IDEQ does not feel Thompson Creek is sediment limited, indicated by the presence of sediment intolerant invertebrates. As with the Yankee Fork, using biotic indices as the main indicator of sediment impairment is unsound. Also, simply noting fish presence, absent some evaluation of habitat quality, doesn't adequately identify the effects of sediment loading. Since IDEQ presents little data for sediment levels in Thompson Creek it is difficult to know if this stream is or is not sediment impaired. IDEQ identifies Thompson Creek as a reach lacking thorough data. Until data are obtained that adequately characterize sediment and metals loading for this reach, and adequately describe beneficial use support, NMFS believes the 303(d) listing should be retained.

See response above regarding issues that NMFS may have with the Beneficial Use Reconnaissance Program.

Upper Salmon River:
IDEQ proposes to delist the Upper Salmon River, from Hell Roaring Creek to Redfish Lake Creek, for sediment impairment. IDEQ provides limited data that indicate significant levels of fines are present (42% and 51%). There appears to be more discussion on the source of this sediment that was inadvertently eliminated from the document (page 51 in the document provided to NMFS on Jan 28, 2002) that may explain these high sediment levels. However, absent that discussion, the only data provided are the two extremely high percent fine levels. IDEQ identifies natural processes as the dominant sediment source in this reach, but goes on to identify sediment contributions from agricultural and recreational impacts. These impacts are not quantified in the document, providing little support for the position that sediment loads are not unduly elevated and could not be corrected through the TMDL process. The subbasin

assessment identifies this reach as one for which little data is available. Since the only monitoring data presented indicate high sediment loads, and the BURP program is not able to adequately determine listed salmonid population health, NMFS believes the 303(d) listing for this reach should be retained until data are provided that satisfactorily indicate no impairment.

This section of the Salmon River has been determined to be in full support of coldwater biota and salmonid spawning beneficial uses based on Large River BURP assessment and available fish data. Index scores were high and this segment of river has been identified for potential use as a reference segment for this size river.

NMFS is eager to participate in finding solutions to watershed impairment. As TMDLs and implementation plans for this subbasin are developed, NMFS would be pleased to offer opportunities to take advantage of NOAA habitat restoration funds. NOAA/NMFS has an active marine, estuarine and anadromous fresh water habitat restoration program. The NOAA Community-Based Restoration Program began in 1996 to inspire local efforts to conduct meaningful, on-the-ground restoration of marine, estuarine and riparian habitat. Since that time, NOAA has funded 179 small-scale habitat restoration projects around the U.S. coastline and in freshwater anadromous fish habitats. Most of these projects contain an outreach or education component to develop natural resource stewardship.

The program links seed money and technical expertise to citizen-driven restoration projects, and emphasizes collaborative strategies built around improving NOAA trust resources and the quality of the communities they sustain. Community-based habitat restoration helps repair habitats required by marine and anadromous fishes, endangered species and marine mammals. These programs have proven advantageous to communities in Washington and Oregon, and could provide assistance to Idaho residents as well. They may help fill gaps left by EPA, state, and private efforts, and become part of a cohesive strategy to correct ailing watersheds. Vincent Kozakiewicz (208-685-6905), in NMFS' Boise field office, can provide details and assistance to those interested in NMFS granting programs. Funding for these projects is provided through an annual direct solicitation for project proposals. Applications for fiscal year 2002 must be postmarked by April 15, 2002.

Thank you for this opportunity to comment on the draft Upper Salmon River subbasin assessment and TMDL. NMFS hopes that these comments can be used to further IDEQ's mission and promote recovery of listed Snake River salmon and steelhead. If you have questions regarding these comments, please call Chris Looney at 208-378-5689. I can also be reached via email at chris.looney@noaa.gov, or by post at NMFS, 10215 W. Emerald St. Suite 180, Boise ID, 83704.

Comments by EPA (response in bold print)

Thank you for the opportunity to review the draft Upper Salmon River Subbasin Assessment and Total Maximum Daily Load (TMDL) that was released for public

comment on January 22, 2002. Following are the U.S. Environmental Protection Agency (EPA) comments on this draft Subbasin Assessment and TMDL.

This draft document presents a Subbasin Assessment for the Upper Salmon River Watershed, a TMDL for Challis Creek for sediment, a TMDL for Kinnikinic Creek for zinc, and the analysis used in developing the TMDLs and Subbasin Assessment. EPA would like to acknowledge the significant effort that went into developing this Subbasin Assessment and TMDL. The following comments provide some suggestions on changes which would help clarify the Subbasin Assessment and TMDL, as well as comments regarding 303(d) listing issues that were raised in the Subbasin Assessment.

Executive Summary
Please include an orienting map that details the location of Challis and Kinnikinic Creek and where they are in relation to the Salmon River.

A map will be included in the Executive Summary that includes the Salmon River and Challis Creek, the TMDL stream.

Please include a brief discussion of the Idaho Water Quality Standards (WQS) that lead to the 303(d) listing of these waters as impaired for sediment and zinc and that the TMDLs are being developed to ensure compliance with these WQS.

As stated in the Executive Summary of the document TMDLs are written to restore full support of beneficial uses which include salmonid spawning and coldwater aquatic life. The origin of the 1998 §303(d) listing, from which the TMDL for Challis Creek is being prepared, is not related to particular water quality standards, but to beneficial use support. It is further stated that full support in Challis Creek may not be attained due to flow alteration, even after sediment BMPs are implemented. The Idaho Water Quality Standards for sediment are narrative and the intent of the TMDL is directed toward restoration of beneficial use support.

Kinnikinic Creek is listed for unknown pollutants on the 1998 §303(d) list. Water quality standards for zinc <u>are</u> quantitative, though the TMDL endpoint is restoration of beneficial use support. Sampling in April 2002 shows that zinc levels in Kinnikinic Creek are below criteria, streambank erosion is slight and that diversion of surface water to operate a hydroelectric turbine has been eliminated. It has become apparent that the greatest purturbance to water quality in Kinnikinic Creek was from dewatering of the stream channel below the mine. Fine sediment deposition has been observed to be primarily along the banks of the Creek and not in significant quantities. Spawning habitat is primarily above the Clayton Silver Mine on Kinnikinic Creek. Based on this follow-up assessment, in light of the fact that the tailings pile has been capped and the channel has been reconstructed to isolate it from the tailings the TMDL has been removed from the document.

DEQ will continue to evaluate beneficial use support through the regular monitoring of surface waters.

The listing of a 350% reduction for zinc in the Kinnikinic Creek Loading Summary is perplexing. The more common calculation for percent reduction for this case would be (225-59/225) which equates to a 74% reduction. Please include an explanation for how a 350% reduction will meet the WQS.

This load reduction is no longer warranted and will be removed.

Characterization of the Watershed
For orienting purposes, it would be helpful if the several maps between pages 3-10 included the names of landmarks, especially cities.

Challis and Stanley will be added to the maps to aid orientation.

Several of the Sub-Watershed Descriptions include discussion about temperature data. For example, on page 25 in the Upper Harden-Big Casino sub-watershed discussion it is noted that a spot temperature measurement in the Salmon River was as high as 18°C; based on the presentation of this material, EPA would encourage IDEQ to review all the temperature data that has been collected for the Upper Salmon Watershed to ensure that the criteria are being met and list any waters where the criteria are not being met.

Water temperature data that was provided to DEQ after written request was made to federal land management agencies for development of the Subbasin Assessment appear in sub-watershed discussions. Water quality data is requested from all known sources at the beginning of the Subbasin Assessment process. No raw data was received, only graphical data summaries were provided. If graphical representations of temperature data can be interpreted to show temperature criteria exceedances they will be described in the appropriate sections. Spot temperatures do not show criteria exceedance in relation to the percent of observations over a particular time, and TMDLs for temperature will not be written for streams based on single instantaneous temperature measurements. These data will be treated as anecdotal data. Bull trout temperature criteria, according to the US Fish and Wildlife Service, is still in consultation, and will not be used to write TMDLs by the Idaho Falls Regional Office of DEQ until resolved.

Throughout the Sub-Watershed Descriptions information is presented on sub-watersheds that do not include 303(d) listed water. In some cases the information presented suggests data gaps exist in determining if the waters are meeting Idaho WQS. For example, on pages 28-29 the Huckleberry-Fisher sub-watershed discussion mentions that Fisher Creek appears to have fine sediments in excess of 30% and that Gold Creek and Williams Creek are believed to have elevated fine sediment and reduced streambank stability. To better present this data in a way the public can easily understand, EPA recommends that IDEQ create a table similar to Table 20 on page 59, for Data Gaps that exist for non 303(d) listed waters.

If waters are determined to be in full support of aquatic life beneficial uses it is not implied that there is a data gap in determining if the waters are meeting Idaho WQS, particularly narrative "free from" standards. The data used in Sub-Watershed Descriptions is existing data supplied by agencies to aid in assessment of the Subbasin's water bodies. These water bodies receive continued monitoring by land management agencies and by DEQ.

The data gaps section is intended to reflect the data needs to further evaluate streams that are 303(d) listed and fall into Need Verification or Not Full Support assessment categories. Logistical limits of Federal Land Management agencies will dictate monitoring data priorities. Idaho WQS are not based on sediment targets used in TMDLs, and, conversely, compliance with Idaho WQS cannot be determined based on % fine sediment or % streambank stability since the standards are narrative and not based on these quantitative targets. A clearer statement will be made to illuminate the difference between TMDL sediment targets and water quality standards for the public's benefit as well as EPAs.

Page 27, Valley Creek
The information presented by the Forest Service habitat assessment data on sediment and stream bank stability suggest that Valley Creek is not meeting Idaho WQS and should be 303(d) listed for sediment and habitat alteration.

The Forest Service habitat assessment data show elevated depth fines and streambank stability less than 80%. Targets used in TMDLs are not to be confused with water quality standards, or Forest Service Standards for depth fines (20% in anadromous waters). Valley Creek is assessed to be in full support of aquatic life beneficial uses and will not be 303(d) listed for sediment or habitat alteration. Narrative water quality standards are being met in Valley Creek.

Water Quality Concerns and Status

Water Quality-limited Waters

Page 37, Water Quality-limited Waters
It should be noted that Squaw Creek has been 303(d) listed for temperature as stated in Table 3. It is no longer being proposed as suggested in the opening paragraph.

The text will be changed to reflect that EPA listed Squaw Creek based on an instantaneous temperature measurement collected as part of a BURP survey.

Page 38, Figure 7:
Kinnikinic Creek is not highlighted as 303(d) Listed.

The map will be changed to reflect Kinnikinic as a 303(d) listed water from Sawmill Creek to the Salmon River, approximately 3 miles.

Water Quality Standards

Page 39, Table 4:
Table 4 makes reference to Map Codes that relate to specific Water Bodies and Designated Uses, but no map is included to show what those Map Codes relate to. For clarity, a map should be included so the public can understand what those Map Codes are referring to.
The Map Code referred to in Table 4 has changed in the Water Quality Standards and should be referred to as a Unit Code. There is no map within the Water Quality Standards that refer to the unit codes, this designation is narrative for administrative use.

This column is represented in the text and will be removed to simplify the table.

For clarity, please note that existing uses must also be protected, in addition to Cold Water aquatic life and Primary and Secondary Contact Recreation.

A statement that defines existing and designated beneficial uses and their protection will be added to the Water Quality Standards section and to the Glossary

Page 40
For clarity, Idaho's standard for turbidity should be included with the discussion of the sediment standard.

The standard for turbidity will be added to this section.

For a better understanding of the relationship between nutrients and dissolved oxygen (DO), the DO standard should be included with the nutrient standard on page 40.

The standard for dissolved oxygen will be added to this section.

Page 41, Bull Trout Temperature Criteria
The Federal Bull Trout standard should be included in this section, as well as a discussion of which streams it applies to in this watershed.

The federal bull trout standard is included in this section.

Water Body Assessments

Page 42, Garden Creek
The BURP Assessment for Garden Creek within Challis city limits shows a "Need Verification" Assessment because of a 3.42 MBI Score and 65 Habitat Score, while the Subbasin Assessment recommends re-listing this section for flow and habitat alteration.

On page 62, in the Garden Creek Summary, it is stated that one sediment sample suggests high depth fines. Is DEQ planning to re-evaluate this site to ensure compliance with Idaho's WQS?

This reach is in compliance with Idaho's narrative WQS for sediment. The WQS for sediment are not based on depth fines. Garden Creek is included in the region wide Beneficial Use Recconnaissance Program for continued rapid bioassessment, which determines beneficial use support.

Page 43, Road Creek
The 1995 BURP Assessment shows that two sampling locations are not in full support of WQS for cold water biota. While one of the locations has low flow, the other had a flow of 14.5 cfs. The MBI Scores for the 1997 monitoring are both above the 3.5 threshold that are considered adequate by Idaho's water quality standards. It would be helpful to know where the sampling sites from 1995 are in relation to the sites from 1997, because it seems from the information presented that the area around an elevation of 1722 m is not fully supporting cold water biota. The Conclusions and Recommendations presented by Clark in Appendix F suggest that Road Creek is impacted by fine sediment. Based on this information, it would seem that Road Creek should be listed for sediment.

There is no question that Road Creek is impacted by fine sediment. Sediment impacts are not great enough to limit beneficial use support at sites that have adequate flow. Sites with adequate flow show full support. The 1995 site that you are referring to was sampled on June 27th during peak runoff. It is dry for significant periods after peak runoff in normal years. In dry years it may not flow at all during the period of snowmelt. The greatest purturbance to the stream here is lack of flow for significant periods of the year. The greater impact to the lower site at 1722 meters is from consistent and sustained dewatering for much of the year. If there comes a time when flow issues can be addressed and the reach continues to show less than full support then a sediment TMDL may be warranted. Until that time it can be expected that MBI scores will be quite variable due to flow conditions. This condition will be made more clear in the TMDL.

Page 45, Challis Creek
It is noted that there were no indications of deleterious levels of aquatic plants or nuisance levels of algae in Challis Creek. For clarity, IDEQ should include any DO, field survey or other data that has been collected to show how this conclusion was reached.

Dissolved oxygen data has not been collected through the BURP analysis or by land management agencies. Observations are made during erosion inventories.

Page 45, Thompson Creek
To better understand the possible influence of the Thompson Creek Mine, a discussion of where the BURP sampling locations are in relation to the mine and the Schellite Mill, should be included.

A map showing BURP locations and the Schellite Jim Mill Site will be developed and included in the text.

Please see the attached document, 303(d) Listing Comments, that have been provided by Region 10's Impaired Waters Coordinator, Kerianne Gardner.
303(d) Listing Comments (response in bold print)
For clarity, it would be helpful to know what BMPs were implemented and what data is available to show that they are working.

A complete description of the Scheelite Jim Wetlands and the associated water quality data was received from (and is available from) the Salmon-Challis National Forest: Yankee Fork Ranger District (HC67, BOX 650, Clayton Idaho 83227) on May 15, 2002. Scheelite Jim Wetlands Phase II: WETLANDS DEVELOPMENT, STREAM HABITAT RESTORATION AND WATER QUALITY MONITORING February 2002. This data has been summarized in the final TMDL.

Page 47, Warm Spring Creek
Statements in the third paragraph, pertaining to the need to develop a TMDL for "ditches", are not entirely accurate. If a waterbody does not meet the definition of a water of the U.S. (See 40 CFR 122.2), then the Clean Water Act and water quality standards do not apply to the water, and therefore TMDLs are not required. However, if Warm Springs Creek meets the definition of a water of the U.S., then a TMDL would be required since it is included on the Idaho 303(d) list, unless it can be demonstrated that it complies with water quality standards.

If there is a factual basis to conclude that Warm Springs Creek is not a water of the U.S., we recommend that you provide documentation in the SBA, and subsequently propose de-listing the waterbody.

If Warm Springs Creek is a water of the U.S., then options you might want consider include proceeding to write a TMDL, or in recognition that a coldwater aquatic life beneficial use and criteria may not be appropriate, defer TMDL development (e.g. TMDL schedule change) until such time as beneficial uses and criteria are revised

By definition, Warm Springs Creek is not navigable water of the United States, as it is used to define authorities of the Corps of Engineers, or the Environmental Protection Agency. As stated in the Federal Register in Vol. 51, No. 219 Part 329 § 329.3. Precise definitions of "navigable waters of the United States" … are ultimately dependent on judicial interpretation and cannot be made conclusively by administrative agencies.

Warm Springs Creek is diverted in its entirety into a manmade ditch for the primary use of agricultural irrigation, and secondarily for hydroelectric production. It's flow is not returned to surface water of the United States, and the ditch is not a water transfer system between waters of the United States. Warm Springs Creek: has not been, and is not susceptible to use in interstate commerce, is not interstate

water, nor would it affect interstate commerce, is not a recreational water subject to use by interstate travelers (it's exclusively on private land), and is not a commercial fishery.

The natural channel is dry, and is not expected to receive water in the future. Excluded in 40 CFR 122.2 under definitions of Waters of the United States are manmade bodies of water, which neither were originally created in waters of the United States (such as disposal area in wetlands) nor resulted from the impoundment of waters of the United States. [See Note 1 of this section.] Waters of the United States do not include prior converted cropland.

Page 47, Yankee Fork
On page 59, Table 20 Yankee Fork is listed on the "Data Gaps for 303(d) listed water bodies," as having some sediment data and on page 25 in the Upper Harden-Big Casino Sub-Watershed Description it is stated that "The Yankee Fork is also presumed to be a major source of sediment to the Salmon River (SNRA, 1999c)." The BURP data presented on page 48 show that the sites sampled had high MBI scores, however two of the habitat scores fall below 70. In the discussion of the Yankee Fork it is also mentioned that two of the five sites sampled showed "significant increases" in depth fines. Based on all of this information, will IDEQ continue to monitor Yankee Fork for sediment problems?

As stated in the TMDL, habitat is not a recognized pollutant and the depth fines samples that increased were well below sediment targets identified in the TMDL.

This reach is in compliance with Idaho's narrative WQS for sediment. The WQS for sediment are not based on depth fines. The Yankee Fork of the Salmon River is included in the region wide Beneficial Use Reconnaissance Program for continued rapid bioassessment, which determines beneficial use support.

Page 49, Kinnikinic Creek
With respect to the language of the TMDL, the goals of the TMDL are erroneously described as "EPA Gold Book Standards". The goals should be described as the Idaho water quality criteria for zinc. Idaho has adopted federal toxics criteria into their water quality standards.

The reference will be changed to reflect 40 CFR 131.36 (b)(1) (National Toxics Rule) as incorporated by reference.

The Conclusions and Recommendations presented by Clark in Appendix F suggest that Kinnikinic Creek is impacted by fine sediment. Based on this information, it would seem that Kinnikinic Creek should be listed for sediment.

Kinnikinic Creek will continue to be evaluated to determine if it is potentially impacted by sediment in addition to zinc. Best management practices have been implemented to reduce sediment and metals loading to Kinnikinic Creek.

Continued monitoring will determine if beneficial uses continue to not be fully supported. Kinnikinic Creek is included in the region wide Beneficial Use Recconnaissance Program for continued rapid bioassessment, which determines beneficial use support. Kinnikinic Creek will be placed under category 4b of the 2002 Integrated Water Quality Monitoring and Assessment Report Guidance.

Page 50, Lost Creek
The Conclusions and Recommendations presented by Clark in Appendix F suggest that Lost Creek is impacted by fine sediment. Based on this information, it would seem that Lost Creek should be listed for sediment. While it is true that for flow that is below 1 cfs, numeric criteria do not apply. Narrative criteria still apply, as would be the case for sediment.

As stated in IDAPA 58.01.02 §.070 06: Numeric water quality standards only apply to intermittent waters during optimum flow periods sufficient to support the uses for which the water body is designated. For recreation, optimum flow is equal to or greater than five (5) cubic feet per second (cfs). For aquatic life uses, optimum flow is equal to or greater than one (1) cfs.

The narrative criterion for sediment is: Sediment shall not exceed quantities specified in section 250 (turbidity criteria), or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determination of impairment shall be based on water quality monitoring and surveillance and the information utilized in section 350.02.b.

Evaluations of surrogate measures are often used as a mechanism to reflect potential sediment problems. In the case of Lost Creek, streambank stability approaches 100% in a very low flow (.6 cfs) spring driven wet meadow system characterized by an E5 channel. Substrate fine sediment less than 6.35mm diameter greater than 80% are typical in this channel type.

Based on water quality monitoring and surveillance water quality criteria are being met. There is not impairment as a result of a nonpoint source activity by itself or in combination with other point and nonpoint source activities and there are no activities occurring in a manner not in accordance with approved best management practices. In summary, narrative sediment criteria are being met.

Page 50, Salmon River
The BURP data for the Salmon River shows that one of the 1995 locations, between Alturas Lake Creek and Hwy 93, is in full support of beneficial uses, yet the MBI score falls below the 3.5 and the Habitat Score falls below 70, scores that would typically lead to a "Needs Verification" assessment. The MBI score for the Headwaters above Frenchman Creek in the 1998 assessment is 2.48. IDEQ did note that the 1998 information has not been assessed. However, this information coupled with the 42% and 51% of depth fines less than 6.35 mm at the upper and lower sites would seem to indicate that these sites need further assessment to determine if all areas in question are full

support of beneficial uses. Table 20 on page 59, "Data gaps for 303(d) listed water bodies," also states that limited suspended sediment and temperature data are available for the Salmon River and there are only two depth fine samples, again this would seem to suggest that further assessment is needed before a determination about whether or not a TMDL would be necessary for this system.

The WQS for sediment are not based on depth fines. The Salmon River above Hell Roaring Creek is included in the region wide Beneficial Use Reconnaissance Program for continued rapid bioassessment, which determines beneficial use support. If the upper reach of the Upper Salmon River is assessed at less than full support on the next 303 (d) list it will have a total maximum daily load allocation developed in the next TMDL cycle.

Large River BURP assessment shows that the 303 (d) listed reach of the Upper Salmon River is in Full Support of Aquatic Life Beneficial Uses.

Page 53, Abandoned Mines and Mill Sites and NPDES Discharges
Based on the information presented in Tables 16 and 17, EPA agrees with IDEQ's recommendation that more sampling is needed to determine if there are any violations to the states WQS. The "Comments" suggest that for Clayton Silver Mine/Mill, Silver King Mine/Mill, and Livingston Mill more data needs be collected to determine if they are in compliance with Idaho WQS.

The information presented on the Thompson Creek tungsten mine site near Basin Creek, shows the pH to be below Idaho WQS. Based on this information, this section of the creek should be 303(d) listed for pH and a TMDL developed to address pH.

Data submitted after the public comment period shows that pH is within Idaho WQS for pH on Thompson Creek near Basin Creek. This data will be summarized in the Thompson Creek Water Body Assessment section.

Page 55, Table 18 Salmon-Challis National Forest Sampling Sediment Data
Based on the information on percent fines presented in this chart, the following have high sediment values: Morgan Creek (3A), East Pass Creek, Herd Creek, Tenmile Creek, McKay Creek, and Basin Creek. Will IDEQ be doing any follow up monitoring to ensure that WQS are being met?

The WQS for sediment are not based on depth fines. These streams are included in the region wide Beneficial Use Recconnaissance Program for continued rapid bioassessment, which determines beneficial use support. These streams currently are assessed to be full support of beneficial uses for aquatic life.

Page 59, Table 20
For 303(d) listed waters that have nutrient data gaps, EPA recommends that IDEQ list DO as a data gap, based on the relationship between nutrients and DO.

The Idaho WQS are narrative criterion for nutrients and are based on visible nuisance aquatic growth. Where there are visible levels of nuisance aquatic growth combined with elevated nutrients determined through laboratory evaluation it may be appropriate to evaluate dissolved oxygen. The Water Quality Standards section of the TMDL adequately discusses considerations related to DO sampling.

Challis Creek TMDL

A map should be included for Challis Creek that shows where it flows into the Salmon River and where landmarks are located (For example, in the Challis Creek TMDL mention is made of Mosquito Flat Reservoir and Challis Creek Road, but no map is include to show where these features are located). For clarity, the Challis Creek Summaries (pages 17-19 and pages 44-45) and the applicable Water Quality Standards should be included as part of the Challis Creek TMDL. In the discussion about Loading Capacities and Targets, information about the current sediment load in Challis Creek should also be included.

Given that the load allocations listed in Table 21 are addressed by reach number, a map needs to be included to show where the reaches are located on the creek. Please include on Table 21 that wasteload allocations are zero.

Figure 7. shows an overview of the relationship of Challis Creek to the Salmon River in the subbasin. A map that shows inventory reaches and landmarks will be incorporated into the TMDL section.

Including the TMDL with the Subbasin Assessment is intended to get away from the redundancy of including several sections in multiple places in the document. This system has been used successfully in previous approved TMDLs. It is not felt that repeating sections improves clarity.

<u>Loading Capacities and Targets</u> and <u>Load Allocation</u> are distinct sections in the EPA Region 10 TMDL Review Guidelines that list specific considerations. IDEQ has incorporated these considerations into the required elements. Immediately following the Loading Capacities and Targets section, for clarity, are sections on Existing Sediment Sources, Estimates of Existing Load, Waste Load Allocation and Load Allocation.

Kinnikinic Creek TMDL

A map should be included for Kinnikinic Creek that shows where it flows into the Salmon River and where landmarks are located.

Figure 7. shows an overview of the relationship of Kinnikinic Creek to the Salmon River in the subbasin.

Loading Capacity and Load Allocation

The TMDL elements are expressed as instream concentrations. These instream targets are important and should be provided in the document, but a more traditional TMDL

approach is to calculate loading capacity as the allowable metals load and allocate that load to natural background, point and non-point sources, and a margin of safety. For reference, this is the approach used in the Coeur d'Alene Basin TMDL. While the available flow data are more limited for this creek, one could estimate the range of potential flows and employ the same approach here.

Allocations for adits and/or mine tailings should be expressed as wasteload allocations, since they are considered point sources.

The TMDL elements are expressed as instream concentrations based on existing data. More precise data on natural background, point and non-point sources is not currently available. The particular loading for adits and specific tailings are arrived at as instream concentrations because specific loading data does not exist, and the relationship of groundwater inputs cannot be specified at this time. This, combined with the lack of an NPDES permit, precludes dealing with these potential sources as a wasteload allocation. Kinnikinic Creek will be placed under category 4b of the 2002 Integrated Water Quality Monitoring and Assessment Report Guidance.

Percent Reduction
The listing of a 350% reduction is perplexing. The more common calculation for percent reduction for this case would be (225-59/225) which equates to a 74% reduction.

The Kinnikinic Creek TMDL will be removed from the document because follow-up monitoring by DEQ has shown that the TMDL is no longer warranted and best management practices have been implemented.

Margin of Safety
The instream zinc goals of the TMDL (65 ug/l chronic and 59 ug/l acute) are calculated using the mean hardness (50 mg/l), and it is then asserted that the use of this hardness value represents a margin of safety. There is no margin of safety in using a mean hardness. Instead, the target concentration will be too high 50% of the time. The state of Idaho used the 5th percentile hardness value in establishing the instream zinc goals for the Coeur d'Alene River Basin TMDL for Dissolved Cadmium, Lead, and Zinc issued in August 2001. EPA's NPDES program also uses the 5th percentile hardness when establishing water quality-based permit limits.

EPA appreciates the opportunity to comment on the draft Upper Salmon River Subbasin Assessment and TMDL and looks forward to the final submission. If you have any questions regarding the comments on the draft TMDL, please contact me at 206-553-6326.

Sincerely,

Tracy Chellis
TMDL Project Manager

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GLOSSARY

7Q2 – A term used in the state Water Quality Standard to express the lowest 7-day average flow with an average frequency of recurrence of every two years.

"A" channel - A Rosgen channel type characterized by a fairly straight (sinuosity < 1.2), steep (high gradient 2-10%), highly confined (<1.4), single channel, with a low (<12) width to depth ratio.

Adaptive Management – An explicit and analytical process for adjusting management and research decisions to better achieve management objectives; this process should quantitative wherever feasible. Adaptive management recognizes that knowledge about natural resource systems is uncertain. Therefore, some management actions are best conducted as experiments in a continuing attempt to reduce the risk arising from that uncertainty. The aim of such experimentation is to find a way to achieve the objectives as quickly as possible while avoiding inadvertent mistakes that could lead to unsatisfactory results. The concept of adaptive management is readily understood because it represents the common sense of "learning by doing."

Agriculture Water Supply - A beneficial use, designated by the Division of Water Quality, which indicates that water quality is at such a level that it can be used for irrigation or livestock watering.

Aesthetics and Human Health - A beneficial use, designated by the Division of Water Quality, which indicates that water quality is good enough to not pose a significant health risk or be aesthetically unpleasant.

Allotment - An area of land designated and managed for the grazing of livestock.

Allotment Management Plan - A plan designed by the permitting agency and the user which prescribes the grazing management for the allotment, including rotation system and resource objectives.

Anadromous - An aquatic life history strategy where freshwater habitat is used for spawning and juvenile rearing and the ocean (saltwater) is used for maturation to adult.

Aspect - The direction a surface is facing, generally related to a magnetic bearing. A south aspect would face south.

Attainable Beneficial Use or Attainable Use – A beneficial use, that with appropriate point and nonpoint source controls, a water body could support in the future.

Background – The biological, chemical, or physical conditions of waters measured at a point immediately upstream (up gradient) of the influence of an individual point or nonpoint source discharge, or existing prior to the point or nonpoint discharge if no valid up gradient site is available.
Base Flow - The water flow as measured during the period of lowest standard flow; in this area, it is usually mid-summer.

"B" channel - A Rosgen channel type characterized by a moderately straight (sinuosity 1.2-1.4), steep (high gradient < 2-9%), moderately confined (1.4-2.2), single channel, with moderate (14-26) width to depth ratio.

Beneficial Use - A term used by the Idaho Department of Environmental Quality to identify uses which water quality supports in a given stream or lake.

Best Management Practice (BMP) - A state of Idaho standard that defines a component practice or combination of component practices determined to be the most effective, practical means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.

Biological Evaluation/Assessment - A process document that evaluates the effect of a regulated action on the biologic species under investigation and quantifies the extent of that effect. If it is determined that an action "may affect" the given species, consultation with the designated oversight agency (either National Marine Fisheries Service or US Fish and Wildlife Service) is required.

BLM - Bureau of Land Management, United States Department of the Interior.

C - Celsius; a temperature scale where freezing occurs at 0 degrees and boiling at 100 degrees.

Candidate Species - A species under investigation for listing under the Endangered Species Act, but for which limited information is known about its current status or biological vulnerability, or for which regulatory rules have been created but not issued.

"C" channel - A Rosgen channel type characterized by a winding (sinuosity > 1.4), flat (low gradient < 1-3.9%), unconfined (> 2.2), single channel, with a moderate to high (> 12) width to depth ratio.

***Carex/Juncus* Community** - A vegetative community composed predominately of sedges and rushes.

cfs - cubic feet per second; used for characterizing the volume of moving water in a stream.

Channelization - The action of altering the natural stream channel and hydrology of the system to redirect water flow or prevent soil loss.

Channel Type - A classification system which seeks to identify the hydrologic characteristics of a stream, such as sinuosity, gradient, meander potential and bank characteristics.

Cobble Embeddedness - The degree to which cobbles are surrounded or covered by fine sediment (sand or silt); usually expressed as a percentage.

Cold Water Biota - A beneficial use, designated by the Idaho Division of Water Quality, which indicates that water quality is high enough to support macroinvertebrates and fish.

Cumulative Effects - All of the combined actions and resultant effects which must be considered to effectively evaluate the effect of an additional, new action (i.e., a review to see if this is "the straw that will break the camel's back").

Deferred Rotation - A grazing system in which pastures are used at different times each year.

Degradation - The alteration of a given biological community in a negative manner which reduces the viability or diversity of the community and results in a change in ecological processes.

DEQ – State of Idaho Department of Environmental Quality.

Discretionary Action - An action that a land management agency has the ability to regulate.

Dispersed Recreation - Any recreational activity that doesn't occur at a designated recreational site or area.

Diversion - A physical structure that redirects water flow from a stream or spring into a ditch used for irrigation purposes.

Diversity - A variety of plants, animals or community types.

Ecological Condition - A reflection of the dynamic equilibrium of an overall watershed; the long term health of the complete system and not individual parts of it.

Ephemeral - A water source that only flows at certain, irregular times of the year, such as at spring runoff or during thunderstorms.

F - Fahrenheit; a temperature scale where freezing occurs at 32 degrees and boiling at 212 degrees.

Fault - A fracture or a zone of fractures along which there has been displacement of the sides relative to one another parallel to the fracture.

Fecal Coliform Bacteria – A type of bacteria common to the digestive tract of warm blooded animals that is identified as an indicator of the presence of a range of pathogenic bacteria that can cause illness to humans or livestock if ingested.

Fines – A particle of sediment below a designated diameter (such as 6.35 mm) that is known to effect salmonid egg or fry survival through emergence.

Fish Screen - A screen on a diversion designed to allow water to flow through it while preventing passage by fish and directing them back into the stream.

Flood Irrigation - A method of irrigation using water diverted from a stream or spring through a ditch that allows the water to flow across a wide area, using gravity or topography to spread the water.

Forb - Any herbaceous plant, other than a grass, especially one growing in a field or meadow.

Forest Land - Forested lands of ten or more acres capable of being ten percent stocked by forest tree species, and not currently set aside for non-timber use.

FS – United States Forest Service, Department of Agriculture

Full Support – A category of water quality status. A water body whose status is "Full Support" is in compliance with those levels of water quality criteria listed in Idaho's *Water Quality Standards and Wastewater Treatment Requirements*, or with reference conditions approved by the Idaho Department of Environmental Quality Director in consultation with the appropriate Basin Advisory Group.

Functional at Risk Condition - Riparian-wetland areas that are in a functional condition but an existing soil, water or vegetation attribute makes them susceptible to degradation.

Geometric Mean – The nth root of the product of n data: $((X_1)(X_2)(X_3))^{1/3}$ Used to establish the central tendency when averages of rates or index numbers are required.

Gradient - A measure of steepness of ascent or descent. In this document it is usually used in reference to streams and the topographical rate of descent.

Habitat Inventory - A stream habitat inventory evaluates and attempts to characterize the stream channel. A riparian habitat inventory evaluates the vegetative characteristics of the riparian corridor.

Herbaceous (vegetation) - A vegetative group including grasses and forbs, but excluding woody vegetation such as willows or sagebrush.

Habitat Index (HI) - A tool used to evaluate whether beneficial uses of aquatic life are being supported; aquatic habitat criteria are scored and compared against a standard based on the ecoregion being evaluated.

Hydrologic Divide - Topographical feature that bounds a watershed or watershed by forcing all water to flow one direction (e.g., Continental Divide).
Hydrology - The scientific study of the properties, distribution and effects of water on and below the earth surface; the effect of flowing water on the land or stream channel.

Instantaneous – A characteristic of a substance measured at any moment (instant) in time.

Interdisciplinary Team - A team comprised of people with various educational or professional backgrounds and individual abilities.

Intermittent - A water source which only flows on the surface at irregular intervals along the stream channel. It flows subsurface along the remainder of the stream channel.
Issue - A matter of wide concern.

Land Disposal - A process of transferring land from public ownership to private ownership.

Land Exchange - A transfer of land of nearly equal value between public and public ownership.

Lateral Recession Rate - The rate at which a stream bank erodes away from its original position in relation to the stream.

Loading: Acute – The relatively short duration of the presence or addition of a pollutant, such as sediment or bacteria, to surface water above specified water quality criteria.

Loading: Chronic – The longer term duration of the presence of a pollutant, such as sediment or bacteria, to surface water above specified water quality criteria.

Macroinvertebrate Biotic Index (MBI) - A tool used to evaluate water quality based on quantitative measurements of biological attributes of the communities of aquatic insects present at a sample site. Scores are adjusted based on the ecoregion being evaluated.

Margin of Safety – The additional load reduction applied to a load allocation to increase the likelihood that beneficial uses will be restored in a reasonable period of time.

Monotype - A community that contains only one species of vegetation, lacking the normal diversity found in similar locations.

Moraine - A pile of debris, including rocks and dirt, which is pushed ahead of, or along the sides of a glacier.

Natural Condition – A condition without human-based disruptions.

Needs Verification- A category of water quality status. A water body whose status is "Needs Verification" has not been assessed due to a need for additional information that will allow the distinction between "Full Support" and "Not Full Support."
Non-Functioning Condition - Riparian-wetland areas that are clearly not providing adequate vegetation, landform, or large woody debris to dissipate stream energy associated with high flows and thus are not reducing erosion, improving water quality, etc. The absence of certain physical attributes such as a floodplain where one should be is an indicator of nonfunctioning conditions.

Non-point Source Pollution – A pollution source that is ill-defined or comes from a broad area, such as sedimentation.

Not Full Support – A category of water quality status. A water body whose status is "Not Full Support" is not in compliance with those levels of water quality criteria listed in Idaho's *Water Quality Standards and Wastewater Treatment Requirements*, or with reference conditions approved by the Idaho Department of Environmental Quality Director in consultation with the appropriate Basin Advisory Group.

Noxious Weed - A weed arbitrarily defined by law as being especially undesirable, troublesome and difficult to control.

OHV - Off-highway vehicle; any vehicle capable of traveling off the highway.

Outmigration - The action of fish leaving their birthplace, rearing or spawning area and moving a significant distance out of a given system into another for the needs of a different life stage.

PACFISH - A BLM and FS directed, comprehensive and coordinated strategy for restoring and protecting the habitat of anadromous fish affected by dam construction and operation, water diversions, hatchery operations, fish harvest and the widespread degradation of the habitats of these species.

Parcel - Any piece of land.

Patented Land - Land that has been transferred to private ownership, and that is still retained by the original owner.

Perennial - A water source that flows throughout the year, each and every year.

Physiographic Province - A region of which all parts are similar in geologic structure and climate, and which has consequently had a unified geomorphic history.

Pollution – Any alteration in the character or quality of the environment that renders it unfit or less suited for beneficial uses.

Primary Contact Recreation - A beneficial use, designated by the Division of Water Quality, that indicates that water quality is good enough for any activity in which full or partial, unprotected bodily contact occurs with water (e.g. swimming or wading).

Proper Functioning Condition - Riparian-wetland areas are functioning properly when adequate vegetation, landform, or large woody debris are present to dissipate stream energy associated with high water flows, thereby reducing erosion and improving water quality. This vegetation also filters sediment; captures bedload; and aids floodplain development; improves flood-water retention and ground-water recharge; develops root masses that stabilize stream banks against cutting action; develops diverse ponding and channel characteristics to provide the habitat and the water depth, duration and temperature necessary for fish production, waterfowl breeding and other uses; and supports great biodiversity. The functioning condition of riparian wetland areas is a result of interaction among geology, soil, water and vegetation.

Range Condition - A classification system (Excellent, Good, Fair or Poor), which provides an indication of the ecological health of the area and the degree of management necessary to maintain or improve the current condition. These classifications are generally indicated by differences in species composition, or deviation from the perceived potential of the site. Differences between condition classes are somewhat arbitrary because they form a continuum across a spectrum with ill-defined borders.

Reconnaissance – An exploratory or preliminary survey of an area.

Redd - The spawning nest of a fish dug in the stream bottom, which covers the eggs until emergence.

Reference Condition – A condition that fully supports applicable beneficial uses, with little effect from human activity and represents the highest level of support attainable.

Regression Analysis – Regression Analysis is the analysis of the relationship of two variables that may allow prediction of one variable from another variable. The dependent variable is assumed to be determined by (is a function of) the magnitude of the second (independent) variable.

Resident Fish – Non-anadromous fish that are generally native or naturalized exotic species. Resident fish may migrate within or between subbasins or watersheds at various life history stages to utilize various habitat aspects within their preferred range.

Resource Objective - An objective to be reached or maintained, which defines the desired condition of the resources.

Riparian - A vegetative community associated with surface or subsurface waters and watercourses within active watersheds. This community is rich in diversity of plants, as well as wildlife and aquatic organisms. The habitat includes not only lake and river ecosystems, but also wetland communities.

Riparian Habitat Conservation Agreement (RHCA) - A PACFISH term designating portions of watersheds where riparian-dependant resources receive primary emphasis, and management activities are subject to specific standards and guidelines. These areas include traditional riparian corridors, wetlands, intermittent headwater streams, and other areas where proper ecological processes are crucial to the maintenance of the stream's water, sediment, woody debris, and nutrient delivery systems.

Riparian Management Objective (RMO) - Objectives that are designed to measure the functionality of the riparian area and its affected stream channel. PACFISH has a set of RMO's that must be met for streams with anadromous fish unless local biologists have data that can define ones better suited to local conditions.

Salable Timber - Timber in an area designated for commercial timber harvest, accessible for harvest, and which contains trees favorable for sale.

Salmonid Spawning - A beneficial use, designated by the Idaho Division of Water Quality, which indicates that water quality is good enough for salmonid fish to use for spawning with a high chance of egg survival.

Screened Diversion - A diversion which has a fish screen on it.

Secondary Contact Recreation - A beneficial use, designated by the Idaho Division of Water Quality, which indicates that water quality supports any activity in which partial or incidental, protected bodily contact occurs with water (e.g., fishing).

Sediment-Sorbed – Molecules adhering to the surface of a solid sediment.

Shrub - Multi-stemmed woody vegetation not large enough to be considered a tree, such as a rose, willow, current, etc.

Sinuosity - The ratio of stream channel length to valley length.

Subbasin - A collection of watersheds that forms a much larger area, which yet drains into another, larger system.

Substrate - The stream bottom, composed of silt, sand, gravel, cobble, boulder or bedrock. The type of substrate and its looseness affects the ability of fish to spawn and the survivability of the eggs.

Suspended Sediment - Fine sediment suspended within the water column of moving or standing water.

Synoptic Sampling - Sampling at an upstream site, and timing sampling at a downstream site, such that the sample is collected at the time the same water sampled upstream is passing the sampling location downstream. The purpose is to take out any diurnal variance in water conditions.

Terminal Moraine - A pile of dirt and rocks pushed in front of a moving glacier that was left behind when the glacier receded.
Thermal Sanctuary - A refuge area that has water temperatures lower or higher than the surrounding waters, to the degree that it reduces the metabolic stress to the fish (e.g., a tributary spring or upwelling groundwater source).
Thrust Fault - A fault with a dip of 45 degrees or less over much of its extent, on which the hanging block appears to have moved upward relative to the footwall. Horizontal compression rather than vertical displacement is its characteristic feature.

Topography - The physical features of a place or region.

Transverse Fault - A fault that strikes obliquely or perpendicular to the general structural trend of the region.
Tributary - A river or stream that flows into a larger river or stream.

Unauthorized Use - An action or use of federal lands that has not been authorized by the regulatory agency or is outside the allowable season of use.

Unscreened Diversion - A diversion that does not have a fish screen on it.

Viability - Capability to grow or develop under normal conditions.

Warranted but Precluded - A phrase used to indicate that a species under consideration for listing as threatened or endangered probably should be listed but other species are in more immediate danger and time or monies don't allow for equal consideration at this time.

WEPP – Water Erosion Prediction Project: the WEPP model is a process-based, distributed parameter, continuous simulation, erosion prediction model for use on personal computers. The software is produced by the U.S. Department of Agriculture National Soil Erosion Research Laboratory at Purdue University and is available for free download at: http://topsoil.nserl.purdue.edu/weppmain/wepp.html.

Water Body – A homogeneous classification that can be assigned to rivers, lakes, estuaries, coastlines, streams or other water features.

Water Quality – A term used to describe the biological, chemical, and physical characteristics of water with respect to its suitability for a beneficial use.

Water Quality Target – An interim goal of water quality or habitat condition that provides the potential for beneficial use status of "Full Support." Percent subsurface or instream surface fine sediment, stream bank stability, percent overhead cover, riparian buffer width and average daily stream temperature are examples of possible targets.

Watershed - A side stream and all the land that it drains, which is a tributary to a much larger stream or river.

Wolman Pebble Count - A monitoring tool used to determine the amount of surface fines (material < 6.35 mm) as an index of sedimentation and beneficial use impairment. The samples are conducted at the same sites macroinvertebrates are collected. The sampler walks across the stream, from bankfull width to bankfull width, selecting pebbles at equidistant intervals. The intermediate axis is measured and recorded for each sample. A minimum of 50 samples from each cross-section must be obtained.

Woodland - Forested land used to provide forest resources such as firewood and Christmas trees, and is not used in the determination of the annual allowable cut.

APPENDICES

APPENDIX A

BURP Data Summary Table

Site ID No.	Stream Name	Eco-Reg	Elev Feet	Strm Ord	Ros Typ	HI	MBI*	Year Fish	% Fns	W/D Rat	% Stable LB	% Stable RB	% Cover LB	% Cover RB
98-C124	Alder Creek	NR	7700	1	Aa+	92	4.73		30	17.9	100	98	100	96
98-C122	Alder Creek	NR	6815	2	A	110	5.33		18	18.8	100	82	96	100
96-Y108	Basin Creek	NR	6480	3	B	81	3.90	98	29	25.4	69	77	93	82
96-Y124	Bayhorse Creek	NR	8360	1	B	98	4.53		74	14.2	65	60	83	82
98-C108	Bayhorse Creek	NR	7680	2	A	105	4.53	98	20	15	100	100	100	100
97-L056	Bayhorse Creek	SR	6760	3	B	107	4.39	98	27	16	94	94	94	94
98-C106	Bear Creek	SR	6510	2	B	109	4.76		26	9.7	100	100	100	100
98-C119	Bear Creek	SR	5875	1	A	48	5.22		56	18.3	31	29	88	82
98-C111	Bear Creek	NR	6960	1	Aa+	128	5.12		11	9.3	100	100	100	100
98-C110	Bear Creek	NR	6200	2	A	116	5.43	98	7	30	98	98	100	97
96-Y094	Beaver Creek	NR	7940	1	A	100	4.90		24	13	72	83	49	44
96-Y095	Beaver Creek	NR	7520	2	B	88	3.67	98	14	31.8	59	68	82	60
98-C103	Big Boulder Creek	NR	7190	3	B	111	4.61	98	16	9.7	96	86	88	100
98-C068	Big Casino Creek	NR	6150	2	A	107	5.27	98	19	14.1	100	100	100	100
97-L050	Big Lake Creek	SR	6020	3	B	110	2.43	98	50	7.9	100	88	75	80
98-C107	Birch Creek	SR	5320	2	A	96	5.26		59	9.2	89	99	89	99
96-Y123	Birch Creek	NR	5480	1	A	79	4.58		66	18.7	44	57	84	91
98-C070	Blind Creek	NR	5990	1	A	90	5.20		41	19.3	100	100	100	100
98-C116	Blowfly Creek	NR	6280	1	A	101	4.83	98	21	18.5	92	100	85	83
98-C061	Boundary Creek	NR	6650	2	A	121	4.41	98	38	9.8	100	100	100	100
96-Y113	Broken Ridge Creek	NR	7280	1	A	86	4.80		61	15.3	54	79	92	91
96-Y119	Bruno Creek	NR	6100	2	A	74	3.02		43	16	54	51	79	97
97-L053	Bruno Creek	NR	6095	2	A	105	1.88		45	9	90	77	88	63
98-C096	Buckskin Creek	NR	6230	1	A	107	3.70		30	15.2	100	100	100	100
98-C058	Cabin Creek	NR	7150	2	A	124	4.86	98	29	9	100	92	74	100
96-Y115	Cabin Creek	NR	7500	1	G	85	4.25		96	6.7	71	82	95	94
98-C098	Cash Creek	SR	6120	2	D	77	5.93	98	32	29.2	98	85	78	84
98-C115	Challis Creek	NR	7550	1	C	112	5.53		19	14.3	100	100	88	100
95-A025	Challis Creek	NR	6600	2	A	98	3.92	98	30	13.2	95	95	20	20
95-A029	Challis Creek	SR	5640	3										
95-A090	Challis Creek	SR	5244	3	F	66	3.17	98	20	32.8	65	42	62	67
98-C135	Champion Creek	NR	7390	3	C	117	4.49	98	28	10.9	100	90	100	100
96-Y100	Champion Creek	NR	6940	3	B	77	4.40		37	15.1	44	88	96	91
97-L051	Cherry Gulch Creek	SR	5800	1	Aa+	96	3.48		65	15	69	75	78	77
96-Y120	Cinnabar Creek	NR	6280	2	D	60	4.30	98	43	32.2	51	35	36	41
96-Y104	Coal Creek	NR	6200	1	A	92	4.94	98	63	13.5	78	68	83	81
98-C125	Darling Creek	SR	5280	3	B	95	4.33	98	23	14.5	94	100	88	100
98-C102	Decker Creek	NR	6640	1	E	103	2.80	98	68	1.6	100	100	99	97
96-Y105	East Basin Creek	NR	6480	2	B	86	5.06	98	25	12.3	72	87	64	45
98-C109	Eddy Creek	SR	5500	2	B	106	5.15	98	23	14.9	100	94	94	100
98-C087	Eightmile Creek	NR	7200	2	B	112	5.25		18	24	100	100	100	100
98-C075	Eightmile Creek	NR	6830	3	D	90	4.49	98	11	23.7	65	86	92	100
98-C088	Eightmile Creek North Fork	NR	7260	2	A	99	4.56		19	18.1	88	80	88	80
98-C084	Elevenmile Creek	NR	7200	2	A	115	5.13	98	12	11.3	100	90	100	90
98-C065	Elk Creek	NR	6720	2	C	109	3.72	98	26	19	100	100	100	97
96-Y102	Fisher Creek	NR	7740	1	A	74	4.38		88	16.3	28	22	93	86
96-Y103	Fisher Creek	NR	7220	2	B	90	4.09	98	69	12.2	79	79	92	92
98-C074	Fivemile Creek	NR	6750	2	C	94	4.29	98	17	20.2	90	85	100	81

98-C073	Fourth of July Creek	NR	6620	1	Aa+	120	3.70		14	17.4	90	94	100	100
96-Y098	Fourth of July Creek	NR	8800	2	A	113	4.57		39	13.8	95	98	84	62
96-Y099	Fourth of July Creek	NR	7560	3	B	108	4.70	98	40	9.5	65	56	86	87
96-Y082	Frenchman Creek	NR	8100	1	A	100	3.93	98	52	11.6	96	82	78	71
96-Y083	Frenchman Creek	NR	7420	2	C	100	4.74	98	48	11.5	81	53	88	77
95-A026	Garden Creek	NR	8160	1	A	101	3.59		39	6.6	95	90	65	90
95-A030	Garden Creek	NR	6600	2	B	96	4.54	98	32	14.5	95	97	85	93
95-A031	Garden Creek	NR	5401	2	F	65	3.42		15	13.3	0	90	75	0
98-C136	Germania Creek	NR	8160	2	A	110	3.52	98	38	12.9	100	96	100	96
97-L103	Germania Creek	NR	6309	3	B	92	4.00	98	40	30.6	100	100	90	95
98-C079	Greylock Creek	NR	6800	2	C	90	4.34		27	13.3	38	27	100	100
96-Y107	Hay Creek	NR	6520	1	A	98	4.65		55	21.4	66	90	78	84
98-C100	Hellroaring Creek	NR	7160	2	C	108	2.58	98	32	16	95	93	85	76
97-L105	Herd Creek	NR	5800	3	B	107	3.82	98	36	21.7	100	100	93	90
97-L054	Holman Creek	NR	5635	2	B	94	4.41		54	14.9	84	91	92	94
97-L045	Horse Basin Creek	SR	6270	3	F	114	1.80		75	3.2	98	96	98	96
98-C101	Huckleberry Creek	NR	6640	2	C	98	4.66		48	8.1	100	100	74	97
98-C060	Huckleberry Creek	NR	6630	2	C	105	5.29	98	28	14.7	100	100	100	80
98-C071	Jerrys Creek	NR	6600	1	A	89	4.16		42	14.2	100	92	100	100
98-C104	Jim Creek	NR	8200	1	A	105	4.08	98	26	11.3	96	93	94	87
98-C067	Job Creek	NR	6350	1	E	82	4.08	98	93	6.2	100	100	100	100
95-A038	Jordan Creek	NR	7464	2	A	103	5.75	95	41	8	85	90	95	95
95-A039	Jordan Creek	NR	6460	3	B	75	4.89	95	9	23.6	30	20	0	0
96-Y125	Juliette Creek	NR	6920	2	A	102	4.76	98	26	24	73	84	73	57
96-Y114	Kinnikinic Creek	NR	7580	1	A	94	4.86		48	13.2	77	81	55	67
96-Y112	Kinnikinic Creek	NR	7240	2	B	94	4.59	98	52	8.1	65	54	83	87
96-Y118	Kinnikinic Creek	NR	5600	2	B	61	2.52	98	44	14.1	9	29	68	67
97-L048	Lake Creek	SR	6470	2	C	112	4.12	98	62	7.9	91	90	97	98
98-C092	Last Chance Creek	NR	6550	2	A	106	3.82		23	10.2	100	100	100	100
97-L122	Last Chance Creek	NR	6520	2	B	104	2.82		84	3.5	100	100	100	100
95-A056	Lick Creek	NR	5960	1	A	107	4.68	98	35	4.3	63	86	67	81
96-Y093	Little Beaver Creek	NR	7300	1	B	69	3.36		68	10	41	35	97	97
98-C132	Little Boulder Creek	NR	6150	2	A	111	5.03		27	19.6	97	98	75	84
98-C062	Little Casino Creek	NR	6240	2	B	114	4.74	98	28	11	100	100	100	100
98-C093	Livingston Creek	NR	6440	1	A	122	3.88	98	27	4.5	100	95	100	95
98-C114	Lodgepole Creek	NR	6480	2	A	94	4.98	98	8	15.4	70	78	82	97
96-Y097	Lost Creek	NR	6940	2	E	81	1.22		94	5.5	92	93	100	98
98-C069	Lower Harden Creek	NR	6280	1	A	113	3.84		28	11.7	100	100	99	100
97-L047	Marco Creek	SR	5990	2	A	95	2.94		66	8.1	60	59	71	67
96-Y101	Mays Creek	NR	6860	1	E	107	3.23	98	82	5.8	91	88	100	100
98-C080	McKay Creek	NR	7760	1	A	120	4.14		30	15.7	100	98	100	98
98-C081	McKay Creek	NR	7580	2	B	120	4.72	98	22	10.9	97	100	91	100
98-C064	Meadow Creek	NR	6675	1	E	114	3.66		57	13	96	100	96	100
97-L055	Mill Creek	NR	5715	1	Aa+	78	1.64		72	20.7	82	78	92	84
98-C130	Mill Creek	NR	7350	2	A	115	4.58		25	13	100	100	100	100
98-C131	Mill Creek	NR	7000	3	B	96	5.29	98	18	28.7	76	80	89	97
98-C123	Morgan Creek	NR	6900	1	B	100	5.27		35	22.1	80	69	93	92
95-B041	Morgan Creek	NR	6036	2	F	100	4.21	98	46	18.8	80	85	85	90
94-38	Morgan Creek	NR	6000	3	B	70	3.58		30	43.8	65	65	70	65
95-A050	Morgan Creek	NR	5040	3	A	96	3.22		24	13.7	90	95	20	10
94-37	Morgan Creek	NR	4960	3	B	97	5.13	98	1	21	90	85	10	20
98-C118	Morgan Creek Little West Fork	NR	6710	1	A	111	4.48	98	42	13.9	99	97	100	92

98-C117	Morgan Creek West Fork	NR	6425	2	C	100	5.61	98	8	19.3	74	72	100	100
98-C105	Mosquito Creek	SR	6360	2	B	85	2.74		45	22.1	99	76	99	84
98-C089	Muley Creek	NR	5950	1	Aa+	107	4.75		29	12.9	100	100	97	100
98-C086	Ninemile Creek	NR	7000	1	A	124	4.63		24	7.4	100	100	100	100
98-C066	Park Creek	NR	6460	1	E	93	4.18	98	51	11	99	100	92	100
98-C091	Peach Creek	NR	7110	2	A	116	4.96		26	11.3	94	99	98	99
98-C090	Peach Creek	NR	5870	3	A	97	5.40	98	37	11.2	90	100	96	94
95-B088	Pettit Lake Creek	NR	7000	2	B		1.82							
95-B087	Pettit Lake Creek	NR	7000	2	D	97	2.96	95	17	19	100	100	90	93
95-B086	Pettit Lake Creek	NR	6880	2	A	117	3.22	95	10	20	100	100	100	100
96-Y088	Pole Creek	NR	8240	1	A	92	3.31	98	77	6.4	83	82	96	95
96-Y089	Pole Creek	NR	7700	2	B	97	4.25	98	60	12.6	80	69	95	97
96-Y092	Pole Creek	NR	7310	3	F	81	4.27	98	39	15.8	54	81	100	100
96-Y091	Rainbow Creek	NR	7540	2	A	108	4.73		55	9.2	76	80	86	87
98-C054	Rainbow Creek	NR	7520	2	A	102	5.30	98	50	13.5	100	100	100	100
98-C078	Ramey Creek	NR	6270	3	C	93	4.76	98	22	23	82	79	98	95
98-C077	Rankin Creek	NR	6190	2	C	102	4.58		28	29.8	86	99	94	94
95-A027	Road Creek	NR	7200	2	G	60	1.68		63	6.9	75	55	90	85
94-35	Road Creek	NR	7200	2										
97-L106	Road Creek	NR	6520	2	A	105	4.29	98	65	7.3	98	100	100	100
97-L046	Road Creek	SR	6310	3	B	93	4.89		54	11.5	80	96	85	100
94-36	Road Creek	NR	5650	4				98						
95-A028	Road Creek	NR	5650	4	F	99	2.79	98	54	6.3	85	75	100	95
98-C128	Roaring Creek	NR	7040	1	Aa+	114	4.78	98	20	19.1	98	96	98	100
96-Y109	Rough Creek	NR	7380	1	F	128	3.98	98	89	9.4	79	76	87	93
96-Y110	Rough Creek	NR	6720	2	A	103	5.00		34	16.8	89	93	72	55
98-C057	Salmon River	NR	7820	1	A	107	5.29	98	21	13.9	100	90	98	100
98-C056	Salmon River	NR	7590	2	C	143	2.48		38	11	90	90	90	87
95-A076	Salmon River	NR	7560	3	G	111	5.02	98	51	9	70	79	53	73
95-A075	Salmon River	NR	6830	4	C	69	3.13		36	50.1	66	40	69	89
98-C129	Salmon River East Fork	NR	6600	4	C	95	4.59	98	8	54.6	100	100	100	100
97-L104	Salmon River East Fork	NR	6580	3	C	97	3.69		11	43.7	100	100	100	100
96-Y117	Sawmill Creek	NR	6480	1	Aa+	109	4.85		50	8	88	90	98	93
98-C097	Second Creek	NR	5960	2	Aa+	106	5.12		15	10.3	100	100	100	100
98-C133	Shep Creek	SR	4910	2	B	74	4.62		61	11.4	100	100	85	85
96-Y106	Short Creek	NR	6380	1	A	102	4.03		69	10.9	77	74	89	93
98-C076	Silver Creek	NR	6230	2	A	112	2.86		28	21.5	100	96	100	94
96-Y122	Sink Creek	NR	5400	1	A	73	3.86		72	14.4	84	69	76	69
98-C095	Slate Creek	NR	7200	1	A	91	4.97		8	14.4	87	81	100	100
98-C094	Slate Creek	NR	6510	2	A	97	3.78		12	14.2	100	100	97	100
98-C099	Slate Creek	NR	5760	3	C	100	5.06	98	16	17.3	97	92	91	94
98-E010	Slate Creek	NR	5760	3	C	57		98	42	25.6	81	84	81	84
96-Y086	Smiley Creek	NR	7440	2	C	92	5.13	98	46	14.4	57	57	60	56
95-A089	Smiley Creek	NR	7350	3			4.33							
96-Y087	Smiley Creek	NR	7320	3	C	91	4.96	98	45	21.3	75	71	66	66
96-Y084	Smiley Creek East Fork	NR	7640	1	A	93	3.96	98	65	13	89	69	83	79
96-Y085	Smiley Creek West Fork	NR	7640	1	A	90	5.06	98	55	10.6	94	83	59	62
97-L052	Spud Creek	SR	5480	2	A	99	3.77		48	10.2	96	91	13	30
95-A069	Squaw Creek	NR	6440	4	B	78	4.76	98	35	23.4	84	76	66	58
94-41	Squaw Creek	NR	6120	4	B	85	3.35	98	10	44.2	85	70	20	35
95-A070	Squaw Creek	NR	5920	4	A	89	4.25		27	11.8	91	94	5	0
94-42	Squaw Creek	NR	5680	4		82	4.54	98	7	22.2	75	55	30	55

98-C072	Stanley Creek	NR	6630	2	C	81	4.47	98	50	15.1	100	90	96	80
95-A016	Stanley Lake Creek	NR	6537	1										
95-A072	Stanley Lake Creek	NR	6520	2	B	81	2.81		42	48.5	70	81	100	96
95-A037	Stanley Lake Creek	NR	6381	3	B	87	4.09	98	38	44.5	90	80	90	100
96-Y096	Taylor Creek	NR	7120	2	B	83	2.87		78	13.8	94	96	97	98
98-C055	Taylor Creek	NR	7040	2	E	96	3.11		61	17.2	96	100	96	100
98-C085	Tenmile Creek	NR	7160	2	B	127	5.36	98	7	23	100	90	90	96
95-A104	Thompson Creek	NR	7040	2	B	104	5.12	95	22	6.4	81	95	38	79
95-A105	Thompson Creek	NR	5640	3	B	80	3.35	95	20	21.8	80	100	52	86
94-39	Thompson Creek	NR	7040	2	B	99	4.98		10	20.4	90	95	60	60
94-40	Thompson Creek	NR	5560	3	A	89	4.44		2	32.8	95	100	15	10
98-C137	Three Cabins Creek	NR	7920	1	Aa+	129	3.79	98	13	7.8	100	100	100	100
98-C120	Trail Creek	SR	6035	2	C	89	4.52	98	12	38.7	100	90	69	81
98-C063	Trap Creek	NR	6890	2	A	104	3.10	98	27	20	100	100	85	98
96-Y121	Trelor Creek	NR	6680	1	A	88	2.80		68	11.6	81	54	81	95
98-C083	Twelvemile Creek	NR	7160	1	A	90	2.70		19	19.4	84	96	100	97
98-C112	Twin Creek	NR	7360	1	Aa+	122	4.20		29	12.3	100	100	90	86
96-Y090	Twin Creek	NR	7600	1	A	109	3.37	98	59	9.2	87	93	88	81
96-Y111	Upper Harden Creek	NR	7080	1	A	96	5.38	98	65	16	84	72	89	73
95-A071	Valley Creek	NR	6758	3	F	82	4.86	98	47	23.7	88	100	97	92
95-A073	Valley Creek	NR	6360	3	C	76	4.49	98	29	32.9	89	91	92	84
95-A074	Valley Creek	NR	6220	3	F	77	4.08		29	99.3	92	81	96	94
95-B048	Van Horn Creek	NR	7320	1	A	124	5.15		33	9.2	100	100	100	100
98-C121	Van Horn Creek	SR	6210	2	C	93	5.42	98	31	27.9	98	92	86	82
95-B047	Van Horn Creek	NR	6200	1	B	93	3.53	98	36	12.5	71	87	92	85
98-C059	Vat Creek	NR	6870	2	E	113	4.07	98	42	8	100	100	92	90
98-C134	Warm Springs Creek	NR	5920	3	B	114	5.29	98	6	19.9	100	98	98	100
95-A033	Warm Springs Creek	SR	5737	3	B	52	2.00		66	13	25	80	10	80
95-A032	Warm Springs Creek	SR	5310	3	B	76	2.76		53	14.7	20	35	65	65
98-C113	West Fork Creek	NR	6940	1	A	118	3.57	98	23	10	100	100	93	97
98-C127	West Pass Creek	NR	7220	3	C	112	4.66	98	10	19.4	100	97	89	96
98-C126	White Valley Creek	SR	6120	1	A	110	4.88		19	13.9	100	100	100	100
97-L049	Wickiup Creek	NR	6360	2	Aa+	108	3.63	98	40	20.3	96	89	87	70
98-C082	Yankee Fork	NR	7480	2	C	102	4.91	98	19	31.8	98	99	98	98
95-A091	Yankee Fork	NR	7400	3	A	92	4.88		33	16.4	76	100	52	76
95-A092	Yankee Fork	NR	6440	4	C	52	5.65	95	18	43.4	89	69	40	37
95-A093	Yankee Fork	NR	6307	4	C	56	5.61	95	15	34.8	100	100	20	26

*MBI scores are from 2000 BAT.

APPENDIX B

BLM Field Data 1999-2000

CHALLIS FIELD OFFICE : SUMMARY OF STREAMFLOW AND WATER QUALITY COLLECTED BY BLM*, 1999-2000

February 2000

Streams are generally listed in downstream order

Stream	Site	Elev. ft.	Flows into	W[1]	yr. mo. day time	Q cfs.	Water °C °F	E.C uS	TDS ppm	pH	Turb. NTU	Comments	Quadrangle USGS 7.5 minute
Kinnikinic Cr.	KI1	7160	Salmon R.	US	1999 09 01 1240	4.09	9.0 48.2	80	50	8.1	Clear		Clayton
Lyon Cr.	LY1	5500	Salmon R.	US	1999 10 12 1330	2.56	11.0 51.8	260	170	8.4	0.94		Bald Mountain
Birch Cr.	BI1	5500	Salmon R.	US	1999 10 08 1115	0.45	9.0 48.2	190	120	8.3	1.22		Bald Mountain
Sink Cr.	SI1	5380	Salmon R.	US	1999 10 08 1115	0.42	10.0 50.0	160	100	8.2	0.80	Diversion takes 90% of flow.	Bald Mountain
Bayhorse Cr.	BA1	6520	Salmon R.	US	1999 10 01 1125	4.27	6.5 43.7	160	100	8.4	0.86		Bayhorse
Birch Cr.	BR1	5380	Salmon R.	US	1999 10 01 1125	0.60	8.0 46.4	200	130	8.3	4.86		Bradbury Flat
Wicklup Cr.	WI1	6240	E. F. Salmon R.	EFSR	1999 12 21 1430	0.35	2.5 35.6	100	65	8.0	2.57		Bowery Cr.
East Fork Salmon R.	EFS1	6150	Salmon R.	EFSR	1999 12 23 1420	40.57	1.0 33.8	160	105	8.4	0.61		Bowery Cr.
					2000 02 10 1210	40.38	3.0 37.4	150	105	8.6			
Little Boulder Cr.	LB1	6440	E. F. Salmon R.	EFSR	1999 08 24 1500	14.00	13.5 56.3	60	40	8.2	Clear		Bowery Cr.
Big Boulder Cr.	BB1	6120	E. F. Salmon R.	EFSR	1999 12 21 1320	16.00	2.5 36.5	110	70	7.8	0.98		Bowery Cr.
Corral Creek	CO1	6480	Jimmy Smith Lake	EFSR	1999 09 02 1155	0.27	10.0 50.0	180	120	8.2	6.18		Potoman P.
Jimmy Smith Cr.	JS1	6410	Jimmy Smith Lake	EFSR	1999 09 02 1450	0.13	10.0 50.0	240	160	8.4	3.79		Potoman P.
Big Lake Cr.	BL1	6120	E. F. Salmon R.	EFSR	1999 09 02 1510	2.27	17.0 62.6	130	85	8.8	30.70	Water slightly cloudy.	Potoman P.
Lake Cr.	LA1	6140	Herd Cr.	EFSR	1999 08 19 1415	2.86	15.5 59.9	110	70	8.2	Clear		Herd Lake
Herd Cr.	HE1	5800	E. F. Salmon R.	EFSR	1999 08 19 1210	32.93	14.0 57.2	150	100	8.4	0.81		Ziegler Basin
Road Cr.	RO1	5740	E. F. Salmon R.	EFSR	1999 08 19 1025	1.22	15.0 59.0	250	160	8.4	6.55		Ziegler Basin
Gooseberry Cr.	BO1	7520	Warm Spring Cr.	US_EF	1999 11 04 1255	0.11	5.0 41.0	430	280	8.6	1.15	Limestone in watershed.	Grouse Cr. Mountain
Lime Cr.	LI1	6110	Warm Spring Cr.	US_EF	1999 11 10 1355	0.32	6.0 42.8	350	230	8.6	8.27		Little Antelope Flat
Garden Cr.	GA1	6540	Salmon R.	US_EF	1999 10 13 1245	4.32	6.5 43.7	120	80	8.2	0.92	No BLM land adjacent to stream	Bayhorse
Eddy Cr.	ED1	5440	Challis Cr.	US_EF	1999 08 31 1500	2.06	14.0 57.2	90	60	8.2	Clear		Pats Cr.
Challis Cr.	CH1	5400	Salmon R.	US_EF	1999 08 16 1530	35.32	17.0 62.6	60	40	8.0	2.51	Gauge height = 3.56 ft.	Pats Cr.
					1999 10 05 1430	23.00	10.0 50.0	60	40	8.1	3.47	Gauge height = 3.44 ft.	
Mill Cr.	MI1	5310	Challis Cr.	US_EF	1999 08 16 1200	7.90	13.5 56.3	140	90	8.0	Clear		Pats Cr.
Bear Cr.	BE1	5960	Morgan Cr.	US_EF	1999 12 01 1330	0.06	3.0 37.4	260	170	8.3	4.73	Q = 28.7 gpm	Blowfly Cr.
Block Cr.	BL1	5700	Morgan Cr.	US_EF	1999 12 01 1205	0.12	3.5 38.3	120	80	8.2	6.32	Q = 55.7 gpm	Blowfly Cr.
West Fork Morgan Cr.	WM1	6080	Morgan Cr.	US_EF	1999 10 05 1125	2.24	6.5 43.7	120	80	8.2	1.59		Blowfly Cr.
Gooseberry Cr.	GO1	5660	Morgan Cr.	US_EF	1999 12 01 1005	0.07	4.0 39.2	180	120	8.5	1.43	Q = 31.4 gpm	Gooseberry Cr.
Blue Cr.	BL1	5550	Morgan Cr.	US_EF	1999 10 26 1435	0.09	8.5 47.3	140	90	8.4	4.33		Gooseberry Cr.
Morgan Cr.	MO1	5550	Salmon R.	US_EF	1999 07 22 1325	20.00	18.0 64.4	120	80	7.9	Clear		Gooseberry Cr.
					1999 09 09 1020	9.32	10.5 51.0	120	80	8.0	5.32		
					1999 10 25 1325	10.08	7.5 45.5	120	80	8.3	1.72		
					2000 03 03 1330	9.87	4.0 39.2	110	70	8.0	2.02		
Upper Pahsimeroi R.	UP2	6810	Salmon R.	P	1999 12 28 1245	E 15	1.0 33.8	230	150	8.5	0.56		Spring Hill
Donkey Cr.	DO1		Pahsimeroi R.	P	1999 07 29 1405	0.18	12.0 54.0	90	60	8.4	1.94		Donkey Cr.
Grouse Cr.	GR1	6320	Pahsimeroi R.	P	1999 09 09 1455	0.00						All of stream channel on BLM is dry.	Meadow Peak
Goldberg Cr.	GO1	6070	Pahsimeroi R.	P	1999 09 09 1550	12.91	15.0 59.0	250	160	8.4	6.03		Donkey Hills NW

Stream	Site	Elev. ft.	Flows into	W[1]	yr. mo. day time	Q cfs.	Water ^0C ^0F	E.C uS	TDS ppm	pH	Turb. NTU	Comments	Quadrangle
Stinking Cr.	ST1	6540	Big Cr.	P	1999 07 27 1205	0.02	15.0 59.0					Q = 10.8 gpm	Donkey Hills
Mill Cr.	ML1	7000	Big Cr.	P	1999 07 27 1550	0.41	10.5 51.0	30	20	8.2	6.67		Donkey Hills
Meadow Cr.	ME1	6140	Pahsimeroi R.	P	1999 09 08 1430	0.66	15.0 59.0	270	180	8.5	35.30	Most of stream channel on BLM is dry	Meadow Peak
Falls Cr.	FA1	5960	Patterson Cr.	P	1999 09 03 1455	7.32	8.0 46.4	70	45	8.2	0.49	Diversion at N.F. takes 95% of flow.	East of May
Morse Cr.	MO1	5880	Patterson Cr.	P	1999 09 03 1145	6.65	8.0 46.4	30	20	8.1	0.68	Diversion at N.F. takes 95% of flow.	East of May
Trail Cr.	TR1	5660	Pahsimeroi R.	P	1999 09 08 1135	0.47	10.0 50.0	230	150	8.0	17.90		May
Tater Cr.	TA1		Patterson Cr.	P	1999 08 30 1325	2.74	8.0 46.4	60	40	8.0	0.75		
Little Morgan Cr.	LM1	5480	Pahsimeroi R.	P	1999 08 26 1415	10.78	12.5 54.5	20	13	8.0	0.79		Ennis Gulch
Sage Cr.	SA1	6870	Thous. Spr. Cr.	BL	1999 12 15 1445	0.89	1.0 33.8	200	130	8.4	4.00		Jerry Peak
Big Lost R.	BL1	6570	Mackay Res.	BL	1999 09 22 1245	71.93	11.5 52.7	140	90	8.2	0.84		Chilly Buttes

* Most of the streamflow and water quality data was collected by Steve Markman, Hydrologist, Challis Field Office, BLM. Additional information on location of sites is available.

[1] US = Upper Salmon River watershed ; Hydrologic Unit Code 17060201.

EFSR = East Fork Salmon River watershed ; Hydrologic Unit Code 17060201.

US_EF = Upper Salmon River watershed below East Fork Salmon River ; Hydrologic Unit Code 17060201.

P = Pahsimeroi River watershed ; Hydrologic Unit Code 17060202

BL = Big Lost River watershed ; Hydrologic Unit Code 17040218

Q = discharge, in cubic feet per second

Water temperature is degrees centigrade and degrees fahrenheit

E.C. = electrical conductivity, in micromhos per centimeter

TDS = total dissolved solids, parts per million. EPA drinking water guideline is 500 ppm.

pH is in standard units, scale 0.0 to 14.0 Idaho standard is 6.5 to 9.5

Turb. = turbidity, in nephelometric turbidity units (NTU). Idaho standard is not to exceed 50 NTU above "background." "Background" is not defined in the Idaho water quality standards.

Quadrange = USGS 7.5 minute quadrangle that contains the streamflow measuring site

APPENDIX C

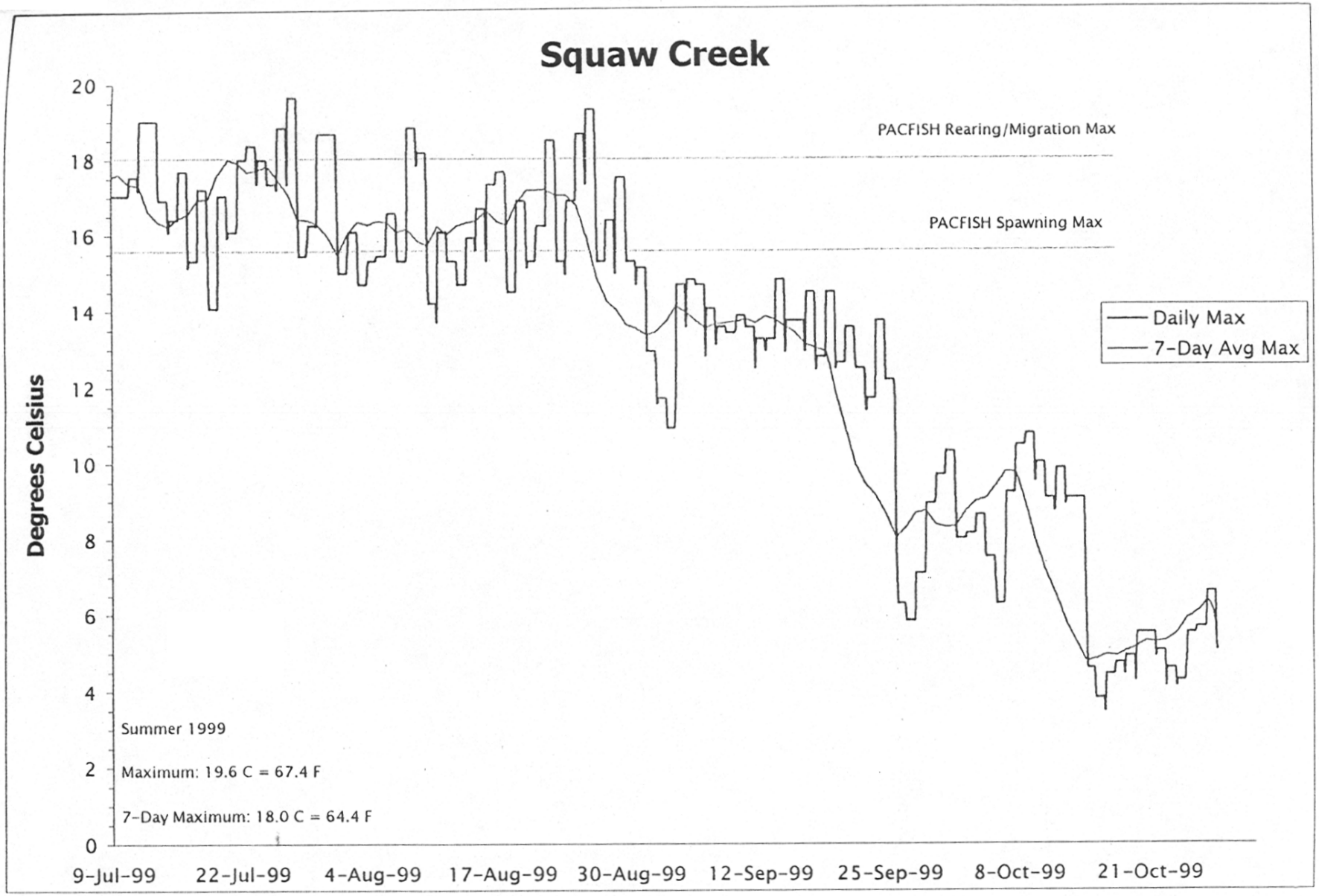
BLM Water Temperature Data

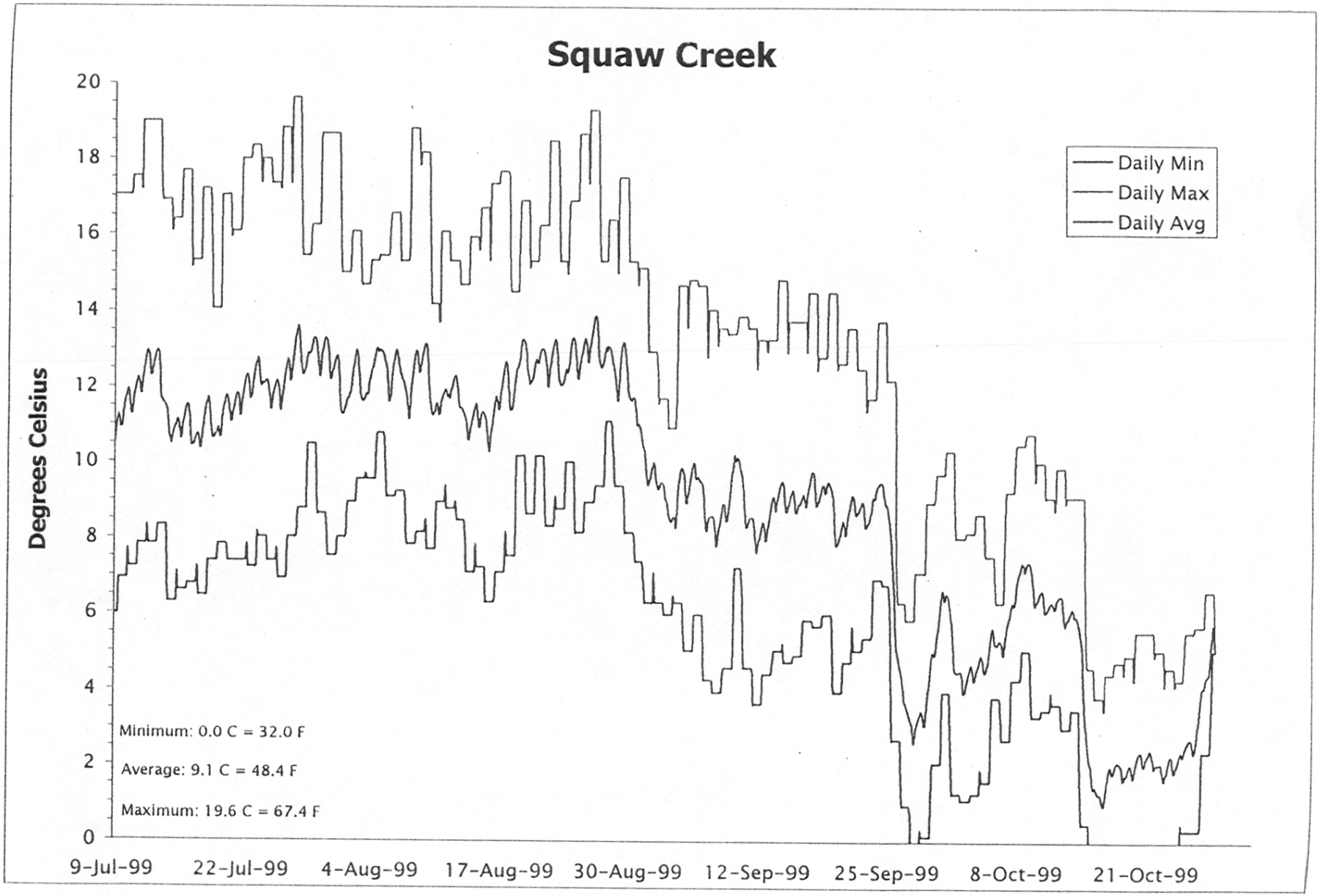
EAST FORK SALMON RIVER WATERSHED

Stream Name	1995		1996		1997		1998		1999	
	Max	7-Day Max	Max	7-Day Max	Max	7-Day Max	Max	7-Day Max	Max	7-Day Max
Bear	58.7		64.2		61.5		59.4	58.6	60.6	58.3
Big Boulder							66.3	63.3	56.7	55.1
Big Lake					69.9		73.2	72.2	71.1	69.4
Herd										
above Lake Creek	56.0		59.2		59.4				57.4	55.4
below private									61.3	59.7
lower			61.8		62.1				62.8	60.0
Horse Basin										
Lower	67.4		74.5		68.3				malf	malf
Upper					58.2					
Lake										
below lake	56.8		59.0		58.7		60.8	59.7	67.6	64.9
at mouth	65.5				64.9					
Little Boulder	58.1						59.6	58.5	57.9	56.7
Mosquito	56.4		65.6		60.1					
Road										
below Horse Basin Creek	65.3		73.3		69.0				66.2	64.0
below Mosquito Creek	60.4				63.5		61.5	60.2	61.3	59.2
Upper	62.7		67.9		64.2		66.3	65.3	63.3	60.8

SALMON RIVER WATERSHED

Stream Name	1995		1996		1997		1998		1999	
	Max	7-Day Max	Max	7-Day Max	Max	7-Day Max	Max	7-Day Max	Max	7-Day Max
Bayhorse BLM			57.0		57.4		60.1	58.9	55.9	55.2
Little Hat	60.7		71.0		64.9		67.7	66.4	62.1	61.1
Morgan										
Recreation Site	70.0		70.7		67.6		69.3	68.3	67.6	65.7
BLM/FS			70.0		70.2		72.5	71.3	70.3	67.9
Squaw	68.2		68.0		67.3		68.8	66.5	67.4	64.4
Thompson	63.9		63.3		61.5				62.1	60.4
West Fork Morgan	62.1		70.7		61.5		62.7	61.8	61.5	59.9


Squaw Creek
Degrees Celsius
20
18
16
14
12
10
8
6
4
2
0
PACFISH Rearing/Migration Max
PACFISH Spawning Max
Daily Max
7-Day Avg Max
Summer 1999
Maximum: 19.6 C = 67.4 F
7-Day Maximum: 18.0 C = 64.4 F
9-Jul-99
22-Jul-99
4-Aug-99
17-Aug-99
30-Aug-99
12-Sep-99
25-Sep-99
8-Oct-99
21-Oct-99


Squaw Creek
Degrees Celsius
20
18
16
14
12
10
8
6
4
2
0
Daily Min
Daily Max
Daily Avg
Minimum: 0.0 C = 32.0 F
Average: 9.1 C = 48.4 F
Maximum: 19.6 C = 67.4 F
9-Jul-99
22-Jul-99
4-Aug-99
17-Aug-99
30-Aug-99
12-Sep-99
25-Sep-99
8-Oct-99
21-Oct-99

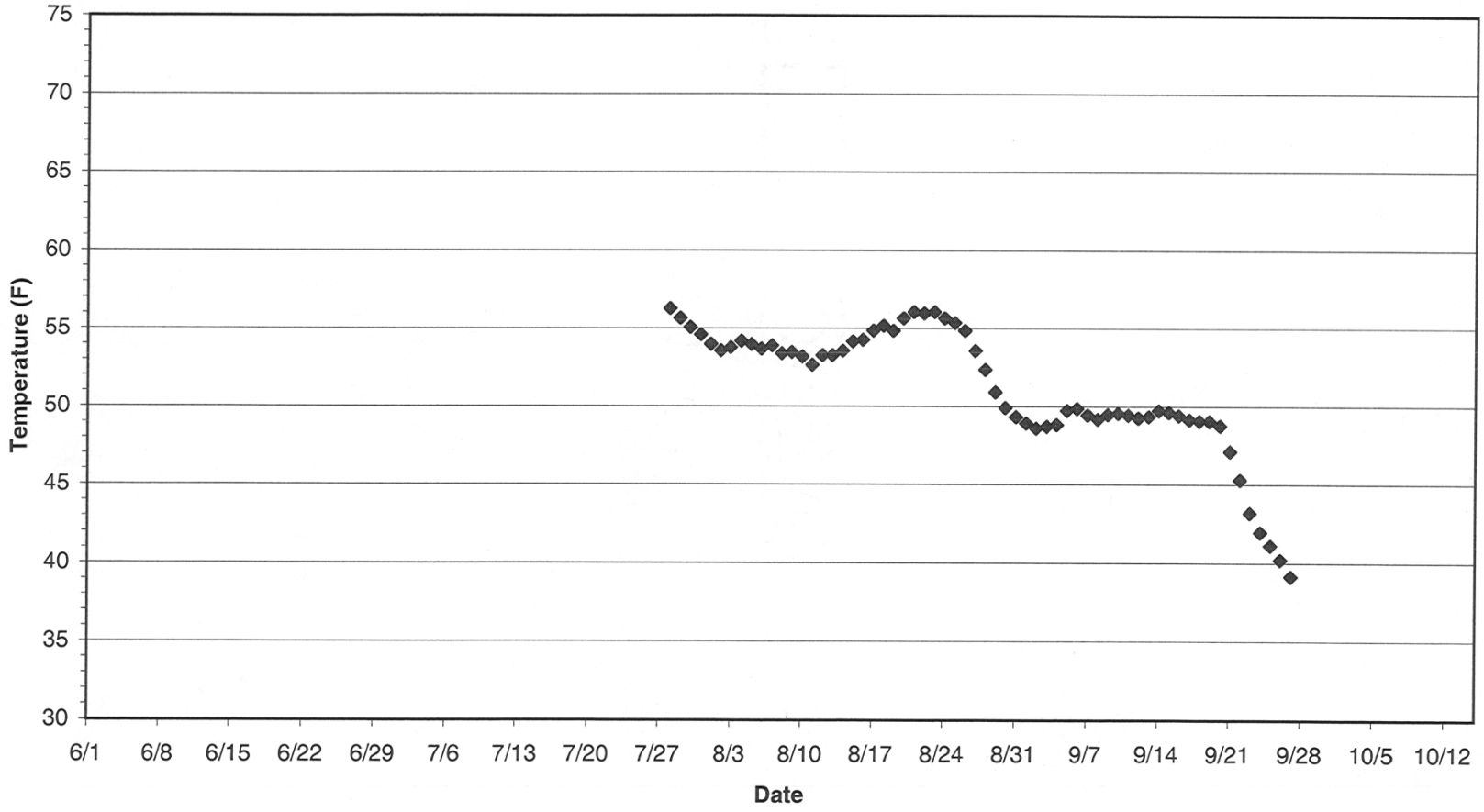
APPENDIX D

Salmon-Challis National Forest Water Temperature Data

1999 Water Temperature Data

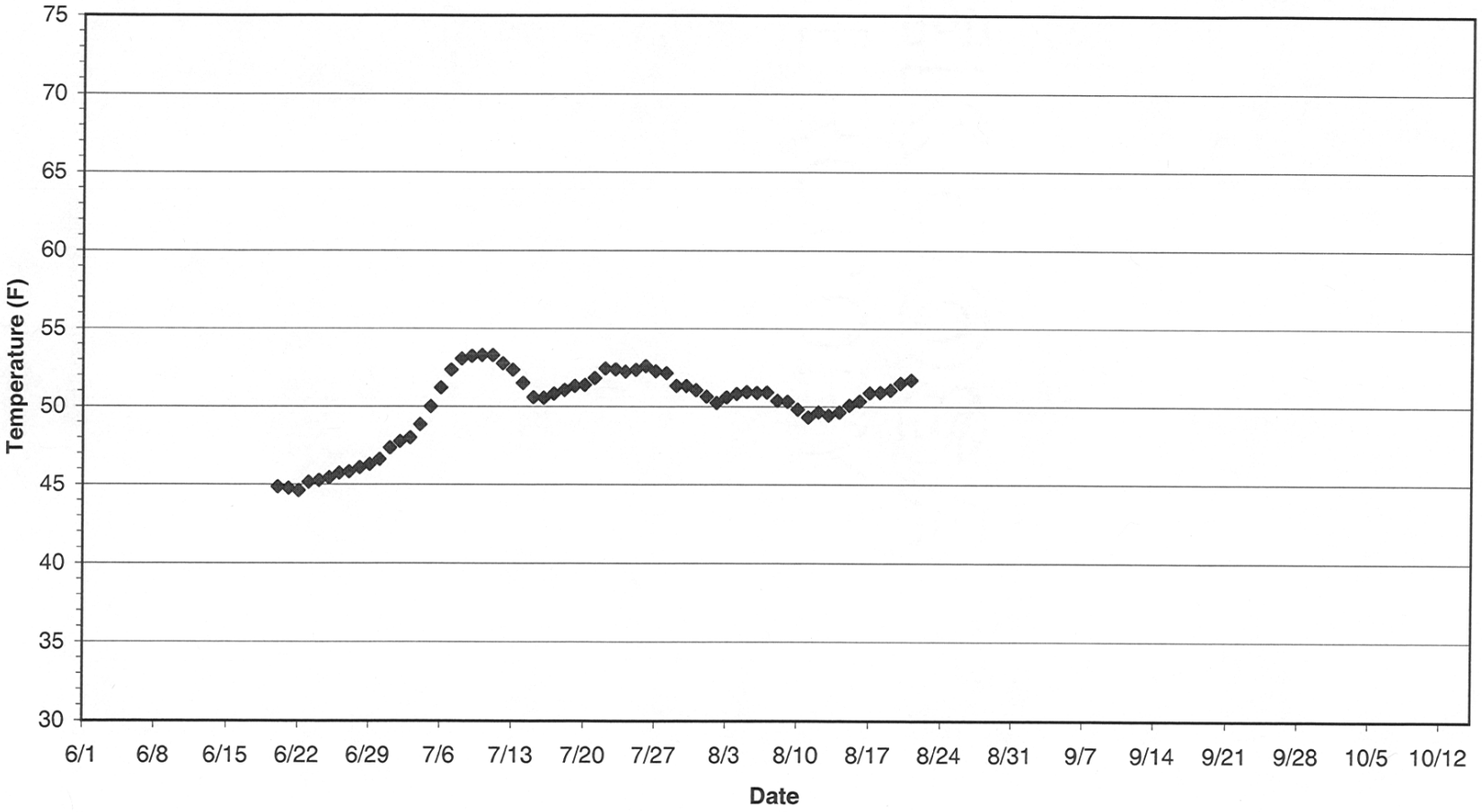
Temperature charts from 1999 Yankee Fork Ranger District Thermograph Sites

Aspen Creek
Upper Squaw Creek Watershed 0807
1999 7-Day Running Average Maximum Water Temperature (7/28-10/3)



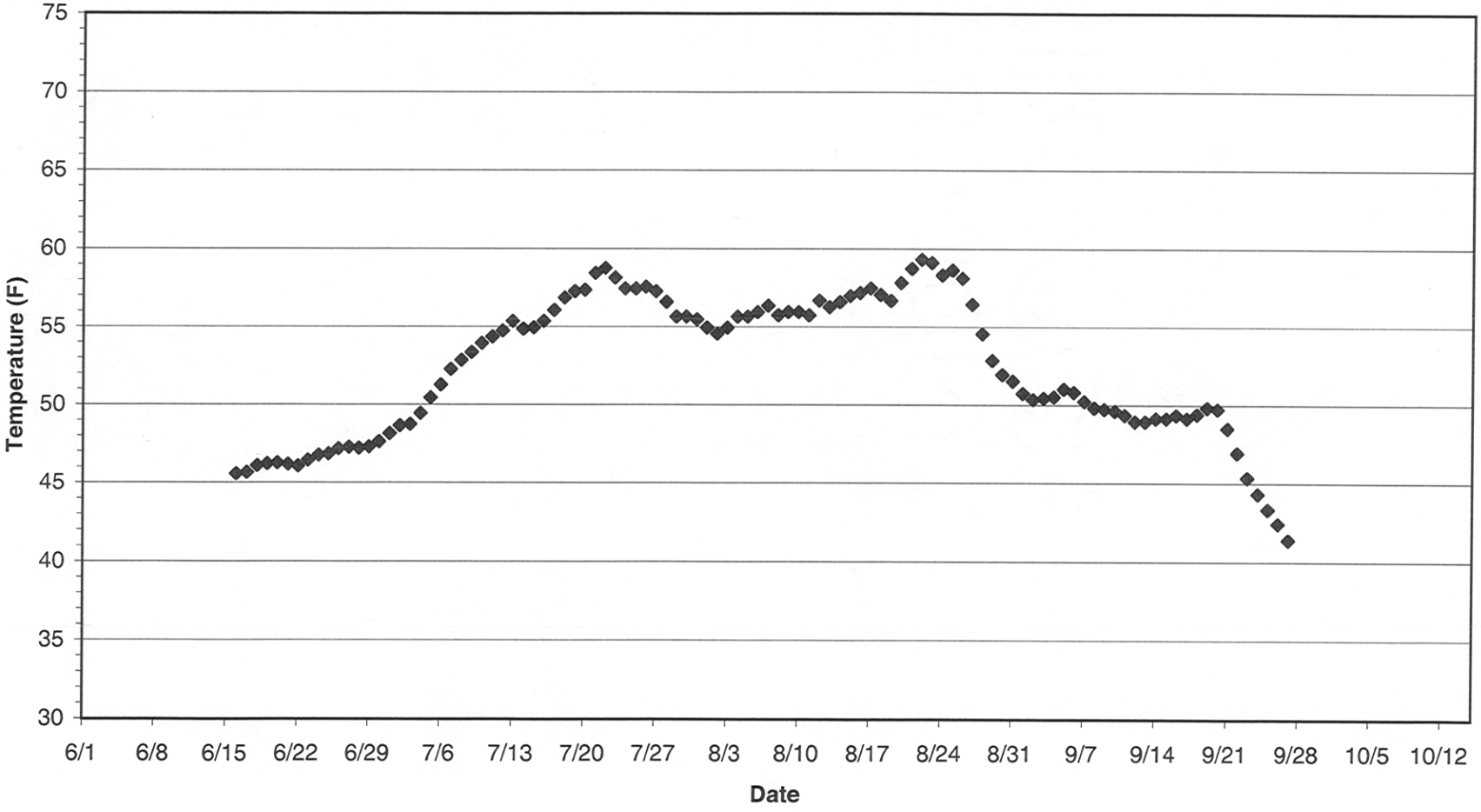
USDA Salmon Challis NF Yankee Fork RD

Cinnabar Creek
Upper Squaw Creek Watershed 0807
1999 7-Day Running Average Maximum Water Temperature (6/20-8/27)



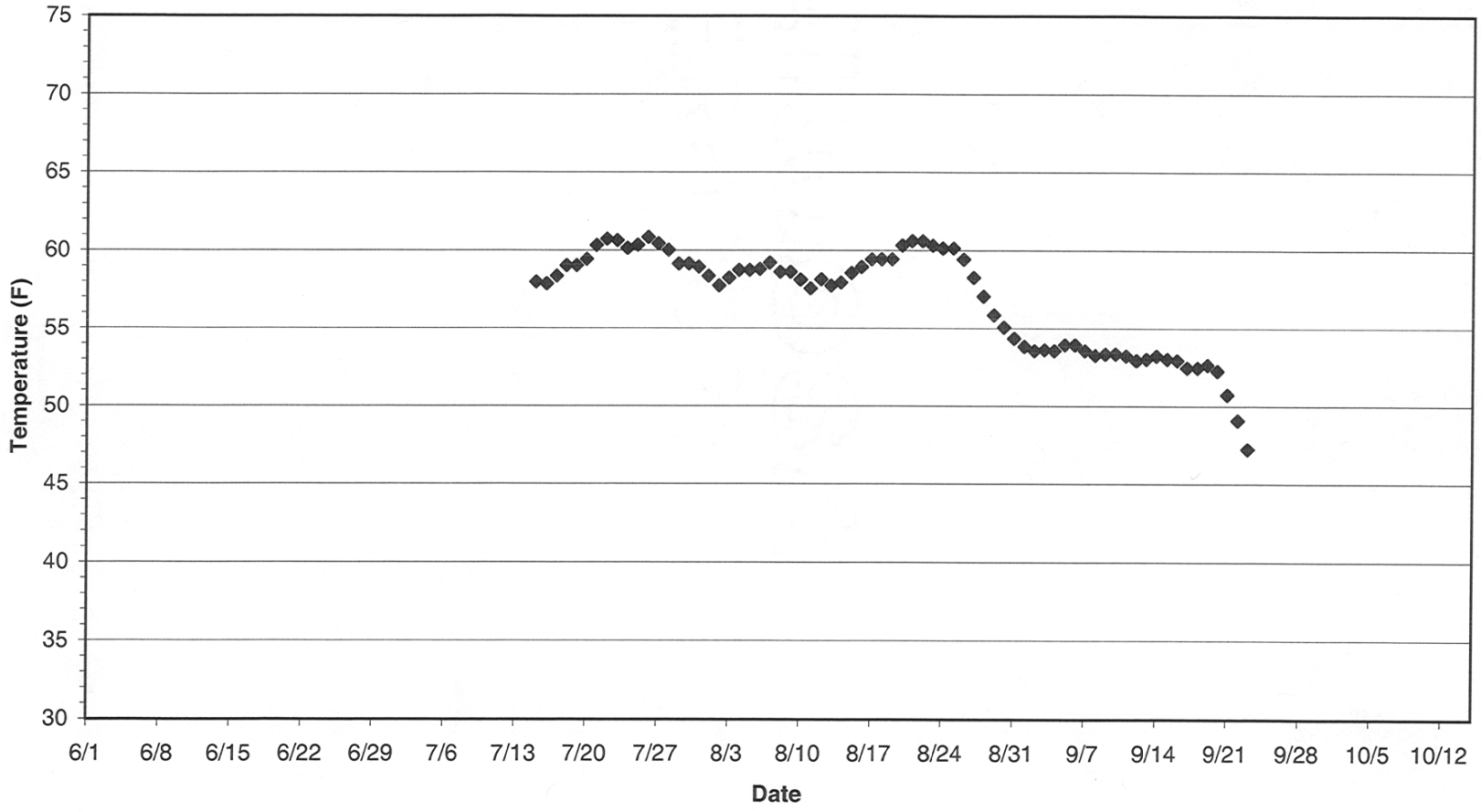
USDA Salmon Challis NF Yankee Fork RD

Martin Creek
Upper Squaw Creek Watershed 0807
1999 7-Day Running Average Maximum Water Temperature (6/16-10/3)



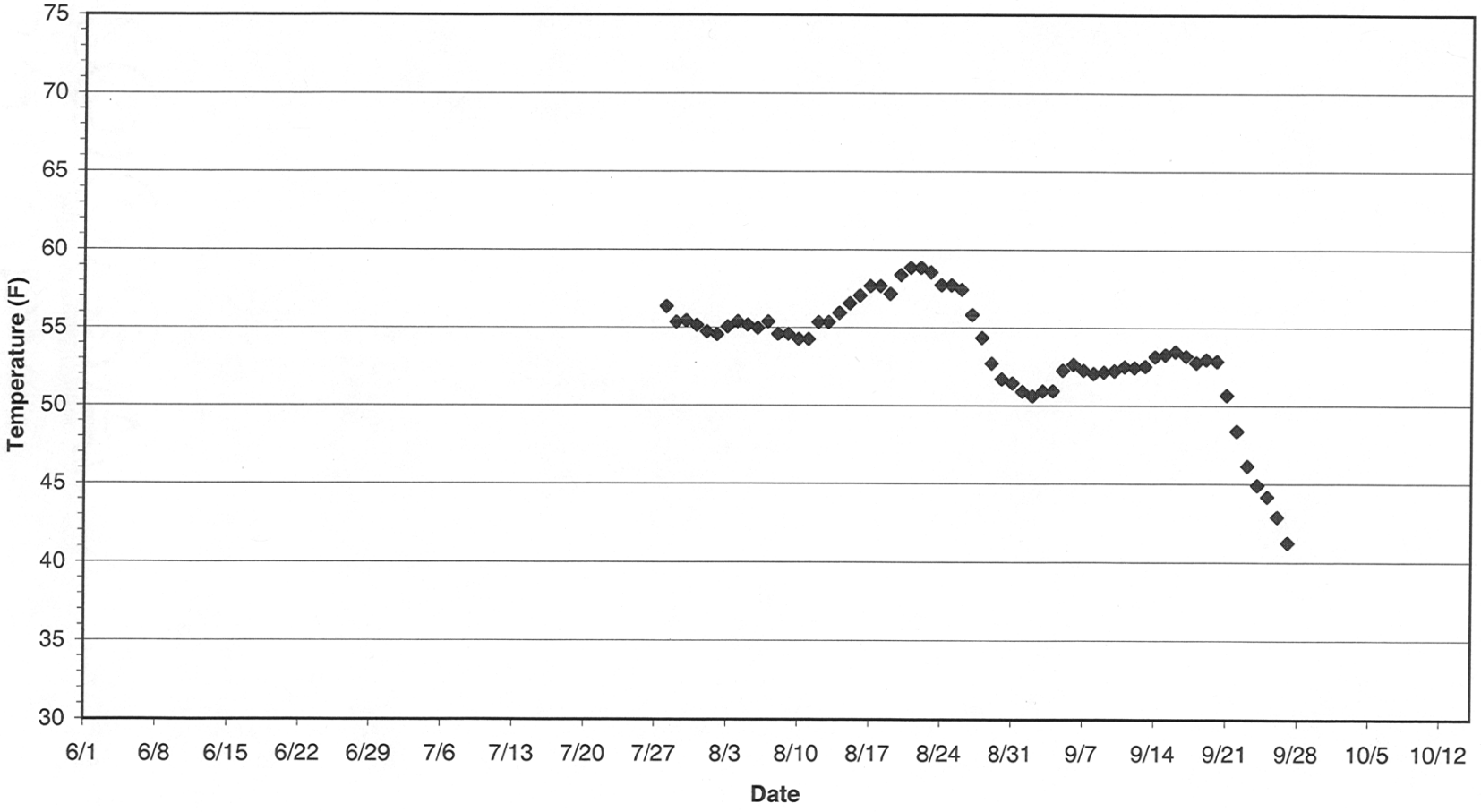
USDA Salmon Challis NF Yankee Fork RD

Middle Squaw Creek
Upper Squaw Creek Watershed 0807
1999 7-Day Running Average Maximum Water Temperature (7/15-9/29)



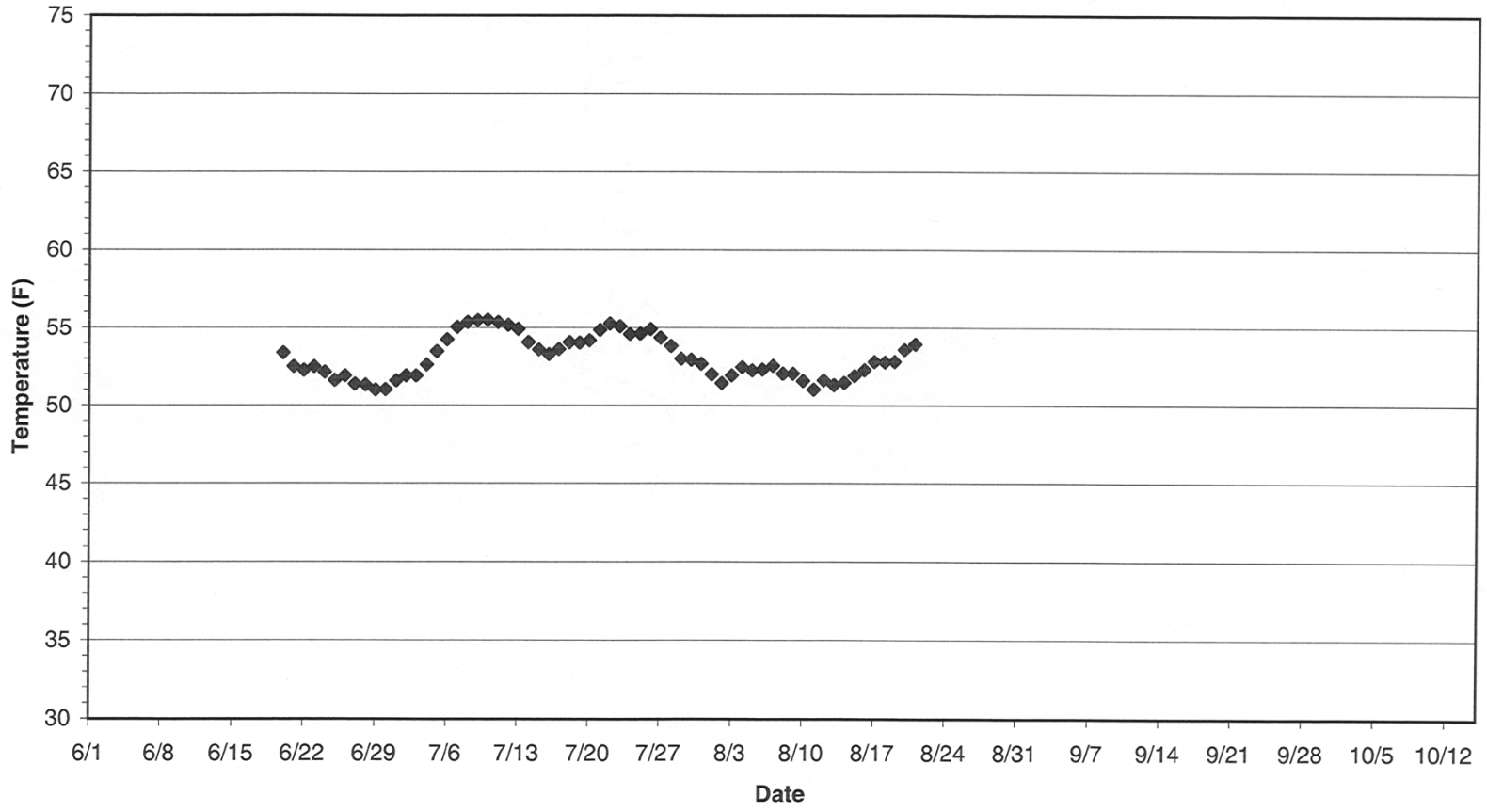
USDA Salmon Challis NF Yankee Fork RD

Upper Squaw Creek
Upper Squaw Creek Watershed 0807
1999 7-Day Running Average Maximum Water Temperature (7/28-10/3)



USDA Salmon Challis NF Yankee Fork RD

Trealor Creek
Upper Squaw Creek Watershed 0807
1999 7-Day Running Average Maximum Water Temperature (6/20-8/27)



USDA Salmon Challis NF Yankee Fork RD

APPENDIX E

USGS Water Quality Data

Station #	Station Name	Date(YMD)	Time	Flow (cfs)	Temp (C)	N(NH3 +Org)	TP (mg/l)	SS (mg/l)	SS (t/day)	As (ug/l)	Cd (ug/l)	Cr (ug/l)	Cu (ug/l)	Fe (ug/l)	Pb (ug/l)	Se (ug/l)	Zn (ug/l)	Hg (ug/l)	Ag (ug/l)	Ba (ug/l)
13292200	SALMON RIVER AT HEAD NR OBSIDIAN ID	19720620	1330	NA	7	NA	NA	27	6.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13293200	CHAMPION CREEK NR OBSIDIAN ID	19720620	1200	NA	6	NA	NA	1260	194	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13293400	FOURTH OF JULY CREEK NR OBSIDIAN ID	19720627	1045	NA	5	NA	NA	369	87	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13293800	SALMON RIVER @ HWY 93 ABV REDFISH CR NR STANLEY	I 19780717	1300	1110	14	0.19	NA	NA	NA	2	2.<	20	3	40	13.<	1.<	20.<	0.1	NA	NA
13293800	SALMON RIVER @ HWY 93 ABV REDFISH CR NR STANLEY	I 19780911	1140	400	8.5	0.3	NA	NA	NA	5	2.U	0	3	100	6.<	1.U	.0<	0.1	NA	NA
13293800	SALMON RIVER @ HWY 93 ABV REDFISH CR NR STANLEY	I 19790608	1100	777	7.5	0.14	NA	NA	NA	2.U	.0<	20	2	80	12.<	1.<	20.<	0.1	NA	NA
13293800	SALMON RIVER @ HWY 93 ABV REDFISH CR NR STANLEY	I 19800116	1030	195	5E-06	0.37	NA	NA	NA	2	0	NA	3	NA	2	NA	20	0	NA	NA
13293800	SALMON RIVER @ HWY 93 ABV REDFISH CR NR STANLEY	I 19800512	1700	982	9	0.35	NA	NA	NA	3	0	4	3	NA	1	NA	10	0	NA	NA
13293800	SALMON RIVER @ HWY 93 ABV REDFISH CR NR STANLEY	I 19810202	1200	153	5E-06	1.1	0.02	NA	NA	2	0	7	4	160	9	NA	30	0.1	NA	NA
13293800	SALMON RIVER @ HWY 93 ABV REDFISH CR NR STANLEY	I 19810617	1215	737	8	0.55	0.02	NA	NA	3	0	5	5	110	14	NA	40	0	NA	NA
13293800	SALMON RIVER @ HWY 93 ABV REDFISH CR NR STANLEY	I 19820112	1830	195	2.2	0.72	0.01	NA	NA	3	1	9	11	400	17	NA	120	0.8	NA	NA
13293800	SALMON RIVER @ HWY 93 ABV REDFISH CR NR STANLEY	I 19820726	1100	1020	11.5	.2<	0.01	NA	NA	3.<	1	11	3	120	1	NA	30.<	0.1	NA	NA
13293800	SALMON RIVER @ HWY 93 ABV REDFISH CR NR STANLEY	I 19830117	1330	245	2.0001	0.5	0.03	NA	NA	3	2.<	1	6	90	4	NA	20	0.2	NA	NA
13293800	SALMON RIVER @ HWY 93 ABV REDFISH CR NR STANLEY	I 19830711	1300	1270	11.5	0.7	0.02	NA	NA	2	2.<	1	4	80	4	NA	130	0.1	NA	NA
13293800	SALMON RIVER @ HWY 93 ABV REDFISH CR NR STANLEY	I 19840120	1100	229	0	.2<	0.01	NA	NA	3.<	1	6	5	50.<	1	NA	20.<	0.1	NA	NA
13293800	SALMON RIVER @ HWY 93 ABV REDFISH CR NR STANLEY	I 19840728	1215	805	12.5	0.2	0.01	NA	NA	2.<	1	5	11	230	9	NA	30	0.4	NA	NA
13293900	REDFISH LAKE CREEK BL LAKE NR STANLEY ID	19790129	1700	34	0	0.05	NA	NA	NA	1.<	2.<	20.<	2.<	10	9.<	1.U	.0<	0.1	NA	NA
13293900	REDFISH LAKE CREEK BL	19790608	1400	275	9.5<	0.1	NA	NA	NA<	1.U	.0U	0	3	20	8.<	1	30.U	0	NA	NA

	LAKE NR STANLEY ID																			
13293900	REDFISH LAKE CREEK BL LAKE NR STANLEY ID	19800115	1345	56	1	0.16	NA	NA	NA	0	0	NA	3	NA	5	NA	30	0	NA	NA
13293900	REDFISH LAKE CREEK BL LAKE NR STANLEY ID	19800713	1915	285	16	0.59	NA	NA	NA	0	1	4	5	NA	14	NA	40	0.1	NA	NA
13294500	SALMON RIVER AT STANLEY ID	19721003	1000	NA	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13295000	VALLEY CREEK AT STANLEY ID	19710524	1700	NA	9	NA	0.05	4	6.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13295000	VALLEY CREEK AT STANLEY ID	19710621	1625	NA	13.5	NA	0.02	3	9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13295000	VALLEY CREEK AT STANLEY ID	19710719	1335	NA	13.5	NA	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13295000	VALLEY CREEK AT STANLEY ID	19710830	1045	NA	12	NA	0.04	8	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13295000	VALLEY CREEK AT STANLEY ID	19711004	1600	NA	11	NA	0.04	3	1.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13295000	VALLEY CREEK AT STANLEY ID	19720616	1400	NA	10.5	NA	0.04	10	29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13295000	VALLEY CREEK AT STANLEY ID	19720724	1100	NA	12	NA	0.02	4	2.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13295650	BASIN CREEK NR STANLEY ID	19720626	1445	NA	7.5	NA	NA	6	3.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13296000	YANKEE FORK SALMON RIVER NR CLAYTON ID	19780717	1515	383	13	0.5	NA	NA	NA	2.<	2.<	20	6	70	3.<	1.<	20.<	0.1	NA	NA

Station #	Station Name	Date(YMD)	Time	Flow (cfs)	Temp(C)	N(NH3+Org)	TP(mg/l)	SS(mg/l)	SS(t/day)	As(ug/l)	Cd(ug/l)	Cr(ug/l)	Cu(ug/l)	Fe(ug/l)	Pb(ug/l)	Se(ug/l)	Zn(ug/l)	Hg(ug/l)	Ag(ug/l)	Ba(ug/l)
13296000	YANKEE FORK SALMON RIVER NR CLAYTON ID	19780911	1355	108	10	0.2	NA	NA	NA	2.U	.0<	20	3	50	4.<	1.U	.0<	0.1	NA	NA
13296000	YANKEE FORK SALMON RIVER NR CLAYTON ID	19790206	1530	52.5	0	0.03	NA	NA	NA	1.U	.0<	20.U	0	40	6.<	1.U	.0<	0.1	NA	NA
13296000	YANKEE FORK SALMON RIVER NR CLAYTON ID	19790607	1615	555	7.5	0.09	NA	NA	NA	1.U	.0<	20	7	140	21.<	1.<	20	0.2	NA	NA
13296000	YANKEE FORK SALMON RIVER NR CLAYTON ID	19800115	1030	39	5E-06	0.31	NA	NA	NA	1	0	NA	5	NA	1	NA	20	0	NA	NA
13296000	YANKEE FORK SALMON RIVER NR CLAYTON ID	19800713	1445	245	13	0.44	NA	NA	NA	1	0	2	6	NA	9	NA	20	0	NA	NA
13296500	SALMON RIVER BL YANKEE FORK NR CLAYTON ID	19710525	1135	NA	4	NA	0.06	17	134	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13296500	SALMON RIVER BL YANKEE FORK NR CLAYTON ID	19710622	1215	NA	6.5	NA	0.05	32	556	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13296500	SALMON RIVER BL YANKEE FORK NR CLAYTON ID	19710723	1335	NA	12.5	NA	0.05	7	46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13296500	SALMON RIVER BL YANKEE FORK NR CLAYTON ID	19710903	1030	NA	10	NA	0.04	3	5.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13296500	SALMON RIVER BL YANKEE FORK NR CLAYTON ID	19711008	1115	NA	6	NA	0.04	1	1.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13296500	SALMON RIVER BL YANKEE FORK NR CLAYTON ID	19720616	1110	NA	6.5	NA	0.03	41	644	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13296500	SALMON RIVER BL YANKEE FORK NR CLAYTON ID	19720724	1130	NA	11	NA	0.02	3	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

13296500	SALMON RIVER BL YANKEE FORK NR CLAYTON ID	19721005	1230	668	8	NA	NA	7	13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13296500	SALMON RIVER BL YANKEE FORK NR CLAYTON ID	19730430	1400	828	5	NA	0.02	6	13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13296500	SALMON RIVER BL YANKEE FORK NR CLAYTON ID	19730604	1350	1740	7.5	NA	0.02	6	28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13296500	SALMON RIVER BL YANKEE FORK NR CLAYTON ID	19740610	1530	4650	7	NA<	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297250	SLATE CREEK NR CLAYTON ID	19720615	1600	NA	11	NA	NA	987	272	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297300	HOLMAN CREEK NR CLAYTON ID	19730604	1620	NA	13.3	NA	0.03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297310	THOMPSON CREEK AB PAT HUGHES CREEK NR CLAYTON I	19720618	1500	NA	8.5	NA	NA	35	9.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297312	PAT HUGHES CREEK AB MINE ADT NR CLAYTON ID	19720629	1150	1	7.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297314	MINE ADT DISC TO PAT HUGHES CR NR CLAYTON ID	19720629	1200	0.5	13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297316	STILLING PONDS TO PAT HUGHES CR NR CLAYTON ID	19720629	1210	0.5	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297320	PAT HUGHES CREEK NR CLAYTON ID	19720618	1700	NA	9	NA	NA	10	0.06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297320	PAT HUGHES CREEK NR CLAYTON ID	19720629	1225	NA	13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297320	PAT HUGHES CREEK NR CLAYTON ID	19730504	1005	7	4	NA	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297330	THOMPSON CREEK NR CLAYTON ID	19730503	1340	17	5.5	NA	0.02	7	0.32	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297330	THOMPSON CREEK NR CLAYTON ID	19730604	1455	31	10.5	NA	0.03	2	0.17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297330	THOMPSON CREEK NR CLAYTON ID	19740614	1530	229	10.5	NA<	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297340	SQUAW CREEK AB BRUNO CREEK NR CLAYTON ID	19720619	1408	NA	6.5	NA	NA	42	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297350	BRUNO CREEK NR CLAYTON ID	19710526	910	NA	3.5	NA	0.1	30	0.89	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297350	BRUNO CREEK NR CLAYTON ID	19710622	1625	NA	11	NA	0.07	17	0.87	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297350	BRUNO CREEK NR CLAYTON ID	19710723	1135	NA	8	NA	0.06	1	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297350	BRUNO CREEK NR CLAYTON ID	19710902	735	NA	2.5	NA	0.07	1	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297350	BRUNO CREEK NR CLAYTON ID	19711007	1415	NA	7	NA	0.08	1	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297350	BRUNO CREEK NR CLAYTON ID	19720614	1620	NA	9	NA	0.07	30	1.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297350	BRUNO CREEK NR CLAYTON ID	19720724	1440	NA	10	NA	0.05	5	0.03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297350	BRUNO CREEK NR CLAYTON ID	19730503	1530	0.88	6.5	NA	0.03	8	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Station #	Station Name	Date(YMD)	Time	Flow (cfs)	Temp(C)	N(NH3+Org)	TP(mg/l)	SS(mg/l)	SS(t/day)	As(ug/l)	Cd(ug/l)	Cr(ug/l)	Cu(ug/l)	Fe(ug/l)	Pb(ug/l)	Se(ug/l)	Zn(ug/l)	Hg(ug/l)	Ag(ug/l)	Ba(ug/l)
13297350	BRUNO CREEK NR CLAYTON ID	19730607	1600	1.6	8.5	NA	0.03	1	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297350	BRUNO CREEK NR CLAYTON ID	19740614	955	25.8	5	NA	0.11	415	29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297355	SQUAW CREEK BL BRUNO CREEK NR CLAYTON ID	19730503	1605	36	6.5	NA	0.06	9	0.87	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297355	SQUAW CREEK BL BRUNO CREEK NR CLAYTON ID	19730607	1700	53	13.5	NA	0.04	4	0.57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297355	SQUAW CREEK BL BRUNO CREEK NR CLAYTON ID	19740614	1300	490	7.5	NA	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297380	SALMON RIVER AB EAST FORK NR CLAYTON ID	19710601	1310	NA	6	NA	0.15	49	1000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297380	SALMON RIVER AB EAST FORK NR CLAYTON ID	19710623	1015	NA	9	NA	0.14	109	2240	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297380	SALMON RIVER AB EAST FORK NR CLAYTON ID	19710722	1645	NA	12	NA	0.04	3	25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297380	SALMON RIVER AB EAST FORK NR CLAYTON ID	19710901	1140	NA	12	NA	0.04	5	16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297380	SALMON RIVER AB EAST FORK NR CLAYTON ID	19711008	915	NA	6.5	NA	0.05	2	5.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297380	SALMON RIVER AB EAST FORK NR CLAYTON ID	19720619	1230	NA	8.5	NA	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297380	SALMON RIVER AB EAST FORK NR CLAYTON ID	19720725	1510	NA	10	NA	0.01	8	42	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297380	SALMON RIVER AB EAST FORK NR CLAYTON ID	19721004	1600	983	7	NA	NA	6	16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297380	SALMON RIVER AB EAST FORK NR CLAYTON ID	19730501	1540	1030	8.5	NA	0.01	10	28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297380	SALMON RIVER AB EAST FORK NR CLAYTON ID	19730607	1445	2150	13	NA	0.01	7	41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297396	WEST PASS CREEK NR CLAYTON ID	19720629	1615	NA	10.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297396	WEST PASS CREEK NR CLAYTON ID	19721004	1000	8.1	7	NA	NA	6	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297400	EF SALMON RIVER BL BOWERYRS NR CLAYTON ID	19720629	1600	NA	11.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297400	EF SALMON RIVER BL BOWERYRS NR CLAYTON ID	19720725	1000	NA	8.5	NA	.01<	1	0.07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297400	EF SALMON RIVER BL BOWERYRS NR CLAYTON ID	19721004	1030	39	7	NA	NA	4	0.42	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297404	GERMANIA CREEK NR CLAYTON ID	19720629	1640	NA	10.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297404	GERMANIA CREEK NR CLAYTON ID	19721004	1115	36	4.5	NA	NA	6	0.58	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297425	EF SALMON RIVER BL WICKIUP CREEK NR CLAYTON ID	19710527	1430	NA	7.5	NA	0.04	21	29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297425	EF SALMON RIVER BL WICKIUP CREEK NR CLAYTON ID	19710627	1215	NA	5.5	NA	0.04	90	316	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297425	EF SALMON RIVER BL WICKIUP	19710722	1040	NA	6	NA	0.04	4	5.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

	CREEK NR CLAYTON ID																			
13297425	EF SALMON RIVER BL WICKIUP CREEK NR CLAYTON ID	19710902	1355	NA	9	NA	0.04	1	0.34	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297425	EF SALMON RIVER BL WICKIUP CREEK NR CLAYTON ID	19711007	1100	NA	5	NA	0.06	1	0.29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297425	EF SALMON RIVER BL WICKIUP CREEK NR CLAYTON ID	19720621	950	NA	5	NA	0.03	36	70	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297425	EF SALMON RIVER BL WICKIUP CREEK NR CLAYTON ID	19720725	1100	NA	8.5	NA	0.04	3	1.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297425	EF SALMON RIVER BL WICKIUP CREEK NR CLAYTON ID	19721004	1200	97	6.5	NA	NA	5	1.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297425	EF SALMON RIVER BL WICKIUP CREEK NR CLAYTON ID	19730501	1045	74	3	NA	0.01	6	1.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297425	EF SALMON RIVER BL WICKIUP CREEK NR CLAYTON ID	19730605	1515	287	10.5	NA	0.01	2	1.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19700623	830	NA	1.5	NA	NA	4	0.79	NA	NA	0	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19700827	840	NA	11	NA	NA	5	0.04	NA	NA	0	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19701013	845	NA	0	NA	0.13	0	0	NA	NA	0	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19710629	845	NA	1	NA	0.01	1	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19710831	915	NA	11	NA	0.05	1	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19711005	1150	NA	5.5	NA	0.04	1	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19720620	830	NA	1.5	NA	0.01	3	0.22	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19720718	800	NA	9.5	NA	0.01	1	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19720829	900	0.37	10	NA	0.03	4	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19721003	840	1.5	2	NA	NA	8	0.03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19730502	1000	0.5	0	NA	0.01	15	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19730605	1015	8	3.5	NA<	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19730710	1100	7	13.5	NA<	0.01	3	0.06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19730905	1030	1.61	8.5	NA	0.06	3	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19740611	930	17	1	NA	0.07	4	0.18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19740710	930	31.4	6.5	NA<	0.01	4	0.34	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19740802	900	17.3	11.5	NA<	0.01	1	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19740926	1030	1.37	7	NA	0.01	2	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19750715	900	57	4.5	NA	0.04	1	0.15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19750813	920	7.17	10	NA<	0.01	0.5	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19750904	930	2.38	6.5	NA<	0.01	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19751001	900	0.91	3.5	NA<	0.01	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19760622	1025	31.2	5	NA	0.04	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19760722	1110	17.2	11.5	NA<	0.01	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19760811	845	4.7	10	NA<	0.01	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19760915	1230	6.3	10.5	NA<	0.01	1	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19770615	930	17	3.5	NA<	.01<	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19770712	1420	4.2	15	NA<	.01<	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19770818	915	1.81	12	NA	.01<	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19770927	1110	1.53	6.5	NA	.01<	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297440	LTL BOULDER CREEK AB BAKER LAKE NR CLAYTON ID	19780913	950	5.92	7	NA	.01<	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19700623	935	NA	3.5	NA	NA	32	15	NA	NA	0	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19700827	945	NA	9.5	NA	NA	4	0.15	NA	NA	0	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19701013	1015	NA	0	NA	0.04	1	0.02	NA	NA	1	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19710629	950	NA	2.5	NA	0.04	4	0.89	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Station #	Station Name	Date(YMD)	Time	Flow (cfs)	Temp(C)	N(NH3+Org)	TP(mg/l)	SS(mg/l)	SS(t/day)	As(ug/l)	Cd(ug/l)	Cr(ug/l)	Cu(ug/l)	Fe(ug/l)	Pb(ug/l)	Se(ug/l)	Zn(ug/l)	Hg(ug/l)	Ag(ug/l)	Ba(ug/l)
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19710831	1025	NA	9.5	NA	0.06	1	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19711005	1225	NA	5.5	NA	0.04	1	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19720620	915	NA	2.5	NA	0.03	5	1.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19720718	900	NA	9.5	NA	0.03	2	0.33	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19720829	1010	NA	10	NA	0.03	3	0.11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19721003	1000	6.5	5	NA	NA	4	0.07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19730502	1050	4.4	2	NA	0.02	7	0.08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN	[19730605	1105	28	5.5	NA	0.01	10	0.76	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

	LK OUTLET NR CLAYTON I																			
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19730710	1200	25	13	NA<	0.01	4	0.27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19730905	1145	4.74	9.5	NA	0.02	1	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19740611	1030	59	3.5	NA	0.1	4	0.64	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19740710	1030	94	7	NA<	0.01	4	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19740802	930	48.1	10	NA	0.01	16	2.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19740926	945	7.64	5	NA	0.01	3	0.06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19750715	1020	142	6.5	NA	0.01	4	1.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19750813	1000	21.4	8	NA<	0.01	0.6	0.03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19750904	1030	12.7	5	NA<	0.01	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19751001	1000	7.6	4	NA	0.01	1	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19760622	1220	98.1	7	NA	0.03	3	0.79	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19760722	1200	45	11	NA<	0.01	5	0.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19760811	930	20	9	NA	0.01	1	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19760915	1345	16.2	9	NA<	0.01	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19770615	1045	35	5	NA<	0.01	2	0.19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19770712	1515	13.3	15	NA	.01<	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19770818	1000	7.12	12.5	NA	0.02	1	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19770927	1145	5.1	5.5	NA	0.01	1	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297445	L BOULDER C BL BO. CHAIN LK OUTLET NR CLAYTON I	[19780913	915	18.1	4.5	NA	.01<	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19700624	1110	NA	7	NA	NA	137	73	NA	NA	0	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19700828	825	NA	10.5	NA	NA	NA	NA	NA	NA	0	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19701012	1800	NA	5	NA	NA	1	0.03	NA	NA	1	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19710527	1625	NA	7	NA	0.08	13	1.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19710628	1530	NA	7	NA	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19710722	1215	NA	11	NA	0.03	8	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19710830	1545	NA	11	NA	0.05	2	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19711006	1405	NA	5.5	NA	0.06	3	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19720620	1325	107	6.5	NA	0.07	20	5.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19720717	1350	NA	11	NA	0.03	4	0.71	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19720830	1010	NA	10	NA	0.02	5	0.22	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19721002	1440	9	5	NA	NA	5	0.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19730503	950	6.8	3.5	NA	0.01	6	0.11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19730606	917	29	7	NA	0.02	1	0.08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19730710	1515	23	15.4	NA	0.01	2	0.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19730906	1300	6.7	10	NA	0.08	3	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19740613	1130	144	5.5	NA<	0.01	93	36	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19740710	1430	103	8.6	NA<	0.01	12	3.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19740805	1400	52.3	13.5	NA	0.01	5	0.71	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19740925	1130	8.65	7	NA	0.01	1	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19750618	930	138	4.5	NA	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19750716	1030	300	7	NA	0.05	21	17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19750812	1340	23.7	10.5	NA<	0.01	0.8	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19750903	1550	17.1	7	NA	0.01	1	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19751001	1415	10	6.5	NA	0.01	1.3	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19760621	1645	114	9.5	NA	0.03	20	6.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19760721	1500	46.3	13	NA<	0.01	4	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19760810	1630	21	11.5	NA	0.01	10	0.57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19760914	1530	21.3	9	NA<	0.01	3	0.17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19770614	1330	35.2	9	NA	0.01	6	0.57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19770712	1845	13	13.5	NA	.01<	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR	19770817	1300	7.82	12.5	NA	0.03	1	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

	CLAYTON ID																			
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19770926	1345	6.83	6.5	NA	.01<	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19780711	1245	136	9	NA	0.02	21	7.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19780912	1515	22.3	6.5	NA	0.01	1	0.06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297450	LITTLE BOULDER CREEK NR CLAYTON ID	19800521	1620	50	10.5	1.3	0.03	34	4.6	3	0	.0<	10	730.<	5	.0<	50.<	1	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19700622	1820	NA	7	NA	NA	325	144	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19700826	1815	NA	11.5	NA	NA	3	0.11	NA	NA	0	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19701012	1500	NA	3.5	NA	NA	1	0.03	NA	NA	1	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19710628	935	NA	3.5	NA	NA	13	2.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Station #	Station Name	Date(YMD)	Time	Flow (cfs)	Temp(C)	N(NH3+Org)	TP(mg/l)	SS(mg/l)	SS(t/day)	As(ug/l)	Cd(ug/l)	Cr(ug/l)	Cu(ug/l)	Fe(ug/l)	Pb(ug/l)	Se(ug/l)	Zn(ug/l)	Hg(ug/l)	Ag(ug/l)	Ba(ug/l)
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19710831	1500	NA	11	NA	0.05	3	0.17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19711006	1015	NA	2	NA	0.05	2	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19720619	1525	NA	5.5	NA	0.04	16	3.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19720718	1400	NA	11.5	NA	0.02	3	0.37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19720829	1530	NA	11	NA	0.03	2	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19721003	1430	11	5	NA	NA	5	0.15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19730502	1635	6.4	3.5	NA	0.02	2	0.03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19730606	1330	35	8.5	NA<	0.01	3	0.28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19730711	1115	25	12	NA<	0.01	1	0.07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT	19730906	1100	7.52	8	NA	0.06	2	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

	LIVINGSTON MILL NR CLAYTON ID																			
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19740612	1300	90.2	6.5	NA	0.09	30	7.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19740711	1300	79	6	NA<	0.01	4	0.85	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19740801	1030	60	9.5	NA	0.01	1	0.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19740924	1130	10.6	4.2	NA	0.01	2	0.06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19750715	1520	109	10	NA<	0.01	8	2.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19750813	1400	18.4	10	NA<	0.01	0.4	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19750904	1440	13.4	7.5	NA<	0.01	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19751002	1100	9.51	3	NA	0.01	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19760622	940	78	4.5	NA	0.03	14	2.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19760722	945	46.3	7.5	NA<	0.01	1	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19760811	1530	23	13	NA	0.01	10	0.62	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19760915	1000	18.4	5.5	NA<	0.01	1	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19770614	1100	33	5.5	NA<	0.01	2	0.18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19770712	1130	15	10	NA<	.01<	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19770818	1500	9.2	14	NA	0.02	2	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19770927	1445	7.11	6.5	NA<	.01<	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297480	BIG BOULDER CR AT	19780712	1045	80.3	6	NA	0.01	12	2.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

	LIVINGSTON MILL NR CLAYTON ID																			
13297480	BIG BOULDER CR AT LIVINGSTON MILL NR CLAYTON ID	19780913	1515	16	7	NA	.01<	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19700622	1600	NA	8.5	NA	NA	1050	74	NA	NA	0	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19700826	1550	NA	10	NA	NA	7	0.06	NA	NA	0	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19701012	1430	NA	3	NA	NA	3	0.02	NA	NA	0	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19710628	850	NA	3	NA	0.08	60	2.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19710831	1425	NA	8.5	NA	0.11	7	0.07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19711006	900	NA	2	NA	0.09	5	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19720619	1430	NA	5	NA	0.09	103	4.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19720718	1330	NA	9.5	NA	0.08	14	0.37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19720829	1430	NA	10	NA	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19721003	1320	3.5	3.5	NA	NA	8	0.08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19730502	1515	1.8	2.5	NA	0.04	9	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19730606	1220	4.6	7.5	NA	0.05	4	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19730711	940	2.9	9	NA	0.03	12	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19730906	950	2.6	6	NA	0.12	9	0.06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19740612	1030	11.2	5.5	NA	0.22	79	2.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19740711	1130	12.1	4	NA	0.04	13	0.42	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19740801	1000	8.86	6.5	NA	0.03	4	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19740924	940	2.6	3.5	NA	0.03	2	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19750715	1400	14.8	7.5	NA	0.05	36	1.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19750813	1300	6.71	8	NA<	0.01	5	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19750904	1330	4.35	6	NA	0.04	1	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19751002	920	2.8	2.5	NA	0.04	1.6	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19760622	850	16.1	5	NA	0.06	12	0.52	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19760722	915	9	6	NA	0.03	7	0.17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19760811	1445	4.4	10	NA	0.04	11	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19760915	930	3	4.5	NA	0.03	2	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19770614	940	3.72	5.5	NA	0.05	20	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19770712	1100	2.2	8.5	NA	0.02	6	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19770818	1345	1.71	10.5	NA	0.06	9	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19770927	1410	1.5	6.5	NA	0.02	2	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19780712	1000	12	5.5	NA	0.05	69	2.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297485	JIM CREEK AT LIVINGSTON MILL NR CLAYTON ID	19780913	1445	3.3	6	NA	.03<	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297500	BIG BOULDER CREEK NR CLAYTON ID	19720725	1200	NA	8.5	NA	0.02	8	0.95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297500	BIG BOULDER CREEK NR CLAYTON ID	19721002	1200	16	3.5	NA	NA	6	0.26	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297500	BIG BOULDER CREEK NR CLAYTON ID	19730501	1140	9.6	2	NA	0.02	6	0.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297500	BIG BOULDER CREEK NR CLAYTON ID	19730606	1505	41	11.5	NA	0.03	6	0.66	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297500	BIG BOULDER CREEK NR CLAYTON ID	19740611	1520	98	9.5	NA	0.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13297600	HERD CREEK NR CLAYTON ID	19721004	1300	26	6.5	NA	NA	7	0.49	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298000	EF SALMON RIVER NR CLAYTON ID	19710601	1115	NA	5	NA	0.1	52	150	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Station #	Station Name	Date(YMD)	Time	Flow (cfs)	Temp(C)	N(NH3+Org)	TP(mg/l)	SS(mg/l)	SS(t/day)	As(ug/l)	Cd(ug/l)	Cr(ug/l)	Cu(ug/l)	Fe(ug/l)	Pb(ug/l)	Se(ug/l)	Zn(ug/l)	Hg(ug/l)	Ag(ug/l)	Ba(ug/l)
13298000	EF SALMON RIVER NR CLAYTON ID	19710623	1150	NA	7	NA	0.35	555	4000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298000	EF SALMON RIVER NR CLAYTON ID	19710722	1440	NA	7	NA	0.07	51	130	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298000	EF SALMON RIVER NR CLAYTON ID	19710901	1030	NA	11	NA	0.04	4	2.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298000	EF SALMON RIVER NR CLAYTON ID	19711007	1250	NA	5.5	NA	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298000	EF SALMON RIVER NR CLAYTON ID	19720615	1310	NA	8	NA	0.07	178	836	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298000	EF SALMON RIVER NR CLAYTON ID	19720725	1330	NA	9	NA	0.02	12	13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298000	EF SALMON RIVER NR CLAYTON ID	19721004	1430	183	7	NA	NA	6	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298000	EF SALMON RIVER NR CLAYTON ID	19730501	1340	142	8	NA	0.02	11	4.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298000	EF SALMON RIVER NR CLAYTON ID	19730607	915	700	9	NA	0.01	21	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

13298000	EF SALMON RIVER NR CLAYTON ID	19740613	1700	2120	11.5	NA	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298000	EF SALMON RIVER NR CLAYTON ID	19800521	1450	795	14	0.58	0.05	114	245	3	2	0	18	1500	10	.0<	50.<	1	NA	NA
13298400	BAYHORSE CREEK NR CHALLIS ID	19730709	1505	0.91	17	NA	0.01	1	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298500	SALMON RIVER NR CHALLIS ID	19710526	1615	NA	8.5	NA	0.06	56	708	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298500	SALMON RIVER NR CHALLIS ID	19710626	1335	NA	8	NA	0.2	172	4690	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298500	SALMON RIVER NR CHALLIS ID	19710723	1000	NA	12.5	NA	0.04	7	70	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298500	SALMON RIVER NR CHALLIS ID	19710901	1330	NA	13	NA	0.04	2	6.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298500	SALMON RIVER NR CHALLIS ID	19711007	1600	NA	11.5	NA	0.05	2	5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298500	SALMON RIVER NR CHALLIS ID	19720614	1130	NA	8	NA	0.07	130	3070	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298500	SALMON RIVER NR CHALLIS ID	19720724	1530	NA	14.5	NA	0.02	9	49	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298500	SALMON RIVER NR CHALLIS ID	19721005	930	1090	7	NA	NA	7	21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298500	SALMON RIVER NR CHALLIS ID	19730430	1605	1100	9	NA	0.02	10	30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298500	SALMON RIVER NR CHALLIS ID	19730608	1000	3170	11.5	NA	0.03	22	188	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13298500	SALMON RIVER NR CHALLIS ID	19740615	1500	14400	8.7	NA<	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX F

Macroinvertebrate Biotic Integrity Report

Upper Salmon (HUC 17060201)

Custer County, Idaho

Subbasin Assessment Biotic Integrity (Macroinvertebrates)

Idaho Department of Environmental Quality

State Technical Services Office

2000

Printed on recycled paper

Upper Salmon (HUC 17060201)
Custer County, Idaho

Subbasin Assessment

Biotic Integrity (Macroinvertebrates)

William H. Clark
State Technical Services Office
Idaho Department of Environmental Quality
1410 North Hilton Street
Boise, Idaho 83706-1255
wclark@deq.state.id.us

October 15, 2000

Abstract

The macroinvertebrates of four streams in the Upper Salmon area, Custer County, Idaho, were sampled as part of the Beneficial Use Reconnaissance Project by the Idaho Division of Environmental Quality between 1994 and 1997. Three stream segments (segments on Road Creek, Lost Creek, and Kinnikinic Creek) were listed in the Division of Environmental Quality 1998 303(d) list as water quality limited for Hydrologic Unit Code #17060201 for Apollutant unknown.@ In addition, the Environmental Protection Agency listed Squaw Creek for having, temperatures that exceeded recommended levels. The objective of this study is to determine the pollutant(s) responsible for degrading these four streams. Analysis of the macroinvertebrate data indicate that the upper and lower parts of Road Creek, Lost Creek, and the lower portion of Kinnikinic Creek are all impacted by fine sediment. Additional sampling for fine sediment on Lost Creek is suggested. DEQ analyses did not show impacts from high temperatures in Squaw Creek. The majority of this creek is not impacted by fine sediment.

Introduction

Macroinvertebrates of several 303(d) listed streams (Idaho Division of Environmental Quality 1999) in the Upper Salmon area were sampled as part of the Beneficial Use Reconnaissance Project (BURP) by the Idaho Division of Environmental Quality (DEQ), Idaho Falls Regional Office from 1994-1997. The State Office of DEQ are using these data, in part, to prepare a subbasin assessment of the Upper Salmon area.

Ten stream segments in Hydrologic Unit Code (HUC) #17040104 were listed on the 1998 303(d) list as having poor water quality (Idaho Division of Environmental Quality 1999). Seven of these listed stream segments were reported as Apollutant unknown@ (unknown pollutants at the time of listing). This report provides findings from an analysis of macroinvertebrate data on 14 sample sites on the seven streams in an attempt to identify the pollutant(s) responsible for low macroinvertebrate biotic index scores and the subsequent 303(d) listing. Surface fines (percent fine sediment) taken at the sample sites is also used to help define limiting factors.

Materials and Methods

Study Area

The study area is in HUC 17060201 in the Upper Salmon area, Custer County, Idaho. A portion of the area lies within the Salmon-Challis National Forest (upper parts of Kinnikinic and Squaw Creeks) and the Sawtooth National Forest (upper part of Lost Creek). Road Creek flows through lands administered by the Bureau of Land Management (BLM). The lower portions of Kinnikinic and Squaw Creeks are also on BLM lands. Substantial portions of each stream (mainly lower reaches) pass through private land. Four streams (12 stream sites) are included in this report for macroinvertebrates for this project (Table 1). The BURP site identification number is included for reference.

Field Methods

Macroinvertebrate sample methods follow Clark and Maret (1993) McIntyre (1994), Idaho Division of Environmental Quality (1995), Idaho Division of Environmental Quality Beneficial Use reconnaissance Project Technical Advisory Committee (1996a), and Idaho Division of Environmental Quality Beneficial Use Reconnaissance Project Technical Advisory Committee (1997). Three Hess samples were taken and combined for each of three separate riffles. Macroinvertebrates were processed by EcoAnalysts, Inc. of Moscow, Idaho. Voucher specimens of the macroinvertebrates have been deposited in the Orma J. Smith Museum of Natural History, Albertson College of Idaho, Caldwell. Fine sediment values were determined by using a modified Wolman pebble count at each of the three riffles sampled for macroinvertebrates (McIntyre 1994, Idaho Division of Environmental Quality Beneficial Use Reconnaissance Project Technical Advisory Committee 1995, 1996a, 1997) and these data are presented in Table 2.

Methods of Analysis

The macroinvertebrate sample metrics were interpreted consistent with current literature. Clark (1997) provides a draft list of cold water macroinvertebrate indicators for Idaho. Hafele and Hinton (1996), Oregon Watershed Enhancement Board (1999), Relyea (1999), PEERS (1998), and Wisseman (1996) were especially helpful in determining the tolerance of the invertebrates collected to fine sediment. Tables 3, 4, and 5 list the metrics examined for this study. For a

regional comparison of macroinvertebrates found in this area, Platts and Rountree (1974) may be consulted.

The Macroinvertebrate Biotic Index (MBI) scores were calculated using Idaho Division of Environmental Quality (1996b) water body assessment guidance process and are listed in Table 2. The MBI uses the seven metrics discussed in detail below (taxa richness, Ephemeroptera Plecoptera Trichoptera [EPT] index, percent EPT, percent scrapers, percent dominant taxa, the Hilsenhoff Biotic Index, and Shannon=s H= diversity index). In summary, the MBI process was developed by DEQ as a non-arbitrary, objective water body assessment tool. An MBI score of 2.5 or less renders an impaired rating for aquatic life (cold water biota in most cases). An MBI score of 3.5 or greater is determined to be not impaired. If a score falls between 2.5 and 3.5 the site was considered too close to determine and given a rating of Aneeds verification@ (Idaho Division of Environmental Quality 1999). The MBI and other metrics were used from the water body assessment guidance (Idaho Division of Environmental Quality 1996b) for the 1994, 1995, and 1996 BURP sites. The two sites sampled during 1997 were assessed using the Biological Assessment Tool (Idaho Department of Environmental Quality 2000).

Cold water indicators (Table 3) are compared with a draft list prepared for Idaho (Clark 1997) and for the Pacific Northwest (Hafele and Hinton 1996). Essig (1998) is a good reference for examination of the dilemma associated with temperature criteria in Idaho. Clark (1999) provides background information on identifying and determining the distribution of the aquatic macroinvertebrates in Idaho.

The macroinvertebrate metrics currently used by DEQ to calculate the MBI include: percent EPT; modified Hilsenhoff Biotic Index (HBI); percent scrapers, percent dominance; EPT index; taxa richness; and Shannon=s H= diversity index. In addition the number of Plecoptera taxa was examined. The macroinvertebrate information examined can be separated into four general categories: richness, composition, tolerance, and trophic/habitat.

Richness

Taxa richness reflects the health of the assemblage through a measure of the variety of taxa (total number of distinct genera or species) present. Taxa richness can be equated to biodiversity. Taxa Richness generally increases with increasing water quality, habitat diversity, or habitat suitability. Barbour *et al*. (1992) and Karr and Chu (1999) report that taxa richness is a reliable indicator of human influence in the Pacific Northwest and will generally decrease with an increase in such influence. The EPT Index is a metric which summarizes the taxa richness of these three orders of insects that are generally considered to be sensitive to pollution (including temperature and fine sediment). Barbour *et al*. (1992) reports that the EPT Index is a reliable indicator of human influence in the Pacific Northwest and will generally decrease with an increase in such influence. It follows then that the number of Ephemeroptera taxa and the number of Plecoptera taxa will likewise be good indicators of temperature and fine sediment pollution. It is sometimes helpful to look at these taxa separately even though they are considered in the two previously-mentioned metrics. Karr and Chu (1999) show that these three metrics are reliable indicators of human influence across the Pacific Northwest, including central Idaho. Another way to measure diversity is with Shannon=s H= Diversity Index. This metric is based on the observation that relatively undisturbed environments support communities having great taxa richness with no individual species present in overwhelming abundance. It has been one of the most popular diversity indices used for water quality assessment.

Composition

Percent EPT increases as water quality increases, since these groups generally contain taxa that are considered more sensitive to temperature and fine sediment pollution. Karr and Chu (1999) show that these taxa decreased with increased human influence in the Pacific Northwest. They show the same relationship with other intolerant taxa as well. Therefore, each of the EPT groups examined separately (percent Ephemeroptera, percent Plecoptera, and percent Trichoptera) will also show the same trend in relation to temperature and fine sediment pollution. It may be useful to examine these metrics separately at times. Total abundance of macroinvertebrate organisms in a sample can also serve as an indicator of stream health. Generally greater total abundance will indicate a stream of decreased impact and increased water quality. There comes a point (this is dependent on the particular stream, impacts, and taxa present) where greater total abundance indicates a decrease in water quality. This condition is evident when pollution (which includes temperature and fine sediment) has reduced or eliminated the sensitive species and the remaining tolerant species thrive with the resulting reduced competition.

Tolerance

The Hilsenhoff Biotic Index (HBI) was originally a measure of organic pollution. It has been modified several times. For each index each macroinvertebrate taxon is assigned a tolerance value relating to the response to organic and toxic pollutants. A value of 0-10 may be assigned to each taxon, with 0 being the least tolerant to pollution (inverse relationship). A score of 11 indicates the tolerance value is unknown. This index has also been shown to be useful for evaluating the effects of both point and nonpoint source pollution. U.S. Environmental Protection Agency (1997) and Barbour *et al*. (1999) indicate that the HBI is useful in determining the impacts of nonpoint source pollution. APercent dominance@ represents the percent contribution of the numerically dominant taxon to the total number of individuals in the community. It provides an indication of community balance at the lowest positive taxonomic level (usually genus or species). A community (assemblage) dominated by relatively few species would suggest environmental stress. Percent dominance will increase with the impacts of human influence on streams in the Pacific Northwest (Karr and Chu 1999).

Trophic/Habitat

APercent scrapers@ is an index that uses the functional feeding group of each taxon to assess water quality. The relative abundance of scrapers provides an indication of the riffle community food base (periphyton or primary production composition). Scrapers increase with increased abundance of diatoms and decrease as filamentous algae and aquatic mosses increase. Scrapers decrease in relative abundance following increases in fine particle sedimentation in coarse particle substrate stream beds. Percent scrapers has been shown to be sensitive to human influence in central Idaho (Karr and Chu 1999).

Results and Discussion

For comparison, the MBI scores for the DEQ 1996 method (Idaho Division of Environmental Quality 1996b) and the DEQ 2000 method (Idaho Division of Environmental Quality 2000), were compared (Table 2) where the data were available. While expected differences are evident, primarily because the Biological Assessment Tool (Idaho Division of Environmental Quality 2000) uses a revised and expanded taxa and taxa attribute list, the results (assessment call), were

the same except for a single case. That site was on Kinnikinic Creek where the 1996 method indicated an Aimpaired@ stream and the 2000 method resulted in a Aneeds verification@ classification.

Road Creek

Road Creek was listed on the 1998 303(d) list as having unknown pollutants (Apollutant unknown@) (Idaho Division of Environmental Quality 1999). Road Creek was represented by four BURP sites sampled between 1995 and 1997 (Table 1).

The MBI scores for the 1995 and 1996 sites (uppermost and lowermost sites) were in the Aimpaired@ and Aneeds verification@categories, while the 1997 sites indicated that the stream was Anot impaired@ (Table 2). Two cold water indicators were present at the two middle sites (Table 3).

The biological metrics listed in Tables 4 and 5 indicate that the upper and lower sites indicate impairment at these two sites. Macroinvertebrates intolerant of fine sediment impacts, such as *Drunella doddsi* (one specimen was found at a mid elevational site), and most Plecoptera were absent. Considering the composition of the macroinvertebrate assemblages at these sites and the extremely low proportion of scrapers (0 and 0.02% respectively), these two sites are likely impacted by fine sediment.

Lost Creek

Lost Creek was listed on the 1998 303(d) list as having unknown pollutants (Apollutant unknown@) (Idaho Division of Environmental Quality 1999). Lost Creek was represented by a single BURP site sampled in 1996 (Table 1). Lost Creek had a low MBI (1.17), indicating impairment. It did have two cold water indicators (Table 3) indicating that temperature was not a problem. The other macroinvertebrate metrics; however, indicate serious problems. A taxa richness of eight is very poor, no scrapers were present (Table 4), and only three EPT taxa and no Plecoptera (Table 5) were present. These factors indicate fine sediment impacts on the biological assemblage at this site.

Kinnikinic Creek

Kinnikinic Creek was listed on the 1998 303(d) list as having unknown pollutants (Apollutant unknown@) (Idaho Division of Environmental Quality 1999). There were three BURP sites located on Kinnikinic Creek (Table 1). The MBIs on the upper two sites indicate that the stream in this area is Anot impaired@ (Table 2). The lower site had a much lower MBI, which indicates that it is Aimpaired.@

The stream had four to eight cold water indicators present (Table 3) which implies that temperature is not a problem. The metrics shown in Tables 4 and 5 indicate that the upper two sites are in much better condition than the lower site. The lower site appears to be impacted by fine sediment.

Squaw Creek

Squaw Creek was originally not listed on the 1998 303(d) list (Idaho Division of Environmental Quality 1999). Subsequently the U.S. Environmental Protection Agency listed Squaw Creek as being impaired due to high temperatures.

Squaw Creek was represented by four BURP sites sampled during the 1994 and 1995 field seasons (Table 1). Three of the sites rank as Anot impaired@ or Afull support@ and have MBIs of

over 3.5 (Table 2). One site, (A041) had an MBI of 3.13, which means Aneeds verification@ (Table 2). However, the stream, especially near this site, may have impacts from other pollutants such as fine sediment.

The stream had cold water taxa at each site (ranging from two to six)(Table 3). These data would indicate that temperature is not a problem on Squaw Creek. The taxa richness for Squaw Creek was the highest of the four streams in this study (range 35-49) (Table 4). Table 5 shows that Squaw Creek had the highest number of EPT taxa (range 20-33) including Plecoptera taxa (range 6-9), again indicating that temperature does not appear to be a problem in this stream.

Conclusions and Recommendations

1. According to the macroinvertebrate data collected, Road Creek appears to be impacted by fine sediment, but not by increased temperature.

2. According to the macroinvertebrate data examined, Squaw Creek does not appear to be impacted by increased temperatures. This creek had good numbers of cold water indicators, high taxa richness, and high EPT values. Based on these data, DEQ recommends that Squaw Creek be removed from the 303(d) list.

3. The macroinvertebrate assemblage data presented showed that the upper two sites on Kinnikinic Creek are not impacted by increased temperature or fine sediment, but that the lower site appears to be impacted by fine sediment.

4. Lost Creek was represented by macroinvertebrate data from only one site, but that site showed the impacts of fine sediment. DEQ recommends establishing and sampling additional sites on Lost Creek.

Acknowledgments

The macroinvertebrate identifications were done by several laboratories: Northwest Management, Inc. (Jody White) provided the 1994 sample results, the Idaho State Bureau of Laboratories (Kate Parkin and Luana McCauley) provided some of the 1995 results, EcoAnalysts, Inc. (Gary Lester, Scott Lindstrom) provided some of the 1995 and 1996 results, and Weese Bollman, and Kate some of the 1996 and the 1997 results presented here. The Idaho Falls DEQ Regional Office BURP crew took the field samples. Thanks to Steve Robinson for coordinating the field work. Amy Luft reviewed an earlier draft of this report and offered valuable editorial comments.

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Table 1. Macroinvertebrate collection sites for the Upper Salmon area, Idaho, 1994-1997 (HUC 17060201) are given along with their 303(d) listed pollutant. The BURP site ID number is given for reference. Streams that have more than one site have the upper most site (highest elevation) listed first and continue down the list so that the last site listed is lowest in the watershed.

303(d) LISTED STREAM	SITE	BURP SITE ID	POLLUTANT
Road Creek	0.5 mi. bl. N. Fk. (Sage Cr.)	1995SIDFA027	unknown[1]
	7.5 mi. Up Road Cr. Rd.	1997SIDFL106	unknown
	Ab. road crossing	1997SIDFL046	unknown
	20 m. ab. E. Fk. Salmon	1996SIDFA028	unknown
Squaw Creek	120 m. bl. Martin Creek	1995SIDFA069	temperature [2]
	300 m. bl. Cinnibar Cr. Tr.	1994SIDFA041	temperature
	Below USFS boundary	1995SIDFA070	temperature
	100 m. bl. bridge @ state land boundary	1994SIDFA042	temperature
Kinnikinic Creek	0.2 mi. ab. Rd. crossing	1996SIDFY114	unknown
	50 m. bl. Broken Ridge Cr.	1996SIDFY112	unknown
	0.5 mi. above mouth	1996SIDFY118	unknown
Lost Creek	50 m. bl. Valley Road	1996SIDFY097	unknown

[1]unknown = Idaho Division of Environmental Quality (1999)
[2]Temperature - EPA

Table 2. 1999 Macroinvertebrate Biotic Index scores for the Upper Salmon area, Idaho, 1994-1996 and for 1997 (HUC 17060201) using both the 1996 Macroinvertebrate Biotic Index (Idaho Division of Environmental Quality 1996b) and the Biological Assessment Tool (Idaho Division of Environmental Quality 2000).

STREAM	BURP SITE ID	1996 MBI	2000 MBI
Road Creek	1995SIDFA027	0.75	1.64
	1997SIDFL106	n/a	3.84
	1997SIDFL046	n/a	4.2
	1996SIDFA028	2.52	2.54
Squaw Creek	1995SIDFA069	4.69	4.35
	1994SIDFA041	3.13	3.12
	1995SIDFA070	4.07	3.9
	1994SIDFA042	4.55	---
Kinnikinic Creek	1996SIDFY114	4.73	4.57
	1996SIDFY112	4.32	4.13
	1996SIDFY118	2.17	2.49
Lost Creek	1996SIDFY097	1.17	1.17

Table 3. 1999 Macroinvertebrate cold water indicators for the Upper Salmon area, Idaho, 1994-1997 (HUC 17060201).

STREAM	BURP SITE ID	# COLD WATER TAXA	% COLD WATER TAXA
Road Creek	1995SIDFA027	0	0
	1997SIDFL106	2	0.8
	1997SIDFL046	2	0.4
	1996SIDFA028	0	0
Squaw Creek	1995SIDFA069	5	3
	1994SIDFA041	6	2
	1995SIDFA070	2	2
	1994SIDFA042	3	1
Kinnikinic Creek	1996SIDFY114	8	52.1
	1996SIDFY112	6	40.1
	1996SIDFY118	4	1
Lost Creek	1996SIDFY097	2	<0.1

Table 4. Macroinvertebrate data (taxa richness, modified Hilsenhoff Biotic Index, Shannon=s H= Diversity Index, percent scrapers) for the Upper Salmon area, Idaho, 1994-1997 (HUC 17060201).

STREAM	BURP SITE ID	TAXA RICHNESS	HBI	H=	% SCRAPERS
Road Creek	1995SIDFA027	4	5.90	0.18	0
	1997SIDFL106	32	3.84	1.1	13.9
	1997SIDFL046	31	3.47	1.04	6.6
	1996SIDFA028	11	4.8	0.89	0.02
Squaw Creek	1995SIDFA069	37	3.9	1.09	0.24
	1994SIDFA041	35	5.2	0.74	0.05
	1995SIDFA070	42	4.5	0.98	0.15
	1994SIDFA042	49	4.5	1.04	0.24
Kinnikinic Creek	1996SIDFY114	27	2.3	1.03	0.35
	1996SIDFY112	23	2.7	1.06	0.32
	1996SIDFY118	20	5.4	0.57	0.02
Lost Creek	1996SIDFY097	8	5.9	0.29	0

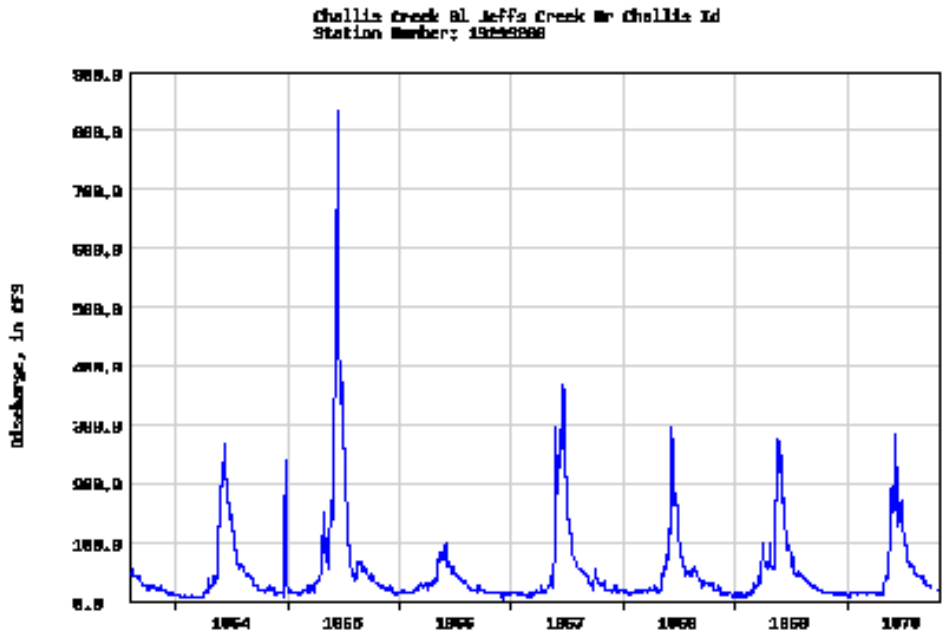
Table 5. Macroinvertebrate data (sum Ephemeroptera Plecoptera Trichoptera taxa, percent EPT, and sum Plecoptera taxa) for the Upper Salmon area, Idaho, 1994-1997 (HUC 17060201).

STREAM	BURP SITE ID	# EPT TAXA	% EPT	# PLECOPTERA TAXA
Road Creek	1995SIDFA027	0	0	0
	1997SIDFL106	18	30.9	4
	1997SIDFL046	17	38.2	2
	1996SIDFA028	4	0.3	1
Squaw Creek	1995SIDFA069	24	0.8	7
	1994SIDFA041	20	0.3	6
	1995SIDFA070	30	0.7	6
	1994SIDFA042	33	0.3	9
Kinnikinic Creek	1996SIDFY114	23	0.7	9
	1996SIDFY112	18	0.6	7
	1996SIDFY118	15	32	4
Lost Creek	1996SIDFY097	3	0.1	0

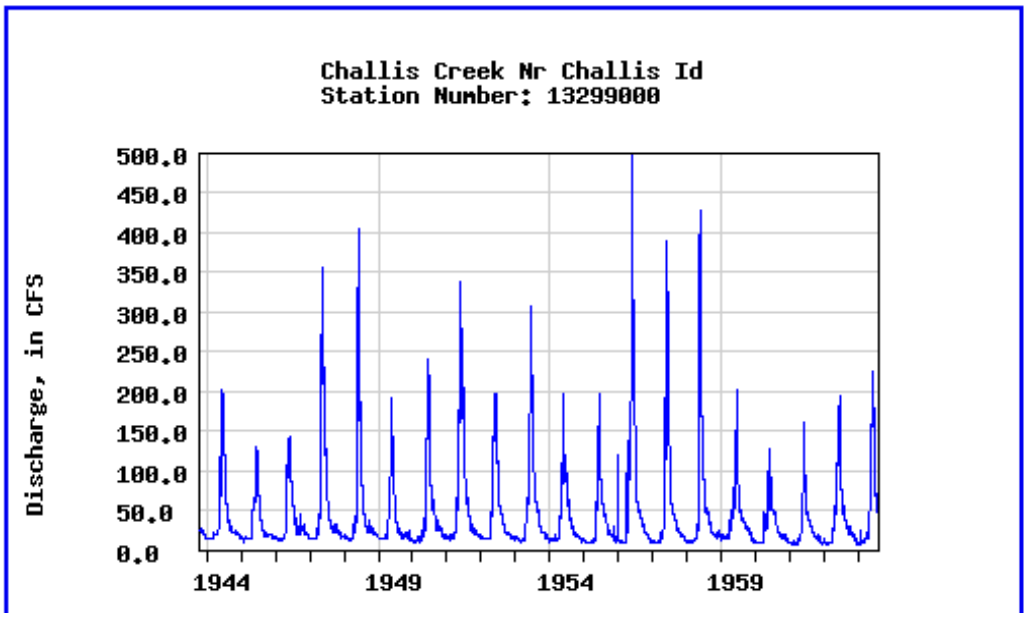
APPENDIX G

USGS Historic Streamflow Graphs

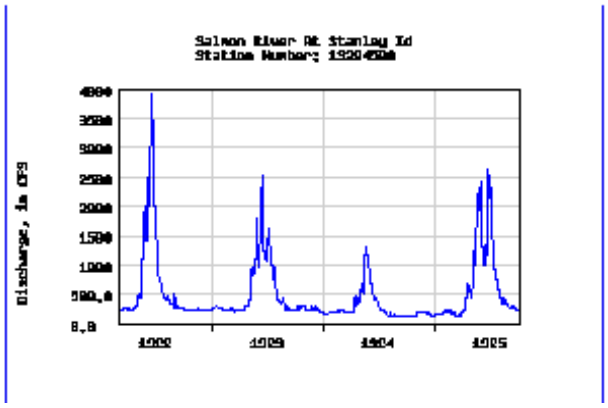
Historical Streamflow Daily Values Graph for Challis Creek Bl Jeffs Creek Nr Challis Id (13299200)



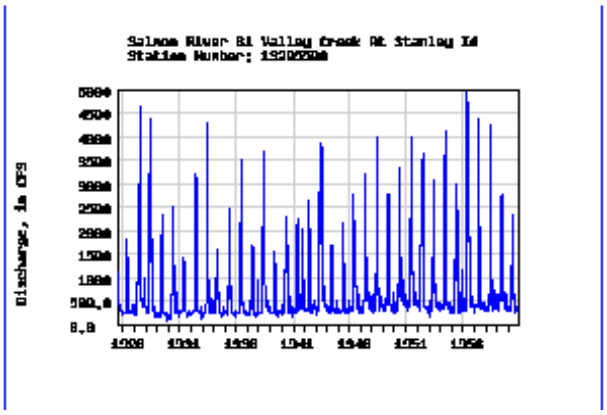
Historical Streamflow Daily Values Graph for Challis Creek Nr Challis Id (13299000)



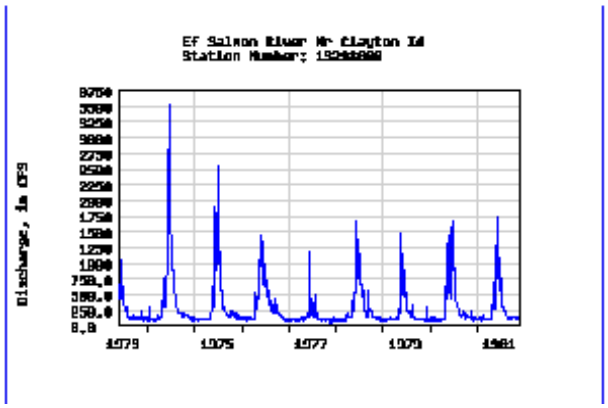
Historical Streamflow Daily Values Graph for Salmon River At Stanley Id (13294500)



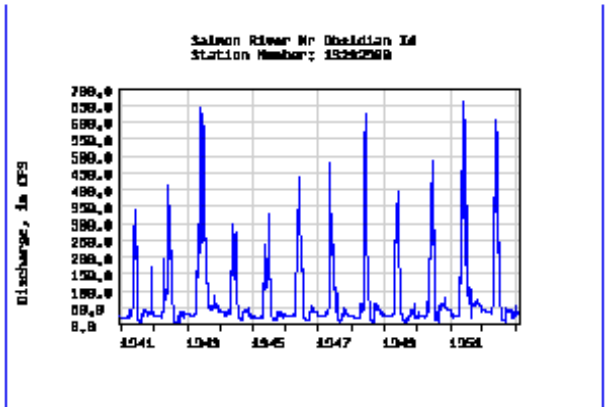
Historical Streamflow Daily Values Graph for Salmon River Bl Valley Creek At Stanley Id (13295500)



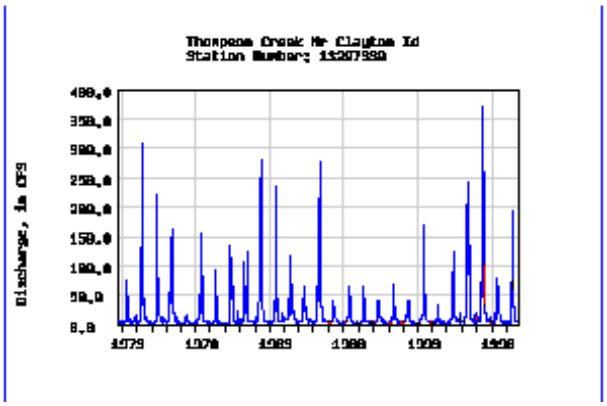
Historical Streamflow Daily Values Graph for Ef Salmon River Nr Clayton Id (13298000)



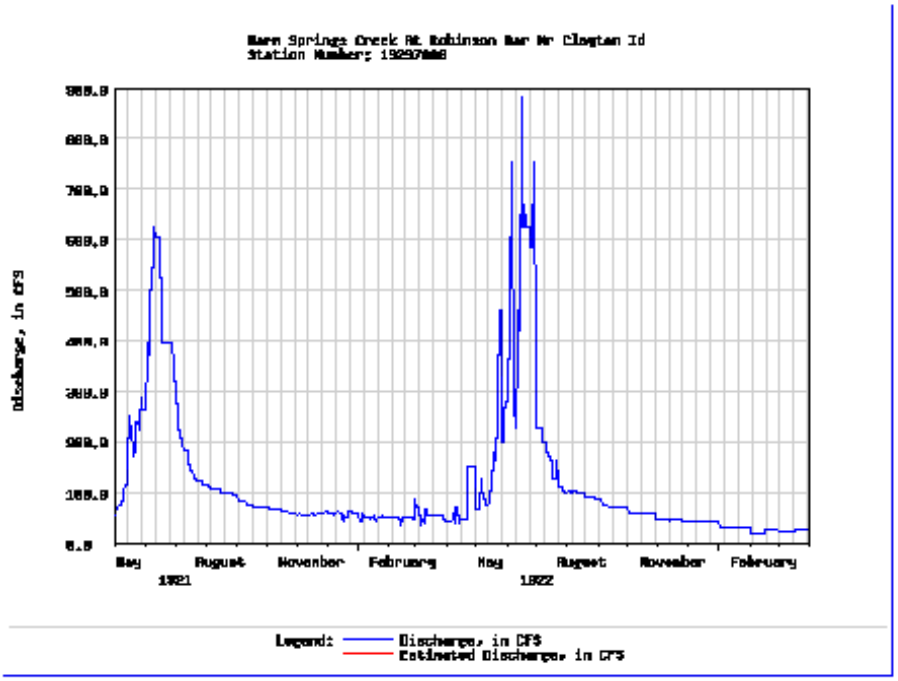
Historical Streamflow Daily Values Graph for Salmon River Nr Obsidian Id (13292500)



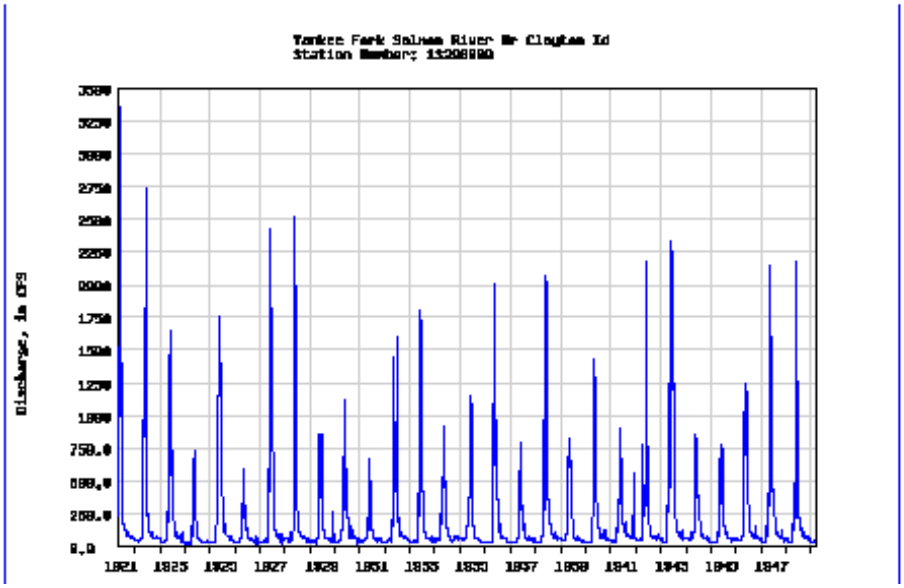
Historical Streamflow Daily Values Graph for Thompson Creek Nr Clayton Id (13297330)



Historical Streamflow Daily Values Graph for Warm Springs Creek At Robinson Bar Nr Clayton Id (13297000)



Historical Streamflow Daily Values Graph for Yankee Fork Salmon River Nr Clayton Id (13296000)



UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - IDAHO DISTRICT 05/18/2000

STATION NUMBER 13297330 THOMPSON CREEK NR CLAYTON ID STREAM SOURCE AGENCY USGS
LATITUDE 441601 LONGITUDE 1143048 DRAINAGE AREA 29.1 DATUM 5700. STATE 16 COUNTY 037

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1998 TO SEPTEMBER 1999
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.2	5.8	4.7	4.0	3.7	4.3	18	52	99	40	10	7.1
2	5.1	6.1	4.6	3.9	3.8	3.7	16	58	103	37	10	7.9
3	4.8	6.1	5.0	e4.0	3.6	4.0	15	54	109	35	10	6.6
4	4.5	6.1	4.9	4.0	3.6	3.3	14	47	121	32	10	6.7
5	4.3	6.2	2.5	3.8	e3.5	e3.5	13	42	110	29	11	6.3
6	4.4	6.2	3.1	3.8	e3.5	e3.5	12	41	114	27	12	6.0
7	4.3	6.0	4.2	3.8	e4.0	e3.5	13	50	104	27	10	5.8
8	5.1	6.1	5.1	3.8	3.9	3.7	14	56	86	26	9.5	5.7
9	6.7	5.6	3.8	3.8	3.8	3.6	14	55	70	25	9.7	5.6
10	6.7	5.8	3.5	3.8	3.7	3.4	14	49	65	23	9.4	5.5
11	6.7	6.0	5.1	3.8	e3.5	3.3	14	43	66	22	9.3	5.4
12	6.8	5.9	4.8	3.8	e3.5	3.7	17	41	71	21	9.3	5.3
13	6.7	6.2	4.2	3.7	e3.5	3.6	22	40	83	21	9.5	5.2
14	6.6	6.6	4.3	3.7	3.8	3.9	29	37	101	20	8.3	5.2
15	6.6	6.6	4.2	4.1	3.6	4.6	31	35	125	19	7.8	5.1
16	6.6	6.4	4.3	4.0	3.6	5.5	35	33	157	18	7.7	5.0
17	6.5	6.3	4.3	3.9	3.7	5.4	57	30	168	17	7.4	5.0
18	6.7	6.9	e4.0	4.0	3.6	5.7	67	32	171	16	7.3	4.9
19	6.8	5.2	e4.0	3.8	3.7	6.9	72	45	164	16	7.2	4.9
20	6.7	3.9	e3.5	3.9	e3.5	10	72	63	144	15	7.0	4.8
21	6.7	4.8	e3.5	3.8	e3.5	13	64	e80	129	15	6.8	4.8
22	6.7	5.1	3.2	3.7	3.7	14	55	94	114	14	6.7	4.8
23	7.0	4.7	e3.5	4.0	3.7	17	45	107	98	13	6.7	4.7
24	6.7	5.6	4.0	3.7	3.7	21	43	120	85	12	6.9	4.6
25	6.6	4.8	4.6	e3.5	3.7	29	51	125	76	12	6.5	4.6
26	6.6	4.2	4.9	4.4	3.6	39	66	114	65	12	6.3	4.6
27	6.5	4.7	4.3	3.9	3.5	32	62	132	56	12	6.3	4.7
28	6.5	4.7	4.3	e4.0	3.9	27	59	145	49	11	7.5	4.8
29	6.4	4.6	4.1	3.7		23	49	196	45	11	9.4	4.9
30	5.9	4.5	4.1	e4.0		21	45	172	42	11	7.0	4.9
31	5.6		4.0	e4.0		19		127		11	6.4	
TOTAL	188.0	167.7	128.6	120.1	102.4	333.6	1098	2315	2990	620	258.9	161.4

MEAN	6.06	5.59	4.15	3.87	3.66	11.1	36.6	74.7	99.7	20.0	8.35	5.38
MAX	7.00	6.9	5.1	4.4	4.0	39.0	72	196	171	40	12	7.9
MIN	4.20	3.9	2.5	3.5	3.5	3.3	12	30	42	11	6.3	4.6
AC-FT	373	333	255	238	203	683	2180	4590	5930	1230	514	320
CFSM	0.21	0.19	0.14	0.13	0.13	0.38	1.26	2.57	3.42	0.69	0.29	0.18
IN.	0.24	0.21	0.16	0.15	0.13	0.44	1.40	2.96	3.82	0.79	0.33	0.21

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1973 – 1999, BY WATER YEAR (WY)

MEAN	5.02	5.20	4.68	4.47	4.62	8.07	24.4	64.0	64.4	18.4	7.11	5.17
MAX	8.07	14.0	11.9	10.3	9.9	25.5	60.1	170	1680	43.9	15.3	9.90
(WY)	1985	1984	1984	1984	1984	1986	1986	1997	1974	1982	1984	1984
MIN	2.87	2.47	2.85	2.46	2.24	3.13	5.34	7.88	9.56	3.45	2.14	2.07
(WY)	1980	1980	1980	1980	1980	1977	1975	1977	1994	1994	1977	1994

SUMMARY STATISTICS	FOR 1998 CALENDAR YEAR		FOR 1999 WATER YEAR		WATER YEARS 1973 – 1999	
ANNUAL TOTAL	6211.1		8494.2			
ANNUAL MEAN	17.0		23.3		18.0	
HIGHEST ANNUAL MEAN					37.9	1997
LOWEST ANNUAL MEAN					4.70	1977
HIGHEST DAILY MEAN	78	May 6	196	May 29	373	May 15 1997
LOWEST DAILY MEAN	2.5	Mar 4	2.5	Dec 5	1.4	Nov 21 1979
ANNUAL SEVEN-DAY MINIMUM	2.7	Mar 4	3.5	Mar 4	1.6	Aug 18 1977
ANNUAL RUNOFF (AC-FT)	12320		16850		13030	
ANNUAL RUNOFF (CFSM)	.58		.80		.62	
ANNUAL RUNOFF (INCHES)	7.94		10.86		8.40	
10 PERCENT EXCEEDS	53		68		50	
50 PERCENT EXCEEDS	6.6		6.6		6.2	
90 PERCENT EXCEEDS	3.5		3.7		3.1	

e Estimate

APPENDIX H

Yankee Fork Ranger District Project List

YANKEE FORK R.D. - SALMON-CHALLIS N.F.

BULL TROUT CONSERVATION – RELATED PROJECTS

BEAR VALLEY KEY WATERSHED

DRAINAGE	PROJECT NAME	YEAR	PROJECT DESCRIPTION	RESOURCE BENEFITS
Kelly Beaver Knapp	Capehorn Allot. Management Plan	1994	Livestock management Plan for grazing in a Manner appropriate for Aquatic resources.	Improvement in Riparian condition And bank stability Decreased sediment
Marsh	Bull Trout Allotment Mgt. Plan	1994	Livestock management Plan for grazing in a Manner appropriate for Aquatic resources.	Improvement in Riparian condition And bank stability Decreased sediment
Marsh	Fish snorkeling Survey	1995	Fish presence/absence Survey	Assess distrib of Aquatic population
Knapp Marsh	Fish Habitat Improvement Str	1995	Construct barbs and Streambank revetment Structures	Reduce sediment Impacts from Eroding banks
Knapp Marsh	Stream Temp Monitoring	1995	Placement and analysis of temperature devices at 9 locations	Assess impacts to water quality from resource mgt
Knapp	Knapp Creek Trail Reloc-ation Project	1996	Relocate 3 miles of trail out of riparian habitat cons area	Eliminate recr impacts to aquatic riparian resources
Knapp	R1/R4 Fish Habitat Survey Subset	1996	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat condition and trend
Knapp	R1/R4 Fish Habitat Survey Subset	1997	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat condition and trend
Knapp	Knapp Creek Bridge reconstr	1997	Reconstruct sheep bridge across Knapp Creek	Reduce impacts to streambanks from sheep herding
Knapp Marsh	Fish Habitat Improvement Str	1997	Maintain stream str placed in 1995	Reduce sediment impacts from eroding banks

UPPER SALMON RIVER KEY WATERSHED

DRAINAGE	PROJECT NAME	YEAR	PROJECT DESCRIPTION	RESOURCE BENEFITS
Valley	Capehorn Allot. Management Plan	1994	Livestock management Plan for grazing in a Manner appropriate for Aquatic resources.	Improvement in Riparian condition And bank stability Decreased sediment
Basin	Basin Creek Trail Reloc-ation Project	1996	Relocate 3 miles of trail out of riparian habitat cons area	Reduce sediment impacts to aquatic riparian resources
Valley	Valley Creek Bridge/Trail Project	1995	Construct bridge across Valley Creek for recreational trail	Reduce disturb of stream banks, decreased sediment
Basin	Fish snorkeling survey	1995	Fish presence/absence Survey on 10 miles of stream	Assess distrib of aquatic population
Valley & Basin	Stream Temp Monitoring	1995	Placement and analysis of temperature devices at 13 locations	Assess impacts to water quality from resource mgt
Valley & Basin	Stream Sediment Monitoring	1995	McNeil Core Sampling of depth fines	Data used to analyze management affects on aquatic
Basin	R1/R4 Fish Habitat Survey Subset	1995	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat condition and trend
Valley	R1/R4 Fish Habitat Survey Subset	1996	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat condition and trend
Valley & Basin	R1/R4 Fish Habitat Survey Subset	1997	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat condition and trend
Valley	Stream Temp Monitoring	1997	Placement and analysis of temperature devices at 2 locations	Assess impacts to water quality from resource mgt
Basin	Salmon River Breaks Allot	1997	Livestock management Plan for grazing in a Manner appropriate for Aquatic resources.	Improvement in riparian condition and bank stability decreased sediment

THOMPSON – BAYHORSE KEY WATERSHED

DRAINAGE	PROJECT NAME	YEAR	PROJECT DESCRIPTION	RESOURCE BENEFITS
Cash	Cash Creek Riparian Excl	1994	Construction of 4 miles of fence to exclude livestock from Cash Cr	Improved riparian seral cond and aquatic habitat
Squaw Thompson	Fish snorkeling survey	1995	Fish Presence/absence survey on 20 miles of stream	Assess distrib of aquatic population
Thompson Squaw	Stream Temp Monitoring	1995	Placement and analysis of temperature devices at 9 locations	Assess impacts to water quality from resource mgt
Thompson Squaw Bayhorse	R1/R4 Fish Habitat Survey Subset	1995	Survey of fish habitat to assess impacts from livestock grazing	Analysis of fish habitat condition and trend
Thompson Squaw	Stream Sediment Monitoring	1995	McNeil Core Sampling of depths fines Squaw Thompson, Kinnikinic	Data used to analyze management affects on aquatic
Kinnik – inic Cr	R1/R4 Fish Habitat Survey	1996	Survey fish habitat to assess condition for future analysis	Analysis of fish habitat condition and trend
Thompson	Fish Habitat Improvement Str	1996	Construct barbs and streambank revetment structures	Reduce sediment impacts from eroding banks
Squaw	Squaw Creek Trail relocation Project	1996	Reconstruction trail and maintenance of stream crossings	Reduce soil erosion and silt input into habitat
Thompson Squaw Bayhorse	R1/R4 Fish Habitat Survey Subset	1996	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat condition and trend
Bayhorse Thompson Squaw	R1/R4 Fish Habitat Survey Subset	1997	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat condition and trend
Thompson	R1/R4 Fish Habitat Survey	1997	Survey fish habitat to assess condition for future analysis	Analysis of fish habitat condition and trend
Thompson	Watershed Improvement Project	1997	Construct 8 barbs and riparian planting to portions of Thompson	Reduce sediment impacts to aquatic habitat
	Salmon River		Livestock management	Improvement in

Thompson	Breaks Allot Management Plan	1997	plan for grazing in a manner appropriate for aquatic resources	riparian condition and bank stability decreased sediment

YANKEE FORK KEY WATERSHED

DRAINAGE	PROJECT NAME	YEAR	PROJECT DESCRIPTION	RESOURCE BENEFITS
Yankee Fork	Stream Temp Monitoring	1995	Placement and analysis of temperature devices at 4 locations	Assess impacts to water quality from resource mgt
Yankee Fork	Stream Sediment Monitoring	1995	McNeil Core Sampling of depth fines Jordan, W F, 10 mi, 8 mi, main	Data used to analyze management affects on aquatic
Yankee Fork	Preachers Cove Reclamation (mining)	1996	Phase 1 of mining mill reclamation project	Reduce risks to Yankee Fork Fisheries
Yankee Fork	Stream Sediment Monitoring	1996	McNeil Core Sampling of depth fines Jordan, W F, 10 mi, 8 mi, main	Data used to analyze management affects on aquatic
Yankee Fork	R1/R4 Fish Habitat Survey Subset	1997	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat condition and trend
Yankee Fork	Preachers Cove Reclamation Project	1997	Phase 2-Removal of 100 tons of hazardous material	Reduce risks to Yankee Fork Fisheries
Yankee Fork	Stream Temp Monitoring	1997	Placement and analysis of temperature devices at 4 locations. Aquatic resources	Data used to analyze affects on aquatic resource Decreased sediment
Yankee Fork	Stream Sediment Monitoring	1997	McNeil Core Sampling of depth fines Jordan, W F, 10 mi, 8 mi, main	Data used to analyze management affects on aquatic

EAST FORK SALMON RIVER KEY WATERSHED

DRAINAGE	PROJECT NAME	YEAR	PROJECT DESCRIPTION	RESOURCE BENEFITS
Pine	Pine Creek Allotment Managemen t Plan	1994	Livestock management plan for grazing in a manner appropriate for aquatic resources	Improvement in riparian condition and bank stability Decreased Sediment
Herd E Pass	Stream Temp Monitoring	1995	Placement and analysis of temperature devices at 3 locations	Assess impacts to water quality from resource mgt
Herd Pine Fox	R1/R4 Fish Habitat Survey Subset	1995	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat condition and trend
Herd E Pass	Stream Sediment Monitoring	1995	McNeil Core Sampling of depth fines Herd and E Pass Creeks	Data used to analyze management affects on aquatic
Herd E Pass Fox	R1/R4 Fish Habitat Survey	1995	Survey Fish habitat to assess condition for future analysis	Analysis of fish habitat condition and trend
Lake Cr Herd W Pass	R1/R4 Fish Habitat Survey	1996	Survey Fish habitat to assess condition for future analysis	Analysis of fish habitat condition and trend
Herd	Herd Creek Riparian Excl	1996	Construction of 2 miles of fence to exclude Livestock from Herd Cr	Improve riparian seral cond and aquatic habitat
Herd Pine E Pass Fox	R1/R4 Fish Habitat Survey Subset	1996	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat condition and trend
Herd Pine Fox	R1/R4 Fish Habitat Survey Subset	1997	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat condition and trend
Pine	R1/R4 Fish Habitat Survey	1997	Survey Fish habitat to assess condition for future analysis	Analysis of fish habitat condition and trend

Yankee Fork R D – Salmon-Challis N F
Bull Trout Conservation – Related Projects

DRAINAGE	PROJECT NAME	YEAR	PROJECT DESCRIPTION	RESOURCE BENEFITS
Bayhorse	Bull Trout Population Survey	1998	Determine Fish Population Density, following IDFG Protocol	Analysis of fish Population and Trend
Kinnicknic	Bull Trout Population Survey	1998	Determine Fish Population Density, following IDFG Protocol	Analysis of fish Population and Trend
Squaw	Bull Trout Population Survey	1998	Determine Fish Population Density, following IDFG Protocol	Analysis of fish Population and Trend
Thompson	Bull Trout Population Survey	1998	Determine Fish Population Density, following IDFG Protocol	Analysis of fish Population and Trend
Burnt, Badger, Gardner	Bull Trout Population Survey	1998	Determine Fish Population Density, following IDFG Protocol	Analysis of fish Population and Trend
Peach	Bull Trout Population Survey	1998	Determine Fish Population Density, following IDFG Protocol	Analysis of fish Population and Trend
Basin	Bull Trout Population Survey	1998	Determine Fish Population Density, following IDFG Protocol	Analysis of fish Population and Trend
Pine	Bull Trout Population Survey	1998	Determine Fish Population Density, following IDFG Protocol	Analysis of fish Population and Trend
Knapp, Marsh	Stream Temp Monitoring	1998-2000	Placement and Analysis of Temperature Devices	Assess impacts to water quality from resource management

DRAINAGE	PROJECT NAME	YEAR	PROJECT DESCRIPTION	RESOURCE BENEFITS
Basin	Stream Temp Monitoring	1998-2000	Placement and Analysis of Temperature Devices	Assess impacts to water quality from resource management
Yankee Fork	Stream Temp Monitoring	1998-2000	Placement and Analysis of Temperature Devices	Assess impacts to water quality from resource management
Peach, Gardner	Stream Temp Monitoring	1998-2000	Placement and Analysis of Temperature Devices	Assess impacts to water quality from resource management
Thompson	Stream Temp Monitoring	1998-2000	Placement and Analysis of Temperature Devices	Assess impacts to water quality from resource management
Squaw	Stream Temp Monitoring	1998-2000	Placement and Analysis of Temperature Devices	Assess impacts to water quality from resource management
Kinnicknic	Stream Temp Monitoring	1998-2000	Placement and Analysis of Temperature Devices	Assess impacts to water quality from resource management
Bayhorse	Stream Temp Monitoring	1998-2000	Placement and Analysis of Temperature Devices	Assess impacts to water quality from resource management
Herd	Stream Temp Monitoring	1998-2000	Placement and Analysis of Temperature Devices	Assess impacts to water quality from resource management
Marsh, Knapp, Valley	R1/R4 Fish Habitat Survey Subset	1998-2000	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat conditions and trend

DRAINAGE	PROJECT NAME	YEAR	PROJECT DESCRIPTION	RESOURCE BENEFITS
Basin	R1/R4 Fish Habitat Survey Subset	1998-2000	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat conditions and trend
Thompson	R1/R4 Fish Habitat Survey Subset	1998-2000	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat conditions and trend
Squaw	R1/R4 Fish Habitat Survey Subset	1998-2000	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat conditions and trend
Kinnicknic	R1/R4 Fish Habitat Survey Subset	1998-2000	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat conditions and trend
Bayhorse	R1/R4 Fish Habitat Survey Subset	1998-2000	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat conditions and trend
Herd	R1/R4 Fish Habitat Survey Subset	1998-2000	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat conditions and trend
Pine	R1/R4 Fish Habitat Survey Subset	1998-2000	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat conditions and trend
Muley	R1/R4 Fish Habitat Survey Subset	1998-2000	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat conditions and trend
Peach	R1/R4 Fish Habitat Survey Subset	1998-2000	Survey fish habitat to assess impacts from livestock grazing	Analysis of fish habitat conditions and trend

DRAINAGE	PROJECT NAME	YEAR	PROJECT DESCRIPTION	RESOURCE BENEFITS
Coal Creek (Basin Watershed)	Culvert Replacement	2000	Replace existing culvert with a baffled culvert	Allow for fish migration passage providing access to 3 mi habitat
Rankin Creek (Yankee Fk Watershed)	Culvert Replacement	2000	Replace existing culvert	Allow for fish migration passage providing access to 2 mi habitat
American Creek	Culvert Replacement	2000	Replace existing culvert	Allow for fish migration passage providing access to 3 mi habitat
Yankee Fork	Dredge Pile Restoration	1999-2000	Ongoing Project to Restore active floodplain - Design and analysis	Restore geomorphology of the Yankee Fork River. Providing improved spawning and rearing for salmonids
Yankee Fork	Fire Rehab	2000	Rehab of Rankin Creek Fire	Reduce impacts if Rankin Creek Fire, stabilizing soils
Pine	Bull Trout Population Survey	1999	Determine Fish Population Density, following IDFG Protocol	Analysis of fish Population and Trend
Greylock Creek	Culvert Bridge Replacement	1999	Replace existing Bridge	Allow for fish migration passage, stabilize streambanks
Thompson Creek	Schelite Jim Mill Site Restoration	1999	Create wetland to reduce heavy metals and ARD from mining	Improve water quality

Appendix I

Streambank and Road Erosion Inventory, Depth Fine Sediment Methods and Results

Sediment TMDL Methods and Results

Introduction

This appendix documents the analytical techniques and data used to develop the gross sediment budget and instream sediment measures used in this TMDL. It describes the methods, data, and results for the 1) stream bank erosion inventory and 2) for surface and subsurface fine sediment data. These data are intended to characterize the natural and existing condition of the landscape, estimate the desired level of erosion and sedimentation, and provide baseline data that can be used in the future to track the effectiveness of TMDL implementation. For example, the stream bank erosion inventories can be repeated and will ultimately provide an adaptive management or feedback mechanism.

Stream bank Erosion Inventory

The stream bank erosion inventory used to estimate background and existing stream bank erosion followed methods outlined in the proceedings from the Natural Resource Conservation Service (NRCS) Channel Evaluation Workshop (1983). Using the direct volume method, sub-sections of 1996 303(d) watersheds were surveyed to determine the extent of chronic bank erosion and estimate the needed reductions.

The NRCS stream bank erosion inventory is a field-based methodology, which measures stream bank/channel stability, length of active eroding banks, and bank geometry. The stream bank/channel stability inventories were used to estimate the long-term lateral recession rate. The recession rate is determined from field evaluation of stream bank characteristics that are assigned a categorical rating ranging from 0 to 3. The categories of rating the factors and rating scores are:

Bank Stability:

Do not appear to be eroding - 0
Erosion evident - 1
Erosion and cracking present - 2
Slumps and clumps sloughing off - 3

Bank Condition:

Some bare banks, few rills, no vegetative overhang - 0
Predominantly bare, some rills, moderate vegetative overhang - 1
Bare, rills, severe vegetative overhang, exposed roots - 2
Bare, rills and gullies, severe vegetative overhang, falling trees - 3

Vegetation / Cover On Banks:

Predominantly perennials or rock-covered - 0
Annuals / perennials mixed or about 40% bare - 1
Annuals or about 70% bare - 2
Predominantly bare - 3

Bank / Channel Shape:

V - shaped channel, sloped banks - 0
Steep V - shaped channel, near vertical banks - 1
Vertical Banks, U - shaped channel - 2
U - shaped channel, undercut banks, meandering channel – 3

Channel Bottom:

Channel in bedrock / non-eroding - 0
Soil bottom, gravels or cobbles, minor erosion - 1
Silt bottom, evidence of active downcutting - 2

Deposition:

No evidence of recent deposition - 1
Evidence of recent deposits, silt bars - 0

Cumulative Rating

Slight (0-4) Moderate (5-8) Severe (9+)

From the cumulative rating, the lateral recession rate is assigned.

0.01 - 0.05 feet per year	**Slight**
0.06 - 0.15 feet per year	**Moderate**
0.16 - 0.3 feet per year	**Severe**
0.5+ feet per year	**Very Severe**

Stream bank stability can also be characterized through the following definition and the corresponding stream bank erosion condition rating. Ratings from Bank Stability or Bank Condition, above, are included in italics.

Stream banks are considered stable if they do not show indications of any of the following features:

Breakdown - Obvious blocks of bank broken away and lying adjacent to the bank. *Bank Stability Rating 3*

Slumping or False Bank - Bank has obviously slipped down, cracks may or may not be obvious, but the slump feature is obvious. *Bank Stability Rating 2*

Fracture - A crack is visibly obvious on the bank indicating that the block of bank is about to slump or move into the stream. *Bank Stability Rating 2*

Vertical and Eroding - The bank is mostly uncovered and the bank angle is steeper than 80 degrees from the horizontal. *Bank Stability Rating 1*

Stream banks are considered covered if they show any of the following features:

Perennial vegetation ground cover is greater than 50%. *Vegetation/Cover Rating 0*

Roots of vegetation cover more than 50% of the bank (deep rooted plants such as willows and sedges provide such root cover). *Vegetation/Cover Rating 1*

At least 50% of the bank surfaces are protected by rocks of cobble size or larger. *Vegetation/Cover Rating 0*

At least 50% of the bank surfaces are protected by logs of 4-inch diameter or larger. *Vegetation/Cover Rating 1*

Stream bank stability is estimated using a simplified modification of Platts, Megahan, and Minshall (1983, p. 13) as stated in *Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Rangeland Streams* (Bauer and Burton, 1993). The modification allows for measuring stream bank stability in a more objective fashion. The lengths of banks on both sides of the stream throughout the entire linear distance of the representative reach are measured and proportioned into four stability classes as follows:

Mostly covered and stable (non-erosional). Stream banks are over 50% covered as defined above. Stream banks are stable as defined above. Banks associated with gravel bars having perennial vegetation above the scourline are in this category. *Cumulative Rating 0 - 4 (slight erosion) with a corresponding lateral recession rate of 0.01 - 0.05 feet per year.*

Mostly covered and unstable (vulnerable). Stream banks are over 50% covered as defined above. Stream banks are unstable as defined above. Such banks are typical of "false banks" observed in meadows where breakdown, slumping, and/or fracture show instability, yet vegetative cover is abundant. *Cumulative Rating 5 - 8 (moderate erosion) with a corresponding lateral recession rate of 0.06 - 0.2 feet per year.*

Mostly uncovered and stable (vulnerable). Stream banks are less than 50% covered as defined above. Stream banks are stable as defined above. Uncovered, stable banks are typical of stream banks trampled by concentrations of cattle. Such trampling flattens the bank so that slumping and breakdown do not occur even though vegetative cover is significantly reduced or eliminated. *Cumulative Rating 5 - 8 (moderate erosion) with a corresponding lateral recession rate of 0.06 - 0.2 feet per year.*

Mostly uncovered and unstable (erosional). Stream banks are less than 50% covered as defined above. They are also unstable as defined above. These are bare eroding stream banks and include ALL banks mostly uncovered, which are at a steep angle to the water surface. *Cumulative Rating 9+ (severe erosion) with a corresponding lateral recession rate of over 0.5 feet per year.*

Stream banks were inventoried to quantify bank erosion rate and annual average erosion. These data were used to develop a quantitative sediment budget to be used for TMDL development.

Site Selection

The first step in the bank erosion inventory is to identify key problem areas. Stream bank erosion tends to increase as a function of watershed area (NRCS, 1983). As a result, the lower stream segment of larger watersheds tend to be problem areas. These stream segments tend to be alluvial streams commonly classified as response reaches (Rosgen B and C channel types).

Because it is often unrealistic to survey every stream segment, sampled reaches were used and bank erosion rates were extrapolated over a larger stream segment. The length of the sampled reach is a function of stream type variability where streams segments with highly variable channel types need a large sample, whereas segments with uniform gradient and consistent geometry need less. Typically between 10 and 30 percent of stream bank needs to be inventoried. Often, the location of some stream inventory reaches is more dependent on land ownership than watershed characteristics. For example, private land owners are sometimes unwilling to allow access to stream segments within their property.

Stream reaches are subdivided into *sites* with similar channel and bank characteristics. Breaks between sites are made where channel type and/or dominate bank characteristics change substantially. In a stream with uniform channel geometry there may be only one site per stream reach, whereas in an area with variable conditions there may be several sites. The subdivision of stream reaches is at the discretion of the field crew leader.

Field Methods

Stream bank erosion or channel stability inventory field methods were originally developed by the U.S. Forest Service (Pfankuch, 1975). Further development of channel stability inventory methods are outlined in Lohrey (1989) and NRCS (1983). As stated above, the NRCS (1983) document

outlines field methods used in this inventory. However, slight modifications to the field methods were made and are documented.

Field crews typically consist of two to four people and are trained as a group to ensure quality control or consistent data collection. Field crews survey selected stream reaches measuring bank length, slope height, bankfull width and depth, and bank content. In most cases, a Global Positioning System is used to locate the upper and lower boundaries of inventoried stream reaches. Additionally, while surveying field crews photograph key problem areas.

Bank Erosion Calculations

The direct volume method is used to calculate average annual erosion rates for a given stream segment based on bank recession rates determined in the survey (NRCS, 1983). The erosion rate (tons/mile/year) is used to estimate the total bank erosion of the selected stream corridor. The direct volume method is summarized in the following equations:

$$E = [A_E * R_{LR} * \rho_B]/2000 \text{ (lbs/ton)}$$

where:
E = bank erosion over sampled stream reach (tons/yr/sample reach)
A_E = eroding area (ft^2)
R_{LR} = lateral recession rate (ft/yr)
ρ_B = bulk density of bank material (lps/ft^3)

The bank erosion rate (E_R) is calculated by dividing the sampled bank erosion (E) by the total stream length sampled:

$$E_R = E/L_{BB}$$

where:
E_R = bank erosion rate (tons/mile/year)
E = bank erosion over sampled stream reach (tons/yr/sample reach)
L_{BB} = bank to bank stream length over sampled reach

Total bank erosion is expressed as an annual average. However, the frequency and magnitude of bank erosion events are greatly a function of soil moisture and stream discharge (Leopold et al. 1964). Because channel erosion events typically result from above average flow events, the annual average bank erosion value should be considered a long term average. For example, a 50-year flood event might cause five feet of bank erosion in one year and over a ten-year period this events accounts for the majority of bank erosion. These events have less of an influence where bank trampling is the major cause of channel instability.

The *eroding area* (A_E) is the product of linear horizontal bank distance and average bank slope height. Bank length and slope heights are measured while walking along the stream channel. Pacing is used to measure horizontal distance, and bank slope heights are continually measured and averaged over a given reach or site. The horizontal length is the length of the right or left bank, not both. Typically, one bank along the stream channel is actively eroding, such as the bank on the outside of a meander. However, both banks of channels with severe headcuts or gullies will be eroding and are to be measured separately and eventually summed.

Determining the *lateral recession rate* (R_{LR}) is one of the most critical factors in this methodology (NRCS, 1983). Several techniques are available to quantify bank erosion rates, such as aerial photo interpretation, anecdotal data, bank pins, and channel cross-sections.

To facilitate consistent data collection, the NRCS developed rating factors used to estimate lateral recession rate. Similar to methods developed by Pfankuch (1975), the NRCS method measures bank and channel stability, and then uses the ratings as surrogates for bank erosion rates.

The *bulk density* (ρ_B) of bank material is measured ocularly in the field. Soil bulk density is the weight of material divided by its volume, including the volume of its pore spaces. A table of typical soil bulk densities can be used, or soil samples can be collected and soil bulk density measured in the laboratory.

Subsurface Fine Sediment Sampling

McNeil Sediment Core samples were collected to describe size composition of bottom materials in salmonid spawning beds of streams on the 303(d) list for sediment. Research has shown that subsurface fine sediment composition is important to egg and fry survival (Hall 1986); (Reiser and White 1988). Data gathered as part of this TMDL and other studies relevant to the Challis Creek subwatershed are presented after the narrative section of this appendix.

Site Selection

Sample sites selected displayed characteristics of gravel size, depth, and velocity required by salmonids to spawn and were determined to be adequate spawning substrate by an experienced fisheries biologist. Samples were collected during periods of low discharge, as described in McNeil and Ahnell (1964), to minimize loss of silt in suspension within the core sampling tube. Sample sites were generally in the lower reach of streams where spawning habitat was determined to exist.

Field Methods

A 12-inch stainless steel open cylinder was worked manually as far as possible, at least 4 inches, into spawning substrate without allowing flowing water to top the core sampling tube. Samples of bottom materials were removed by hand, using a stainless steel mixing bowl, to a depth of at least 4 inches and placed into buckets. After solids were removed from the core sampling tube and placed into buckets, the remaining suspended material was discarded. It is felt that this fine material would be removed through the physical action of excavating a redd and would not be a significant factor with regard to egg to fry survival. Additionally, rinsing of sieves to process the sample results in some loss of the fraction below the smallest (0.053 mm) mesh size.

Samples were placed wet into a stack of sieves and were separated into 10 size classes by washing and shaking them through nine standard Tyler sieves having the following square mesh openings (in mm): 63, 25, 12.5, 6.3, 4.75, 2.36, .85, .212, .053. Silt passing the finest screen was discarded.

The volume of solids retained by each sieve was measured after the excess water drained off. The contents of each of the sieves were placed in a bucket filled with water to the level of a spigot for measurement by displacement. The water displaced by solids was collected in a plastic bucket and transferred to a 2,000 ml graduated cylinder and measured directly. Water displaced by solids retained by the smaller diameter sieves was also collected in a plastic bucket and measured in a 250 ml graduated cylinder. Variation in sample volumes was caused by variation in porosity and

core depth. All sample fractions were expressed as a percentage of the sample with and without the 63 mm fraction.

Three sediment core samples were collected at each sample site and grouped together by fractions 6.3 mm and greater and 4.75 mm to 0.53 mm. The results for a particular site are the percentage of 4.75 mm to 0.53 mm as a percent of the total sample. Standard deviation is calculated for estimates including and excluding particles 63 mm and above.

Surface Erosion from Roads

Surface erosion from unimproved/unsurfaced roads and four-wheel drive trails considered to generally be within 50 meters of TMDL waters was estimated using numerical values from an extension of the US Department of Agriculture WEPP model. This model has been widely applied to estimate surface erosion from unsurfaced roads, particularly on USFS lands. The model is based on the gradient of the road, the distance to the stream (buffer distance), the slope angle to the stream (buffer slope), the width of the road, the soil type adjacent to the road and the amount of precipitation on the road. The assumptions used for the estimated tons of sediment produced over a particular reach of road were that the buffer slope was not more than 25%, road width was 15 feet, distance to the stream was not more than 120 meters, the soil or road material was gravelly loam and erosion was primarily snowmelt driven which uses an annual precipitation of 32 inches. It is likely that erosion is consistently over estimated given these assumptions within the Challis Creek watershed, however the purpose is to conservatively estimate erosion load and to prioritize sources that may be having an impact on aquatic beneficial uses. It is felt that erosion estimates are a valid tool for identifying and ranking sources in which to apply reductions based on implementation of BMPs.

Segments to be evaluated were identified using 7.5 minute USGS topographical maps and orthoquad aerial photos. The distance to water was estimated using an optical range finder on site. Gradient was determined using digital rasterized 7.5 minute USGS topographical maps to determine road distance for each 40 foot contour interval along the road being evaluated.

Erosion estimates from the WEPP model were made for gradients of 2%, 4%, 8% and 16%. Linear regression was used to interpolate intermediate values for gradients from 1 to 44 percent. Predicted tons per mile were then applied to the various segment lengths at each of the observed gradients and accumulated to estimate the tons of sediment produced by each segment of Road. Tons of sediment was broken down by the distance to the stream to show the relative amount in each distance interval. The result is a conservative estimate of sediment delivered to the stream in question with an implicit margin of safety.

Stream Bank Erosion Inventory Worksheet

Stream Challis Creek

Section Lower: Approximately 2 miles above confluence with Salmon River

Field Crew Tom Herron DEQ, Sr. Water Quality Analyst **Data reduced by** Tom Herron, DEQ

Land Use Grazing, irrigated pasture and crop

Stream Segment Location

		Degrees	Minutes	Elevation
GPS: Upstream	N	44	33.8298	
	W	114	13.718	
Downstream	N	44	33.726	
	W	114	13.0854	

Stream Bank Erosion Calculations

AVE. Bank Height:	2.3	feet	**Inv. bank to bank length (LBB)**	6168	feet
bank to bank Eroding Seg. Length	2520	feet	(Inventoried stream length X 2)		
Percent eroding bank	0.41				
Bank erosion over sampled reach (E)	95	tons/year/sample reach			
Erosion Rate (ER)	96	tons/mile/year			
Feet of Similar Stream Type	20239	feet			
Eroding bank extrapolation	19057.70	feet			
Total stream bank erosion	**422**	tons/year			

Stream Bank Erosion Reduction Calculations

Bank erosion over sampled reach (E)	41	tons/year/sample reach
Erosion Rate (ER)	71	tons/mile/year
Feet of Similar Stream Types	20239.00	feet
Eroding bank extrapolation	9329.20	feet
Total stream bank erosion	**312.8**	tons/year

Comments

Flow a contributing factor?: No

Other contributing factors?: Head cut at N 44 33.7941, W 114 13.62942. Evidence of old log jam that blew-out resulting in short-term, very high flow. This event likely affected stream for some distance below. Horse paddock and cattle pasture accessing stream over lower reach. Extrapolated upstream to middle reach and downstream to confluence.

Stream Bank Erosion Inventory Worksheet

Stream Challis Creek

Section From 1/4 mile above Mill Cr. Road to 1 mile below Mill Cr. Road

Field Crew Tom Herron DEQ, Sr. Water Quality Analyst **Data reduced by** Tom Herron, DEQ

Land Use Transportation, Recreation, Residential, Grazing

Stream Segment Location

		Degrees	Minutes	Elevation
GPS: Upstream	N	44	33.726	
	W	114	17.0172	
Downstream	N	44	33.7092	
	W	114	15.5364	

Stream Bank Erosion Calculations

AVE. Bank Height:	1.0	feet	**Inv. bank to bank length (LBB)**	14466	feet
bank to bank Eroding Seg. Length	2892	feet	(Inventoried stream length X 2)		
Percent eroding bank	0.20				
Bank erosion over sampled reach (E)	6	tons/year/sample reach			
Erosion Rate (ER)	5	tons/mile/year			
Feet of Similar Stream Type	0	feet			
Eroding bank extrapolation	2892.00	feet			
Total stream bank erosion	**6**	tons/year			

Stream Bank Erosion Reduction Calculations

Bank erosion over sampled reach (E)	8	tons/year/sample reach
Erosion Rate (ER)	6	tons/mile/year
Feet of Similar Stream Types	0.00	feet
Eroding bank extrapolation	2893.20	feet
Total stream bank erosion	**8.0**	tons/year

Comments

Flow a contributing factor?: No.

Other contributing factors?: Valley Narrows, good riparian shrubery, rock armored banks.

Other Notes: Little grazing over this reach. Significant diversion below this reach.

Stream Bank Erosion Inventory Worksheet

Stream Challis Creek

Section From Upper Extrapolation Point to 1/4 mile above Mill Cr. Road

Field Crew Tom Herron DEQ, Sr. Water Quality Analyst **Data reduced by** Tom Herron, DEQ

Land Use Grazing, Transportation, Residential

Stream Segment Location

		Degrees	Minutes	Elevation
GPS Upstream	N	44	34.3686	
	W	114	21.3096	
Downstream	N	44	33.7254	
	W	114	17.0208	

Stream Bank Erosion Calculations

AVE Bank Height:	1.2	feet	**Inv. bank to bank length (Lbb)**	47520	feet
bank to bank Eroding Seg. Length	19008	feet	(Inventoried stream length X 2)		
Percent eroding bank	0.40				
Bank erosion over sampled reach (E)	46	tons/year/sample reach			
Erosion Rate (Er)	10	tons/mile/year			
Feet of Similar Stream Type	0	feet			
Eroding bank extrapolation	19008.00	feet			
Total stream bank erosion	**46**	tons/year			

Stream Bank Erosion Reduction Calculations

Bank erosion over sampled reach (E)	29	tons/year/sample reach
Erosion Rate (Er)	6	tons/mile/year
Feet of Similar Stream Types	0.00	feet
Eroding bank extrapolation	9504.00	feet
Total stream bank erosion	**28.5**	tons/year

Comments

Flow a contributing factor?: No.

Other contributing factors?: Valley Narrows, good riparian shrubery, rock armored banks.

Other Notes: Little grazing over this reach. Significant diversion below this reach.

Stream Bank Erosion Inventory Worksheet

Stream Challis Creek

Section Upper: From Forest Rd crossing below reservoir to just above beaver dams, extrapolated to White Valley Cr (minus beaver dams)

Field Crew Tom Herron DEQ, Sr. Water Quality Analyst **Data reduced by** Tom Herron, DEQ

Land Use Grazing, Transportation, Recreation

Stream Segment Location

		Degrees	Minutes	Elevation
GPS Upstream	N	44	31.859	
	W	114	25.1376	
Downstream	N	44	32.3298	
	W	114	24.613	

Stream Bank Erosion Calculations

AVE. Bank Height:	3.0	feet	**Inv. bank to bank length (Lse)**	7940	feet
bank to bank Eroding Seg. Length	3176	feet	(Inventoried stream length X 2)		
Percent eroding bank	0.40				
Bank erosion over sampled reach (E)	53	tons/year/sample reach			
Erosion Rate (ER)	71	tons/mile/year			
Feet of Similar Stream Type	19681	feet			
Eroding bank extrapolation	18920.80	feet			
Total streambank erosion	**318**	tons/year			

Stream Bank Erosion Reduction Calculations

Bank erosion over sampled reach (E)	27	tons/year/sample reach
Erosion Rate (ER)	36	tons/mile/year
Feet of Similar Stream Types	19681.00	feet
Eroding bank extrapolation	9460.40	feet
Total streambank erosion	**159.1**	tons/year

Comments

Flow a contributing factor?: Yes. Likely high velocities in spring flow.

Other contributing factors?: Steep gradient in alluvial fan and glacial outwash cobble at mouth of canyon. Many old channels at much higher grade. Two large log jams and significant course woody debris. Changes to lower gradient over 2nd reach.

Upper Challis Creek Road Sediment Calculations

Elevation	Road Segment L	Dist.toWater	%Gradient	Tons/Mile	Tons/Seg.	Notes:	
6560	0	5	5	10.3		Start	Segs/Reach
6520	774	60	5	10.3	1.5		1.1
6480	718	15	6	12.4	1.7		1.0
6440	951	90	4	8.3	1.5		1.4
6400	942	60	4	8.3	1.5		1.4
6360	1525	3	3	6.2	1.8		2.2
6320	1076	120	4	8.3	1.7		1.6
6280	944	21	4	8.3	1.5		1.4
6240	640	45	6	12.4	1.5	End	0.9
Relief (ft)	Total Sample(ft)	Transect Interval	Ave. Gradient		Tot. Tons		**11**
320	7570	688	4.2		**12.6**		

Middle Challis Creek Road Sediment Calculations

Elevation	Road Segment L	Average Dist to V	%Gradient	Tons/Mile	Tons/Seg.	Notes:	
5860	0					Start	Segs/Reach
5840	1594	50.4	3	6.2	1.9		4.6
5800	1095	7.3	5	10.3	2.1		3.2
5760	1404	61	6	12.4	3.3		4.1
5720	2181	51.3	4	8.3	3.4		6.3
5680	633	89.5	4	8.3	1.0	End	1.8
Relief (ft)	Total Sample(ft)	Transect Interval	Ave. Gradient		Tot. Tons		**20**
180	6907	345	2.6		**11.7**		

Tons of Sediment

24.3

WEPP OUTPUT	
%Gradi	tons/mile
2	3
4	8
8	19
16	32

Gradient Values	Predicted tons/mile
1	2.1
2	4.2
3	6.2
4	8.3
5	10.3
6	12.4
7	14.5
8	16.5
9	18.6
10	20.7
11	22.7
12	24.8
13	26.8
14	28.9
15	31.0
16	33.0
17	35.1
18	37.1
19	39.2
20	41.3
21	43.3
22	45.4
23	47.4
24	49.5
25	51.6
26	53.6
27	55.7
28	57.7
29	59.8
30	61.9
31	63.9
32	66.0
33	68.1
34	70.1
35	72.2
36	74.2
37	76.3
38	78.4
39	80.4
40	82.5
41	84.5
42	86.6
43	88.7
44	90.7