South Fork Coeur d'Alene River Sediment Subbasin Assessment and Total Maximum Daily Load

IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY

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Abbreviations, Acronyms, and Symbols

303(d)	Refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section
ì	micro, one-one thousandth
§	Section (usually a section of federal or state rules or statutes)
AWS	agricultural water supply
BLM	United States Bureau of Land Management
BMP	best management practice
BURP	Beneficial Use Reconnaissance Program
C	Celsius
CAC	Coeur d'Alene Basin Citizens' Advisory Committee
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations (refers to citations in the federal administrative rules)
cfs	cubic feet per second
cm	centimeters
CW	cold water
CWA	Clean Water Act
CWE	cumulative watershed effects
DEQ	Idaho Department of Environmental Quality
EPA	United States Environmental Protection Agency
F	Fahrenheit
FPA	Idaho Forest Practices Act
GIS	Geographical Information Systems
HI	habitat index
HUC	Hydrologic Unit Code
I.C.	Idaho Code
IDAPA	Refers to citations of Idaho administrative rules
IDFG	Idaho Department of Fish and Game
IDL	Idaho Department of Lands
LA	load allocation
LC	load capacity
LOD	large organic debris
m^2	square meter
mi	mile
mi^2	square miles
MBI	macroinvertebrate index

mg/l milligrams per liter

mm millimeter

MOS margin of safety

NA not assessed

NB natural background

nd no data (data not available)

PCR primary contact recreation

ppm part(s) per million

NPDES National Pollutant Discharge Elimination System

NRCS Natural Resources Conservation Service

QA quality assurance

QC quality control

RASI riffle armor stability index

SCR secondary contact recreation

SS salmonid spawning

STATSGO State Soil Geographic Database

TMDL total maximum daily load

t/y tons per year

U.S. United States

USC United States Code

USFS United States Forest Service

USGS United States Geological Survey

WBID Water body identification number

WLA waste load allocation

Executive Summary

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters (33 USC § 1251.101). States and tribes, pursuant to section 303 of the CWA are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list of impaired waters, currently every two years. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses the water bodies in the South Fork Coeur d'Alene Subbasin that have been placed on what is known as the "303(d) list" for sediment. Those water bodies listed for metals have been addressed by the "Coeur d'Alene Basin Metals TMDL (DEQ-EPA 2000).

This subbasin assessment and TMDL analysis has been developed to comply with Idaho's TMDL schedule. This assessment describes the physical, biological, and cultural setting; water quality status; pollutant sources; and recent pollution control actions in South Fork Coeur d'Alene Subbasin located in the Idaho Panhandle. The first part of this document, the subbasin assessment, is an important first step in leading to the TMDL. The starting point for this assessment was Idaho's current 303(d) list of water quality limited water bodies. Fourteen segments of the South Fork Coeur d'Alene Subbasin were listed on this list for sediment. The subbasin assessment portion of this document examines the current status of 303(d) listed waters, and defines the extent of impairment and causes of water quality limitation throughout the subbasin. The loading analysis quantifies pollutant sources and allocates responsibility for load reductions needed to return listed waters to a condition of meeting water quality standards.

Subbasin at a Glance

Hydrologic Unit Code......….. 17010302
Water Quality Limited Segments..…….... 14
Beneficial Uses Affected....… Cold Water
Pollutants of Concern………….Sediment
Metals
Known Land Uses…………....… Forestry,
Mining,
urban-
suburban

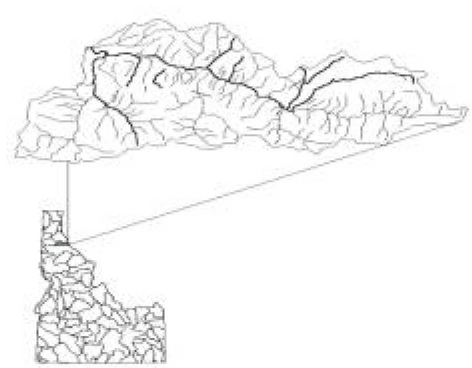


Figure A. South Fork Coeur d'Alene River Subbasin location and listed segments.

Key Findings

The South Fork Coeur d'Alene River watershed is the center of the Coeur d'Alene Mining District. The watershed has been developed for the extraction of minerals and is the residence of a large population engaged in the mining and refinement of metals. Streams are 303(d) listed for metals and sediment. The trace (heavy) metals impacts to water quality have been addressed in the Coeur d'Alene Basin Metals TMDL (DEQ – EPA 2000). Sediment is listed as a pollutant for 14 stream segments of the watershed. Sediment has its source in mine waste piles, urban land use; road erosion; encroachment on stream channels and floodplains; and the encroachment of towns and mining facilities. Impairment of the cold water use has been demonstrated in the low diversity of macroinvertebrates and low trout abundance. These impacts are the result of both metals and sediment. Impacts of the two pollutants are not easily differentiated. However, the impaired segments of the South Fork subbasin typically have low residual pool volumes as compared to segment supporting high trout abundance. These data indicate sediment is filling pools.

The sediment yield of the subbasin was modeled. The sediment yield was modeled at 52% above background exceeding the 50% above background benchmark above which water quality impairment may occur. Many sub-watersheds were considerably higher (75-237%) than the whole subbasin. The model results were lower than in-stream measurements made for the Superfund remedial investigation. These in-stream measurements were made while remedial work was underway in the streams. The model accounted for erosion features recently remediated. It is likely that in-stream sediment flux has not equilibrated with changes in sediment yield during the past six years. The permitted sediment discharges accounted for 0.8% of the sediment load, but are allocated 7%. The model results support the impairment of Canyon, Ninemile-East Fork Ninemile, Pine-East Fork Pine Creeks, Government Gulch and the South Fork Coeur d'Alene River below Canyon Creek. The unknown pollutants of the East Fork Ninemile Creek are determined to be sediment and the metals, cadmium, lead, and zinc. The fish density, residual pool volume, and modeled sediment yield do not support the listings of Moon Creek.

A sediment TMDL was developed for the South Fork Coeur d'Alene Subbasin. The TMDL encompasses Canyon Creek, Ninemile-East Fork Ninemile Creeks, Government Gulch, Pine-East Fork Pine Creeks and the South Fork from the Canyon Creek confluence to the mouth. The TMDL is stated in tons of sediment per year even though sediment yield and transport is erratic and episodic over a time span of years. The TMDL suggests residual pool volume as a surrogate measure of sediment for purposes of implementation planning and monitoring. Pool filling is the mechanism through which the sediment impacts the cold water uses. The TMDL sets loading capacity at sediment yield 25% above background based on the sediment yield of basins fully supporting the cold water uses (Upper South Fork, Big Creek, and Montgomery Creek that are between 15% and 19% above background. The loading capacity was raised slightly to account for infrastructures like Interstate 90, Wallace and Kellogg that cannot be removed. Watersheds in the subbasin have sediment yield near 25% and fully support cold water use (Placer Creek). The model used to develop sediment yield has conservative assumptions for the Belt terrain that provide a large implicit margin of safety (231%). The background is made a part of the allocation to account for any unidentified sources of sediment. Point discharges permits account for 7% of the sediment that could be discharged. This is fine sediment that would not cause pool filling and affect the cold water uses. Since the permitted sources do not discharge at levels remotely comparable to currently permitted loads, waste load allocation is provided at the level 10% less than current permitted discharges by recommended decreases in the water discharge levels. From the 10% trimmed from the permitted discharges, a waste load reserve for future development of 47 tons per year is created. The load allocation was based on the percentage of forestland, mined land, urban-suburban, and highway uses. For purposes of load allocation, it was assumed that encroaching roads and mine facilities are proportionally distributed to the land area of these uses. Full support of the cold water use is expected fifteen years following implementation in the tributary streams (Canyon Creek, Ninemile-East Fork Ninemile Creeks, Government Gulch, Pine-East Fork Pine Creeks) and thirty years following implementation in the South Fork Coeur d'Alene River. A CERCLA remedial action is planned to address mining impacts in the watershed, while 51% of the watershed is managed by federal agencies. The CERCLA actions must address the TMDL as an applicable regulatory requirement assuring sediment as well as metals is addressed. Federal land management actions make sedimentation reduction a priority. These actions will provide reasonable assurance that the load allocations will be implemented. Once full support of the beneficial use is achieved the water body(s) would be delisted for sediment.

The TMDL package went out for public review and comment on December 26, 2001 for a thirty-day period. The comment period was public noticed in three local papers. The TMDL package was placed in three libraries identified in the public notices and the documents were made available electronically on the DEQ and Coeur d'Alene Basin Citizens' Advisory Committee (CAC) web sites. Upon request of three groups the comment period was extended an additional thirty-days to February 27, 2002. During the comment period public meetings to discuss the TMDL package were held with Shoshone Natural Resource Coalition Science Committee (January 7, 2001), CAC (January 9, 2001) and the Panhandle Basin Advisory Group (January 15, 2001). At the end of the comment period eight letters of comment were received which contained 87 distinct substantive comments. The comment resulted in 29 separate revisions of the subbasin assessment and TMDL. A responsiveness summary of the comment was developed and letters of response sent to all, who commented.

A comment requested development of a reserve in the waste load allocation to account for future development. A reserve of 27 tons per year and 1.55 MGD was developed by a 10% reduction in the allocated waste load to the current permitted discharges. A white paper on the reserve creations was sent to the permit holders on March 29, 2002 (Appendix D). A meeting on the issue was held with the permit holders on April 4, 2002. At the meeting and in two written communications the permit holders understood the value of a reserve to provide flexibility to the Silver Valley economy. Permit holders did voice some concern that the volume of their discharge would be curtailed up to 10% from existing permit limits.

Table A. Streams and pollutants for which TMDLs[1] were developed.

Water Body Name	Segment ID Number	1998 303(d) Boundaries	Pollutants
SF Coeur d'Alene River	3516	Canyon Ck to Ninemile Ck	Sediment
SF Coeur d'Alene River	3517	Ninemile Ck to Placer Ck.	Sediment
SF Coeur d'Alene River	3518	Placer Ck. To Big Ck.	Sediment
SF Coeur d'Alene River	3513	Big Ck. To Pine Ck.	Sediment
SF Coeur d'Alene River	3514	Pine Ck. To Bear Ck	Sediment
SF Coeur d'Alene River	3515	Bear Ck. To Coeur d'Alene R.	Sediment
Canyon Creek	3525	GorgeGulch. to SF Cd'A River	Sediment; Habitat Alt.
Ninemile Creek	3524	Headwaters to SF Cd'A River	Sediment
EF Ninemile Creek	5618	Headwaters to Ninemile Ck.	Unknown (sediment)
Government Gulch	5084	Headwaters to SF Cd'A River	Sediment
EF Pine Creek	3520	Headwaters to Hunter Ck.	Sediment
EF Pine Creek	3521	Hunter Ck. To Pine Ck	Sediment
Pine Creek	3519	EF Pine Ck to SF Cd'A River	Sediment

[1]Total Maximum Daily Loads

Table B. Summary of assessment outcomes.

Water Body Segment	Pollutant	TMDL(s) Completed	Recommended Changes to 303(d) List	Recommended Schedule Changes	Justification
SF Coeur d'Alene River 17010302-3516	Sediment	1	None	None	N/A
SF Coeur d'Alene River 17010302-3517	Sediment	1	None	None	N/A
SF Coeur d'Alene River 17010302-3518	Sediment	1	None	None	N/A
SF Coeur d'Alene River 17010302-3513	Sediment	1	None	None	N/A
SF Coeur d'Alene River 17010302-3514	Sediment	1	None	None	N/A
SF Coeur d'Alene River 17010302-3515	Sediment	1	None	None	N/A
Canyon Creek 17010302-3525	Sediment	1	None	None	N/A
Ninemile Creek 17010302-3524	Sediment	1	None	None	N/A
EF Ninemile Creek 17010302-5618	Sediment	1	List for sediment and metals	None	N/A
Moon Creek 17010302- 5127	Sediment	None	Delist for sediment	None	Trout density, residual pool volume and modeling indicate full support of cold water use
Government Gulch 17010302-5084	Sediment	1	None	None	N/A
EF Pine Creek 17010302-3520	Sediment	1	None	None	N/A
EF Pine Creek 17010302-3521	Sediment	1	None	None	N/A
Pine Creek 17010302-3519	Sediment	1	None	None	N/A

1. Subbasin Assessment – Watershed Characterization

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters (33 USC § 1251.101). States and tribes, pursuant to section 303 of the CWA are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list of impaired waters, currently every two years. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses the water bodies in the South Fork Coeur d'Alene Subbasin that have been placed on what is known as the "303(d) list" for sediment. The water bodies listed for metals were addressed in the Coeur d'Alene Basin Metals TMDL (DEQ-EPA 2000).

The overall purpose of this subbasin assessment and TMDL is to characterize and document sediment loads within the South Fork Coeur d'Alene Subbasin. The first portion of this document, the subbasin assessment, is partitioned into four major sections: watershed characterization, water quality concerns and status, pollutant source inventory, and a summary of past and present pollution control efforts (Chapters 1 – 4). This information will then be used to develop a TMDL for each pollutant of concern for the South Fork Coeur d'Alene Subbasin (Chapter 5).

1.1 Introduction

In 1972, Congress passed public law 92-500, the Federal Water Pollution Control Act, more commonly called the Clean Water Act. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Water Pollution Control Federation 1987). The act and the programs it has generated have changed over the years as experience and perceptions of water quality have changed. The CWA has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to insure "swimmable and fishable" conditions. This goal, along with a 1972 goal to restore and maintain chemical, physical, and biological integrity, relates water quality with more than just chemistry.

<u>Background</u>

The federal government, through the U.S. Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the country. The Idaho Department of Environmental Quality (DEQ) implements the CWA in Idaho, while the EPA oversees Idaho and certifies the fulfillment of CWA requirements and responsibilities.

Section 303 of the CWA requires DEQ to adopt, with EPA approval, water quality standards and to review those standards every three years. Additionally, DEQ must monitor waters to identify those not meeting water quality standards. For those waters not meeting standards, DEQ must establish TMDLs for each pollutant impairing the waters. Further, the agency must set appropriate controls to restore water quality and allow the water bodies to meet their designated uses. These requirements result in a list of impaired waters, called the "303(d) list." This list describes water bodies not meeting water quality standards. Waters identified on this list require further analysis. A subbasin assessment and TMDL provide a summary of the water quality status and allowable TMDL for water bodies on the 303(d) list. *South Fork Coeur d'Alene River Sediment Subbasin Assessment and Total Maximum Daily Load* provides this summary for the water bodies currently listed for sediment in the South Fork Coeur d'Alene River Subbasin.

The subbasin assessment section of this report (Chapters 1 – 4) includes an evaluation and summary of the current water quality status, pollutant sources, and control actions in the South Fork Coeur d'Alene Subbasin to date. While this assessment is not a requirement of the TMDL, DEQ performs the assessment to ensure impairment listings are up to date and accurate. The TMDL is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR § 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also includes individual pollutant allocations among various sources discharging the pollutant. The EPA considers certain unnatural conditions, such as flow alteration, a lack of flow, or habitat alteration, that are not the result of the discharge of specific pollutants as "pollution." TMDLs are not required for water bodies impaired by pollution, but not specific pollutants. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

<u>Idaho's Role</u>

Idaho adopts water quality standards to protect public health and welfare, enhance the quality of water, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

The state may assign or designate beneficial uses for particular Idaho water bodies to support. These beneficial uses are identified in the Idaho water quality standards and include:

- Aquatic life support – cold water, seasonal cold water, warm water, salmonid spawning, modified
- Contact recreation – primary (swimming), secondary (boating)
- Water supply – domestic, agricultural, industrial
- Wildlife habitats, aesthetics

The Idaho legislature designates uses for water bodies. Industrial water supply, wildlife habitat, and aesthetics are designated beneficial uses for all water bodies in the state. If a water body is unclassified, then cold water and primary contact recreation are used as additional default designated uses when water bodies are assessed.

A subbasin assessment entails analyzing and integrating multiple types of water body data, such as biological, physical/chemical, and landscape data to address several objectives:

- Determine the degree of designated beneficial use support of the water body (i.e., attaining or not attaining water quality standards).

- Determine the degree of achievement of biological integrity.

- Compile descriptive information about the water body, particularly the identity and location of pollutant sources.

- When water bodies are not attaining water quality standards, determine the causes and extent of the impairment.

1.2 Physical and Biological Characteristics

The South Fork Coeur d'Alene River (South Fork) and its major tributaries (Willow, Canyon, Nine-mile, Placer, Lake, Two-mile, Big, Milo, Pine, and Bear Creeks) drains the entire subbasin (17010302)(Figure 1).

Climate

Northern Idaho is located in the Northern Rocky Mountain physiographic region to the west of the Bitterroot Range. The Coeur d'Alene and St. Joe Mountains, which the South Fork drains, are a part of the Bitterroot Range. Both Pacific maritime air masses from the west as well as continental air masses from Canada to the north influence local climate. The annual weather cycle generally consists of cool to warm summers with cold and wet winters. The relative warmth of summers or winters depends on the dominance of the warmer, wetter Pacific or cooler dryer continental air masses. Precipitation is greatest during the winter.

From 1961 to 1990, the average annual maximum temperature was 55.9^o F and the average annual minimum temperature was 33.2^o F at Wallace/Woodland Park (University of Idaho 1994). For the same time period, the month with the lowest average maximum (33.1^o F) and lowest average minimum (18.6^o F) temperature was January. July had the highest average annual minimum temperature (47.8^o F) recorded during the 1961 to 1990 time period. August had the highest average annual maximum temperature (80.6^o F) observed from 1961 to 1990.

Although intervening mountain ranges progressively dry the Pacific maritime air masses, these air masses deposit appreciable moisture primarily as snow on the South Fork watershed. Maritime air masses originating in the mid-Pacific are relatively warm, often yielding their precipitation as rain. Relief of the watershed is generally between 2,200 and 5,700 feet with 41.6% watershed in the rain on snow elevation range of 3,300 to 4,500 feet. Below 3,300 feet the snow pack is transitory, while above 4,500 feet the snow pack is sufficiently cool that warming by a maritime front is insufficient to cause a significant thaw. In the rain on snow elevation range (3,300 - 4,500 feet), a warm and heavy snow pack accumulates each winter. A warm maritime front can sufficiently warm the snow pack making it isothermal and capable of yielding large volumes of water to a runoff event.

Data from Wallace/Woodland Park shows that the 30-year average annual precipitation from 1931 to 1955 was reported at 35.43 inches (Dancer 1993). From 1961 to 1990 at Wallace/Woodland Park, the average annual precipitation was 39.24 inches. (University of Idaho 1994). January exhibited the largest amount of precipitation at 5.51 inches and July the lowest amount of precipitation at 1.29 inches.

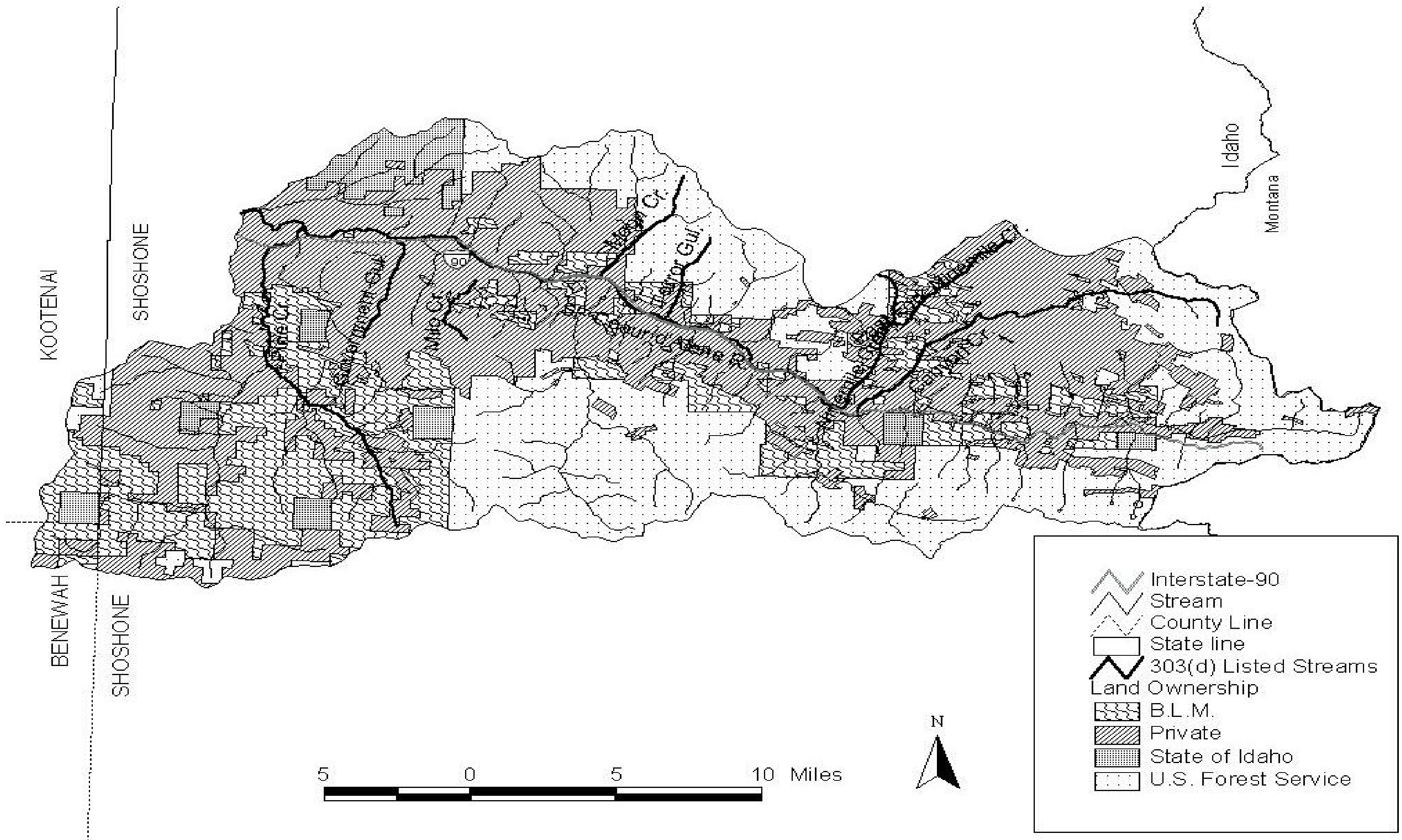


Figure 1. South Fork Coeur d'Alene Subbasin

Subbasin Characteristics

- Hydrology

The South Fork Coeur d'Alene River Subbasin and its tributaries flow from the Coeur d'Alene and St Joe Mountains to the river's confluence with the North Fork Coeur d'Alene River near Enaville, Idaho (Figure 1). The watershed above the North Fork confluence encompasses approximately 298 square miles (190,765 acres).

A weather station has operated intermittently at the Wallace Ranger Station, since 1931. The U.S. Geological Survey (USGS) has operated discharge gauging stations at Pinehurst since 1989, Elizabeth Park since 1987; Silverton, 1967-1987; and Placer Creek, since 1967. As part of the remedial investigation of mining wastes, USGS operated gages on Canyon Creek, Ninemile Creek, Moon Creek and Pine Creek near their mouths during water year 1999. The USGS continues to operate the gages at Pinehurst, Smelterville, Pine Creek, Elizabeth Park, and Ninemile Creek. It operates assorted gages in the East Fork Pine Creek watershed for the Bureau of Land Management (BLM)(Figure 2).

- Geology and soils

The South Fork drains the Coeur d'Alene and St. Joe Mountains, subsets of the Bitterroot Mountains. The mountains are composed in large part of meta-sedimentary rocks of the Proterozoic Belt Super-group. The bedrock is almost entirely from the Wallace, Prichard and Striped Peak formations. Granetic intrusions (Gem stocks) are found in a few areas. Landform is steepened but generally stable. Mass failures are not a typical feature of the landform development, but are specific to a few land types. These are typically glacial deposits located primarily in the valley bottoms. Valley bottoms are composed of colluvial deposits in the steep valleys and gulches. In the broader floodplains of the South Fork below Wallace and lower Canyon Creek, alluvial materials worked by these streams comprise the valley bottoms.

The mountain slopes are underlain by silty to silt loam podsolic soils developed under cool conditions. Volcanic ash deposits are variably found in the soil mantle. Soil mantle is generally thin on slopes with A and B horizons of three to four inches. Soil mantle generally decreases with altitude. Soils in the bottomlands may be silty to sandy podsols developed under upland forest. Near streams and in some pockets, black mucky soils exist where red cedar stands were the dominant vegetation.

- Topography

The Coeur d'Alene and St Joe Mountains are characterized by high and massive mountains and deep dissected intermountain valleys. Valleys range down to 2,200 feet while most mountains reach just over 5,000 feet. Peaks on the Bitterroot, Latour, and St. Joe Divides range to over 6,000 feet. Mountain slopes are generally greater than 40%. The tributary watersheds to the South Fork have slopes predominant with east and west aspects.

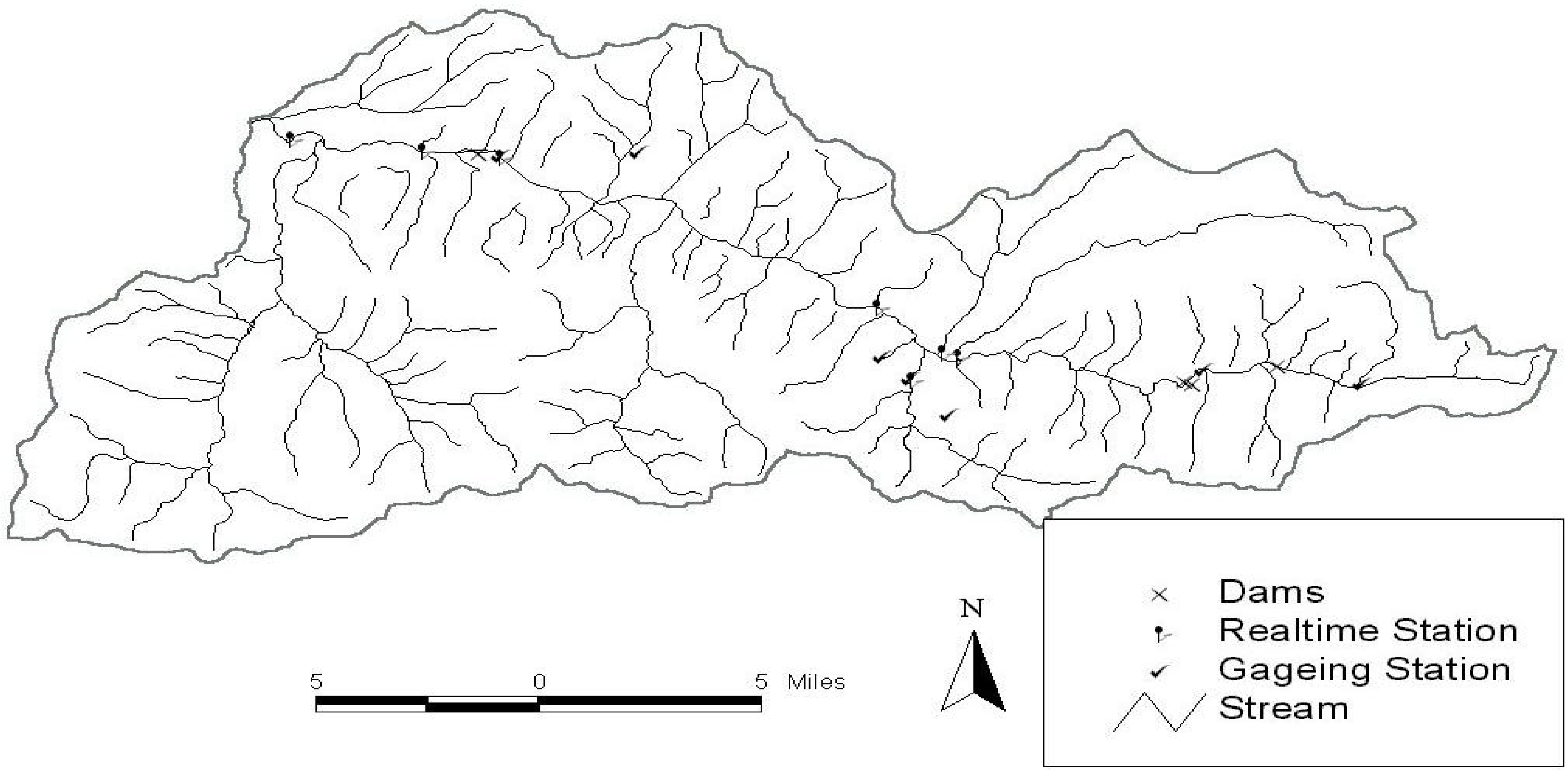


Figure 2. South Fork Coeur d'Alene Subbasin showing real time and stage stream gages.

The exceptions are Canyon, Placer, and Bear Creek that have a predominance of north and south facing aspects. The slopes immediate to the South Fork have a predominance of north and south aspects (Table 1).

- Vegetation

The mountain slopes are mantled with mixed coniferous forest of true fir, Douglas fir, larch, and pine. Rivers and streams are flanked by riparian stands dominated by cottonwood at lower elevations and alder in the higher valleys. Prior to settlement, riparian forests dominated by western red cedar and large cottonwood flanked the river and the lower reaches of its tributaries (Russell 1985). Red cedar boles that fell into the streams were an important source of large organic debris (LOD). The boles provided pool habitat and sediment storage. Logging of the riparian cedar stands and development of the settlements of Wallace, Osburn, and Kellogg removed these riparian stands. Remaining tracts of widened valley bottom where stream gradient are low along the South Fork and Canyon Creek were converted to tailings impoundment areas between 1900 and 1933. These riparian zones have not recovered because metals contaminants interfere with the availability of phosphate to vegetation.

- Fisheries and aquatic fauna

The native salmonids of the subbasin=s streams are cutthroat trout, whitefish, and bull trout. Sculpin and shiners are non-salmonid natives. The tailed frog, giant salamander, and turtles completed the aquatic vertebrate species. The fish fauna of the river and some of its tributaries have been altered by the introduction of rainbow and brook trout as well as chinook salmon. Introduced species have been able to establish in some habitats at lower elevations, while higher elevation water bodies tend to retain the native cutthroat trout. Although fish composition appears stable in the headwaters, fish abundance is depleted from the historic levels by metals and sediment impacts (see Section 2.3). Young of the year salmonids are rarely found in the river below Wallace and the metals impaired tributaries below the mining impacts. Sculpins are rarely found below the mining impacts.

The subbasin was a part of the bull trout range (Maclay 1940). Since bull trout have not been reported in any of the extensive fish monitoring of the basin, the logical conclusion is that it has been functionally extirpated from the subbasin. No sensitive bull trout streams have been identified within the subbasin. No other threatened or endangered aquatic species are known in the subbasin.

<u>Subwatershed Characteristics</u>

The sub-watershed characteristics are summarized in Table 1.

Table 1. Characteristics of the fifth order watersheds of the South Fork Coeur d'Alene Subbasin.

Fifth Order watershed	Area (acres)	Land Form	Dominant Aspect	Relief Ratio[1]	Mean Elevation (m)	Dominant Slope	Hydrologic Regimes	Estimated Water Yield (acre-feet/year)	Mass Wasting Potential
Upper South Fork	32,613	mountainous	west	0.047	1,422	40%+	spring snowmelt	84,363	low
Canyon Creek	13,787	mountainous	west	0.061	1,501	40%+	spring snowmelt	35,664	low
Ninemile Creek	7,355	mountainous	west	0.094	1,311	40%+	spring snowmelt	19,026	low
Placer Creek	10,043	mountainous	east	0.081	1,332	40%+	spring snowmelt	25,979	low
Middle Gulches	18,519	mountainous	west	0.082	1,121	40%+	spring snowmelt; rain on snow	47,905	low
Terror Gulch	1,915	mountainous	south	0.120	1,078	40%+	spring snowmelt; rain on snow	4,954	low
Big Creek	21,377	mountainous	west	0.069	1,557	40%+	spring snowmelt	55,298	low
Moon Creek	5,743	mountainous	west	0.098	1,046	40%+	spring snowmelt; rain on snow	14,856	low
Montgomery Creek	4,914	mountainous	east	0.110	1,049	40%+	spring snowmelt; rain on snow	12,712	low
Lower Gulches	17,219	mountainous	north	0.081	985	40%+	spring snowmelt; rain on snow	44,542	low
East Fork Pine Creek	19,288	mountainous	west	0.082	1,227	40%+	spring snowmelt; rain on snow	49,894	low
Pine Creek Headwaters	18,237	mountainous	south	0.088	1,301	40%+	spring snowmelt; rain on snow	47,176	low
Pine Creek Sidewalls	13,330	mountainous	north	0.093	985	40%+	spring snowmelt; rain on snow	34,482	low
Bear Creek	7,218	mountainous	south	0.090	1,147	40%+	spring snowmelt; rain on snow	18,672	low

1. Relief ratio; $R_h = H/L$, where H is the difference between the highest and lowest point in the basin and L is the horizontal distance along the longest dimension of the basin parallel to the main stream line.

Stream Characteristics

Tributaries to the South Fork Coeur d'Alene River generally have V shaped valleys as a result of the deeply dissected nature of the topography. These valleys accommodate primarily Rosgen A and high gradient B channels. There are exceptions at Woodland Park Flats in lower Canyon Creek, a short section of Placer Creek, lower East Fork Pine Creek, and in the valley of Pine Creek below Langlois Creek. These broader valleys accommodate low gradient Rosgen B channels. The tributaries generally have boulder-bedrock control. Their channel morphology is typically Rosgen A and high gradient B channels. The Belt Supergroup bedrock of the subbasin weathers to soils rich in coarse fragments (60-75%) and rather poor in fine materials (25-40%). Silts dominate the fine soil materials. As a consequence of the soil composition and the steep tributary gradients, boulders and cobble comprise the majority of the stream sediment particles. Width to depth ratios are lower in these streams. The low gradient B channels of tributaries have cobble as the primary stream sediment particles. The width to depth ratio is higher. Floodplains are narrow in most tributary channels. Broader floodplains are found in the wider valleys noted above. Riparian communities correspondingly are narrow in the narrow valleys and broader where valleys and floodplains widen.

The South Fork above the town of Wallace is similar to the other tributary channels in valley shape, stream gradient, channel sediment, floodplain width and riparian communities. At Wallace, the South Fork is joined by Canyon, Ninemile, and Placer Creeks within the distance of a mile reach. The valley slopes remain steep, but the valley floor widens. The channel is a moderate to low gradient Rosgen B channel below Wallace. The channel passes through 'flats" at Osburn, Big Creek, and Smelterville. The channel is at its lowest gradient through these reaches. The "flats" reaches are isolated by "narrows" reaches, which are characterized by a higher gradient. Width to depth ratio is lower in the "narrow" reaches as compared to the "flats." Cobble particle sizes dominate the stream sediments, but a higher percentage of sand and finer materials are present. The "flats" have correspondingly wider floodplains and would naturally have more extensive riparian communities. The "narrows" areas have a narrower floodplain and would naturally have less extensive riparian communities.

1.3 Cultural Characteristics

The South Fork Coeur d'Alene River Subbasin contains silver, lead, and zinc deposits. Since the discovery of these deposits in the mid-1880s, the floodplains and streams of the South Fork have been subject to considerable and intensive development. The scope of the development is described in the following sections.

Land Use

Land use of the South Fork Subbasin is shown in Figure 3. The floodplain of the river and those of several tributaries have been developed for towns and small communities. These areas also support the transportation corridors and most of the ore milling capacity (Figure 4).

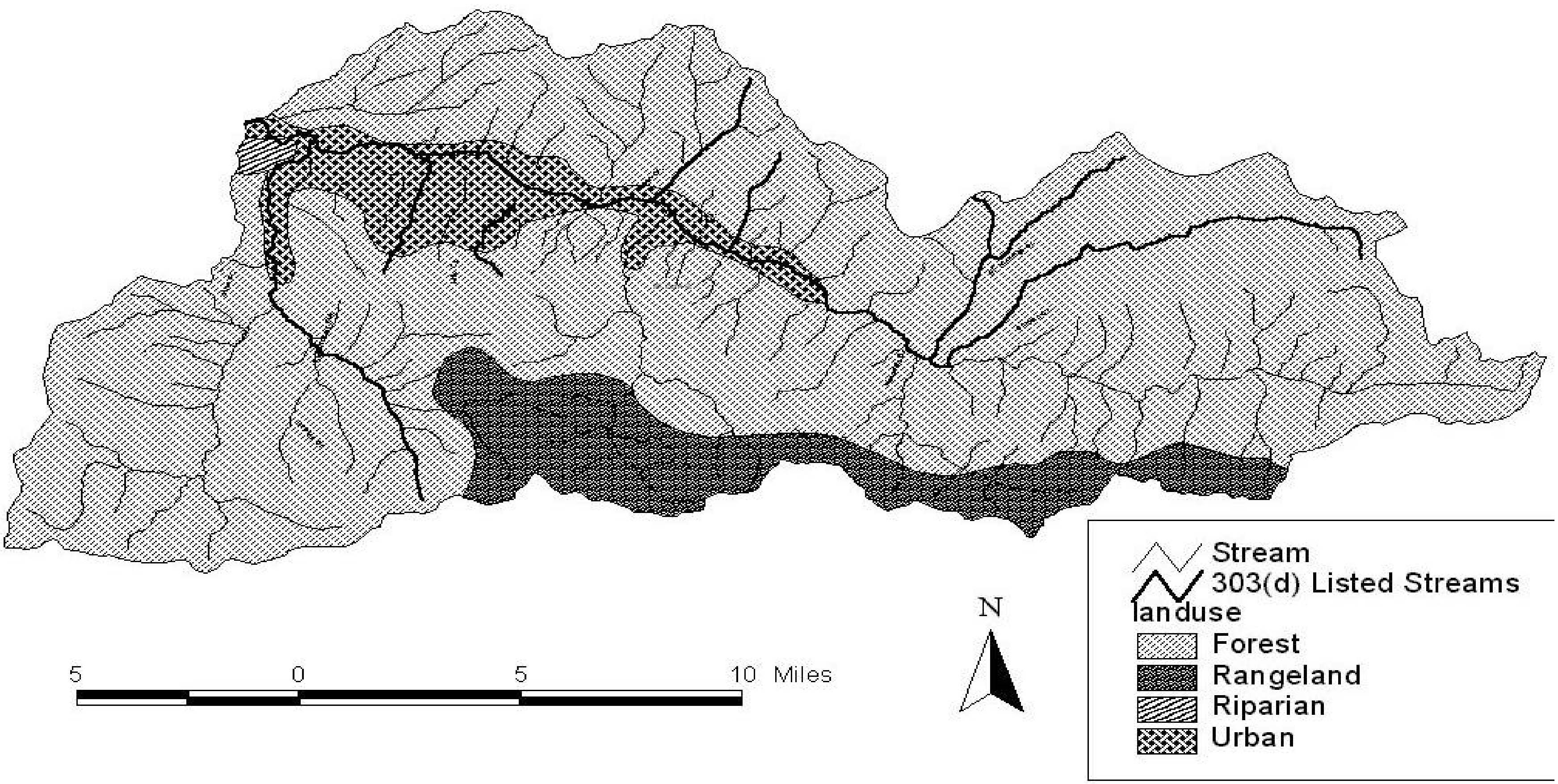


Figure 3. Land use of the South Fork Coeur d' Alene Subbasin

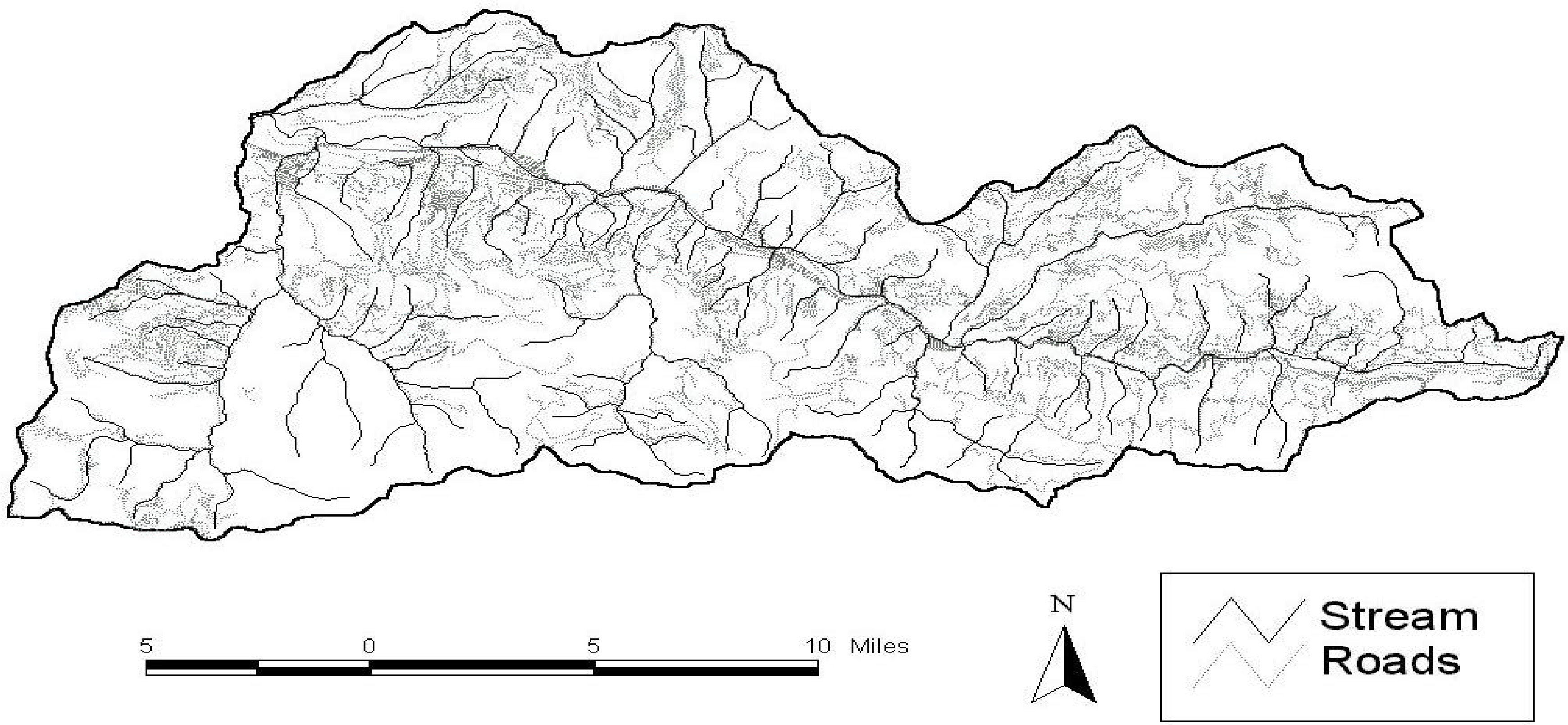


Figure 4. Roads and road crossings of streams of the South Fork Coeur d'Alene Subbasin

Land use is divided between the uplands and the valley bottoms. National forestlands are managed for multiple resource outputs (timber, water, and recreation). Commercial forestlands are managed primarily for timber production. Louisiana Pacific is the largest single commercial forest landowner. One recreation area (picnic and campgrounds) is located at Shoshone Park. One national recreational trail is located along the northern divide of the watershed. In recent years the Silver Valley has promoted winter and summer back road recreation on the forest roads of the watershed.

Mineral locations have been made and highly developed throughout the watershed in the past 120 years. Mineral development was relatively extensive in the Canyon, Ninemile, Lake, Moon, Big, Milo, and Pine Creek sub-watersheds. Mineral development has been intensive along the South Fork from Daisy Gulch to Pine Creek. Silver, lead, and zinc mines and mills are common. The largest mines and mills are listed in Table 2. The Coeur d'Alene Basin Metals TMDL addresses the metals exceedances caused by these sources (EPA-DEQ 2000). Waste rock and tailings piles from these mines or the constraints they place on adjacent streams are a source of sediment.

Much of the mining and/or milling capacity of the Silver Valley Mining District has declined since the 1980s. Mills and the smelter facility at Bunker Hill have been cleaned up under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) authorities or are slated for clean up. After removal of the hazardous materials, some of these sites are finding industrial or recreational uses.

Table 2. Major mines and mills of the South Fork Coeur d'Alene River Subbasin.

Upper SF	**Canyon**	**Ninemile**	**Lake**	**McFarren Gulch**	**Moon**	**Big**	**Milo-Bunker**	**Pine-EF Pine**
Snowline	Hercules	Interstate	Galena	Coeur	Silver Crescent	Sunshine	Sullivan	Constitution
Gold Hunter	Star	Rex		Argentine	Dickens		Bunker Hill	Douglas
Lucky Friday	Tiger-Poorman	Success (Granite)					Page	Highland Surprise
National	Hecla	Day Rock						Sydney
Morning	Standard-Mammoth	Black Cloud						Nevada Stewart
Golconda	Tamarack							Pittsburg
	Black Bear							Hilarity
	Federal							Denver
	Gem							Nabob
								Lynch
								Liberal King
								Amy
								Matchless

Land Ownership, Cultural Features, and Population

The majority of the Shoshone County population of 13,771 resides in the South Fork's watershed (Figure 1). The primary communities are Elizabeth Park, Kellogg, Mullan, Osburn, Pinehurst, Silverton, Smelterville, and Wallace. Significant populations live in the tributary valleys of Canyon, Ninemile, Twomile, Big, Moon, and Montgomery Creeks. Population is sparse in the remainder of the watershed. Population has declined in the subbasin as the mining industry has atrophied.

In the 190,675 acre watershed, management is divided into 84,685 acres of private land (44.4%), 62,369 acres Forest Service managed land (32.7%), 36,227 acres Bureau of Land Management managed land (19%), and 7,426 acres state managed land (3.9%)(IDL GIS database). Private properties are primarily bottomland along the lower South Fork or near the mouths of tributaries and on extensive mine lands (Figure 1).

History and Economics

The watershed has sustained appreciable development since the 1880's as the result of settlement and development driven economically by the mining industry. The towns of the valley and the "gulch communities" were developed in the narrow floodplains of the streams. Initially railroads, and later paved roads further, constrained the streams. Mills, tailings piles, and the smelting facility at Bunker Hill were located in the valley bottoms. The Interstate 90 corridor passes through the valley. In many locations it too constrains the streams. Most of the roads into the tributaries were built in the stream bottoms, fundamentally altering stream gradient and stability.

Timber harvest was restrained in the South Fork watershed during the mining era. Timber stands were young and not of merchantable size as result of the 1910 fire. Some harvest from mine lands occurred. More intensive timber harvest has occurred during the past decade. Mine land previously owned by Hecla Mining Company and Bunker Limited Partnership have been purchased and harvested by Louisiana Pacific and other smaller timber companies. The watershed has approximately, 18**%** of its area harvested at least one time (IPNF Stands and IDL GIS database), most of this by seed tree or shelter wood harvest methods. Agriculture has never been a large land use in the South Fork watershed due to the thin rocky soils.

No dams or diversions of the South Fork Coeur d'Alene River or its tributaries currently exist. In earlier years, some diversions were made to mills in tributaries, but these are all abandoned. Several of the mining facilities retain National Point Discharge Elimination System (NPDES) permits (Table 3). Many of these permits are expired and will not be renewed. The Hecla Lucky Friday, Silver Valley Resources, and Sunshine permit are currently being renewed. The Mullan, Smelterville, and Page wastewater treatment facilities have NPDES permits. The renewal of these permits is in progress.

Table 3. South Fork Coeur d'Alene NPDES permits.

Source	**Permitted Discharges**
Lucky Friday	3
ASARCO (Coeur, Galena)	2
Consil	1
Sunshine	3
Bunker Hill	1
Star/Morning Mine	2
Caladay	1
Silver Baron (inactive)	1
SF Coeur d'Alene Sewer District	2
Smelterville	1

Several local groups have been involved in water quality issues in the subbasin. The Coeur d'Alene Basin Citizens' Advisory Committee (CAC) has provided input to DEQ and EPA for the past nine years. It has served as a watershed advisory group for earlier TMDLs. The CAC has representation of the Idaho Conservation League, Kootenai Environmental Alliance, Save Our River Environment, and The Lands Council. These are the major environmental interest groups in the area. The group also has representatives of the major industries (timber, agriculture, and mining) as well as citizens without affiliation. The newest interest group, the Shoshone Natural Resource Coalition, has been made a member of the CAC. All of these groups work individually on water quality issues in addition to their participation in the CAC.

2. Subbasin Assessment – Water Quality Concerns and Status

The South Fork Coeur d'Alene River below the Canyon Creek confluence and several of the stream segments of its watershed are listed as water quality limited under section 303(d) of the CWA. Sediment and metals are uniformly listed as the pollutant of concern except for the East Fork of Ninemile (headwaters to Ninemile Creek) and Milo Creeks. East Fork Ninemile Creek is listed for an unknown pollutant, while Milo Creek is only listed for metals. Canyon Creek is listed for habitat alteration (Table 4). Fish density surveys (URS Grinier 2000a; IDFG, unpublished data; DEQ Beneficial Uses Reconnaissance Program (BURP) data) indicate that these pollutants have contributed to the decline of trout populations in the South Fork and its tributaries. The relative contribution of metals and sedimentation are difficult to separate. The Coeur d'Alene Basin Metals TMDL addresses the metals exceedances caused by these sources (EPA-DEQ 2000).

2.1 Water Quality Limited Segments Occurring in the Subbasin

According to the 1998 list, the South Fork Coeur d'Alene River Subbasin has 14 water quality limited 303(d) listed stream segments for non-metals pollutants, primarily sediment. These are listed and reasons for listing are described in Table 4. The listed segments are mapped in Figure 1. The characteristics of the watersheds are listed in Table 1 (Section 1.2, page 9).

Table 4: Water quality limited segments of the South Fork Coeur d'Alene River Subbasin.

Water Body Name	Segment ID Number	1998 303(d)[1] Boundaries	Pollutants	Listing Basis
SF Coeur d'Alene River	3516	Canyon Ck to Ninemile Ck	Sediment	App A 305(b)
SF Coeur d'Alene River	3517	Ninemile Ck to Placer Ck.	Sediment	App A 305(b)
SF Coeur d'Alene River	3518	Placer Ck. To Big Ck.	Sediment	App A 305(b)
SF Coeur d'Alene River	3513	Big Ck. To Pine Ck.	Sediment	App A 305(b)
SF Coeur d'Alene River	3514	Pine Ck. To Bear Ck	Sediment	App A 305(b)
SF Coeur d'Alene River	3515	Bear Ck. To Coeur d'Alene R.	Sediment	App A 305(b)
Canyon Creek	3525	GorgeGulch. to SF Cd'A River	Sediment; Habitat Alt.	App A 305(b)
Ninemile Creek	3524	Headwaters to SF Cd'A River	Sediment	App A 305(b)
EF Ninemile Creek	5618	Headwaters to Ninemile Ck.	Unknown	BURP Data
Moon Creek	5127	Headwaters to SF Cd'A River	Sediment	App A 305(b)
Milo Creek	5661	Headwaters to SF Cd'A River	Metals	BURP Data
Government Gulch	5084	Headwaters to SF Cd'A River	Sediment	App A 305(b)
EF Pine Creek	3520	Headwaters to Hunter Ck.	Sediment	App A 305(b)
EF Pine Creek	3521	Hunter Ck. To Pine Ck	Sediment	App A 305(b)
Pine Creek	3519	EF Pine Ck to SF Cd'A River	Sediment	App A 305(b)

[1]Refers to a list created in 1998 of water bodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

2.2 Applicable Water Quality Standards

The water quality standards designate both beneficial uses and set water quality standards for the waters of the state. The designated uses for the South Fork Coeur d'Alene Subbasin and the applicable water quality standards appear below.

Designated Beneficial uses

The designated uses in the Idaho Water Quality Standards of the South Fork Coeur d'Alene Subbasin are listed in Table 5. All other water body segments would be protected for those uses attainable. These would be cold water, salmonid spawning and primary or secondary recreation dependent on the indicators of use (Moon Creek; Table 6) (IDAPA 58.01.02.101.01). The EPA has promulgated cold water biota and primary contact recreation as the designated uses for the South Fork Coeur d'Alene River (Canyon Creek to mouth) and (Daisy Gulch to Canyon Creek), Canyon Creek (Gorge Gulch to mouth), and Shields Gulch (mining impact area to mouth) (CFR 40 Part 131 Vol#. 62. #47 July 31, 1997, P.41166)

Table 5: Designated beneficial uses of the water bodies of the South Fork Coeur d'Alene Subbasin (IDAPA 58.01.02.109.09).

Unit	Water Body and Boundaries	Aquatic Life	Recreation	Other	1998 §303(d) List[2]
P-1	SF Coeur d'Alene River - Canyon Ck to mouth		SCR		x
P-2	Pine Creek - EF Pine Ck to mouth	CW; SS	SCR		x
P-3	Pine Ck – source to EF Pine Ck	CW; SS	SCR	DWS	
P-6	Government Gulch – source to mouth	CW; SS	SCR		x
P-7a	Big Creek – source to mining impact area	CW; SS	PCR	DWS	
P-7b	Big Creek – mining impact area to mouth	CW; SS	SCR		
P-8a	Shields Gulch - source to mining impact area	CW; SS	PCR	DWS	
P-8b	Shields Gulch - mining impact area to mouth		SCR		
P-9a	Lake Creek- source to mining impact area	CW; SS	PCR	DWS	
P-9b	Lake Creek- mining impact area to mouth	CW; SS	SCR		
P-11	SF Coeur d'Alene River–Daisy Gulch to Canyon Ck.		SCR		
P-13	SF Coeur d'Alene River – source to Daisy Gulch	CW; SS	PCR	DWS	
P-14	Canyon Creek – Gorge Gulch to mouth		SCR		x
P-15	Canyon Creek – source to Gorge Gulch	CW; SS	PCR	DWS	
P-16	Ninemile Creek from and including EF Ninemile to Mouth	CW; SS	SCR		x
P-17	Ninemile Creek – source to EF Ninemile Ck.	CW; SS	PCR	DWS	x
P-20	Bear Creek – source to mouth	CW; SS	PCR	DWS	

[1]CW – Cold Water, SS – Salmonid Spawning, PCR – Primary Contact Recreation, SCR – Secondary Contact Recreation, AWS – Agricultural Water Supply, DWS – Domestic Water Supply

[2]Refers to a list created in 1998 of water bodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

Table 6. South Fork Coeur d'Alene Subbasin beneficial uses of impaired streams without standards designated uses.

Water Body	Designated Uses[1]	1998 §303(d) List[2]
Moon Creek	CW, SS, SCR	x

[1]CW – Cold Water, SS – Salmonid Spawning, SCR – Secondary Contact Recreation.

[2]Refers to a list created in 1998 of water bodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

Water quality standards

Water quality criteria supportive of the beneficial uses are stated in the Idaho Water Quality Standards and Wastewater Treatment Requirements (DEQ 2000a). The standards supporting the beneficial uses are outlined in Table 7. In addition to these standards cold water and salmonid spawning are supported by two narrative standards. The narrative sediment standard states:

Sediment shall not exceed quantities specified in section 250 and 252 or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Subsection 350 (IDAPA 58.01.02.200.08).

The excess nutrients standard states:

Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other aquatic growths impairing designated beneficial uses (IDAPA 58.01.02.200.06).

Table 7: Water quality standards supportive of beneficial uses (IDAPA 58.01.02.250.).

Designated Use	**Primary Contact Recreation**	**Secondary Contact Recreation**	**Cold Water Biota**	**Salmonid Spawning**
Coliforms and pH	406 EC/100mL	576 EC/100mL	pH between 6.5 and 9.5	pH between 6.5 and 9.5
Coliforms and dissolved gas	126 EC/100mL geometric mean over 30days	126 EC/100mL geometric mean over 30 days	dissolved gas not exceeding 110%	dissolved gas not exceeding 110%
chlorine			total chlorine residual less than 19 ug/L/hr or an average 11 ug/L/4 day period	total chlorine residual less than 19 ug/L/hr or an average 11 ug/L/4 day period
toxics substances			less than toxic substances set forth in 40 CFR 131.36(b)(1) Columns B1, B2, D2	less than toxic substances set forth in 40 CFR 131.36(b)(1) Columns B1, B2, D2
dissolved oxygen			exceeding 6 mg/L D.O.	exceeding 5 mg/L intergraval D. O.; exceeding 6 mg/L surface
temperature			less than 22 °C (72°F) instantaneous; 19°C (66°F) daily average	less than 13°C (55°F) instantaneous; 9°C (48°F) daily average
ammonia			low ammonia (formula/tables for exact concentration	low ammonia (formula/tables for exact concentration
turbidity			less than 50 NTU instantaneous; 25 NTU over 10 days greater than background*	

* The turbidity standard is a standard applied to the mixing zones of point discharges in the standards (IDAPA 58.01.02.250.01.d.) However, the standard is technically based on the ability of salmonids to sight feed. For this, it is applicable through the narrative sediment standard (IDAPA.0.02.200.08) to impacts on salmonids (cold water biota) wherever these may occur. Abbreviations: pH – negative logarithm of the hydrogen ion concentration; E. Coli - *Escherichia coli;* ug/L – micrograms per liter; D.O. – dissolved oxygen; mg/L – milligrams per liter; °C – degrees centigrade; °F – degrees Fahrenheit; NTU – nephlometric turbidity units.

2.3 Summary and Analysis of Existing Water Quality Data

Metals impair the South Fork Coeur d'Alene River. The CERCLA issues has fostered the collection of a great deal of discharge, water quality, and beneficial use support data. The metals data are summarized in the South Fork Coeur d'Alene Subbasin Assessment addressing metals (DEQ 1998) and in the Coeur d'Alene Basin Remedial Investigation (URS Greiner 2001a). The Metals Concentration Probabilistic Model Technical Memorandum best summarizes these data (URS Greiner 2001b). The remedial investigation developed additional discharge and sediment yield data of value to this assessment. DEQ and others have collected a considerable amount of beneficial use status data. These data are covered below and address both listed and unlisted waters.

Flow Characteristics

The U.S. Geological Survey has continuously operated the Pinehurst Gauging Station since August 1987. The average annual discharge hydrographs of the stations indicate the spring snowmelt event dominates the pattern of stream discharge (Figure 5). Mean high flow discharge occurs in April at 1,350 cubic feet per second (cfs), and mean low flow discharge in September at 114. A more intermittent feature observed on individual yearly discharge hydrographs is rain on snow events precipitated by the climate factors discussed earlier (Figure 6). These events occur between November and March with some years having more than one occurrence and others with none. Rain on snow conditions often result in large discharge (flood) events.

Figure 5: South Fork Coeur d'Alene River Pinehurst ID average monthly discharge (cfs) for water years 1996-2000 (USGS 1996-2001)

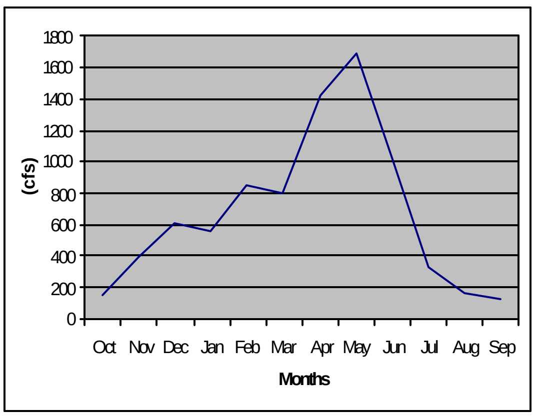
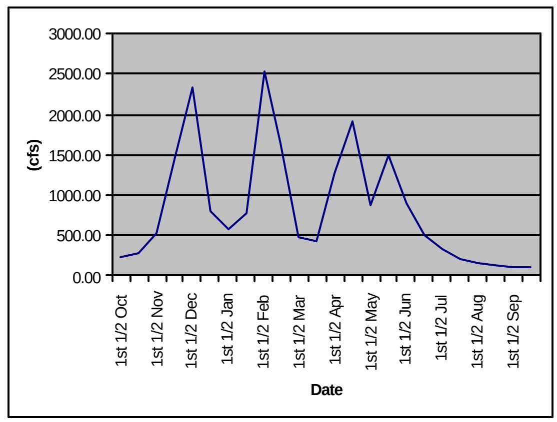


Figure 6: South Fork Coeur d'Alene River near Pinehurst ID average biweekly discharge (cfs) for water year 1996 (USGS 1997)



The maximum period of record for any station in the South Fork Subbasin is 33 years (Placer Gage), while that for the North Fork Coeur d'Alene River is 61 years (Enaville Gage). A flood frequency analysis was developed for the North Fork Coeur d'Alene River and the Coeur d'Alene River based on the long-term stream gages (DEQ 2001c). The South Fork Subbasin receives the identical weather systems, has similar geologic history, has less area in the elevation zone subject to rain on snow effects, and has less area harvested by clear-cut methods. The flood frequency analysis developed for the North Fork Coeur d'Alene Subbasin is applicable to the South Fork Coeur d'Alene Subbasin.

Based on the flood frequency analysis developed for the North Fork, large discharge events occur every 10 to 15 years. The flood frequency and history indicate that clear-cut logging practices have not altered the discharge frequency or discharge magnitude. First and second order stream discharge could be altered by vegetation harvest or land clearing. If this effect occurs, it is desynchronized basin-wide. These results are applicable to the South Fork Subbasin that has sustained a much lower intensity of clear cut logging.

Water Column Data

Water quality data on the metals have been assessed in subbasin assessment addressing the metals contamination issue (DEQ 1998) and the Superfund remedial investigation (URS Greiner 2001a). DEQ and USGS have measured some water quality parameters, in addition to metals. Parameters such as pH, temperature, dissolved oxygen, plant growth nutrients, and conductivity have been measured. Except for metals and some temperature measurements, standards and guidelines are not exceeded for these parameters. Sufficient temperature data has not been collected to make a judgement of temperature exceedances. A metals TMDL has been developed for the entire Coeur d'Alene Basin (DEQ-EPA 2000). Therefore, the existing water column data is not important to sediment impairments.

Biological and Other Data

The existing biological data reflects impacts from metals pollution as well as from sediments. It is often difficult to separate the impacts of these two pollutants with biological data, because the metals and much of the sediment have origins either at the mine sites or in infrastructure built to support the mines.

Biological data provides the most direct measurement of the status of the cold water use, while habitat data provides an assessment of the habitat parameters that can affect that use independent of pollutants of concern. Biological and habitat data collection and analysis do have limitations. These limitations are more fully discussed in the methods and interpretation manuals (EPA, 1999; DEQ, 2002).

- Macroinvertebrate and Habitat Index data

Macroinvertebrate biotic indices (MBI) and habitat indices (HI) are provided in Table 8 for several water bodies of the South Fork Coeur d'Alene River watershed. An MBI score of 3.5 indicates a relatively healthy macroinvertebrate community. The tributaries that are not affected by metals have MBI scores well above 3.5. Tributaries on which mining and milling have occurred have high scores above the mining impacts, but these generally decline below the mining impacts (Canyon and East Fork Ninemile Creeks). The exceptions are Pine, East Fork Pine, Highland, and Moon Creeks, which have scores higher than 3.5. The scores are higher in the South Fork above Wallace than down stream. However, macro-invertebrate communities recovered somewhat, since the surveys of Clark (1992) and Terpening, Hornig, and Bogue (1986).

Habitat indices for the South Fork tributaries do not exceed 70 in most cases. The HI scores remain high above mining impacts but decline in those stream reaches affected by mining impacts. These declines in habitat quality are associated with loss of the riparian communities along the streams as a result of mining and development impacts. The HI scores are low as well due to sedimentation impacts on the stream channels.

- Fisheries data

The fisheries data collected in the BURP (DEQ), data from studies by Hartz (Hartz 1993a; 1993b), IDFG, Natural Resource Damage Assessment, and USGS (URS Greiner, 2001c) are provided in Table 9. Tributaries that are not contaminated with metals indicate salmonid densities of 0.1-0.3 or greater fish per square meter. This density is indicative of full support, based on other control areas in the Panhandle Region (DEQ 2000c). Three age classes are present indicating reproduction. Presence of sculpin and tailed frogs bolster the full support conclusion. Sculpin were not found in tributaries with some metals contamination (Highland, Lake and Moon Creeks). Age class distribution and trout density decline in tributaries with high levels of metals contamination (Canyon and Ninemile Creeks). The South Fork below Wallace has low salmonid densities. Salmonid are generally adult or juvenile fish. Sculpin and tailed frogs are generally not found in the river below the Canyon Creek confluence. The fisheries data indicates healthy fisheries in the tributaries and above mining impacts that is not affected by metals contamination. The fishery is impaired below the mining impacts. Comparison of fisheries data collected in 1993 to that collected in 1999 and 2000 does not indicate that fish density has increased in the South Fork below Wallace or in Canyon and Ninemile Creeks.

Table 8: Macroinvertebrate Biotic Index and Habitat Index data of the South Fork Coeur d'Alene Subbasin.

Stream	WBID Number in Subbasin 17010302	MBI	HI
Bear Creek	020	5.14	73
Big Creek	007	5.13	73
Calusa Creek	003	4.66	65
Canyon Creek (Lower)	014	1.92	34
Canyon Creek (Upper)	015	5.27	74
Denver Creek	004	3.86	32
E.F. Ninemile Cr (Lower)	016	2.86	30
E.F. Ninemile Cr (Upper)	016	4.66	51
E.F. Big Creek	007	4.81	67
EF Pine Creek (Lower)	004	4.01	33
EF Pine Creek (Upper)	004	4.00	58
Government Gulch	006	2.67	22
Highland Creek (Lower)	004	4.27	38
Highland Creek (Upper)	004	4.98	77
Hunter Creek	005	3.76	69
Lake Creek	009	4.08	52
LT N.F. of S.F. CdA R.	013	4.65	77
Milo Creek	001	N.D.	19
Moon Creek (lower)	008	3.63	58
Moon Creek (Upper)	008	3.22	57
Nine Mile Creek (Upper)	016	4.44	54
Pine Creek (Upper)	002	3.58	26
Placer Creek	010	5.31	66
SF CdA R. (Shoshone Pk)	013	4.18	53
SF CdA R. (below Canyon)	001	3.67	50
SF CdA R. (Wallace)	001	3.74	53
SF CdA River (Osburn)	001	3.95	49
SF CdA River (Liz Park)	001	4.06	54
Terror Gulch	001	4.34	62
Trapper Creek	005	4.45	72
Two Mile Creek (Lower)	001	4.84	53
Two Mile Creek (Upper)	001	4.92	56
West Fork Moon Creek	019	4.68	70

WBID – water body identification number; MBI – macroinvertebrate biotic index; HI – habitat index; EF – East Fork; SF – South Fork; R. - River; Lt. – Little.

Table 9: Fish density data of the South Fork Coeur d'Alene Subbasin.

Stream	Site	Date	Salmonid Density (fish/m^2/hr effort)	Presence of Three Salmonid Age Classes	Sculpin Density (fish/m^2/hr effort)	Presence of Tailed Frogs
Bear Creek [1.]	Lower	07/01/98	0.4902	Yes	1.1765	Yes
Big Creek [1.]	Lower	10/28/97	0.1176	No	0.4706	No
Calusa Creek [1.]	Lower	07/01/98	0.0108	No	0.7474	Yes
Canyon Creek [5.]	Near Burke	8/2000	0.044	Yes	0.291	Yes
Canyon Creek [5.]	Near Woodland Park	8/2000	0	No	0	No
EFNine Mile Ck[2.]	ENM-5	09/12/95	1.1409	Yes	0	No
EFNineMile Ck. [6.]	below Interstate	07/11/95	0	No	0	No
EF Big Creek [1.]	Lower	08/21/97	0.0237	Yes	0.0995	No
EF.Big Creek [1.]	Lower	06/29/98	0.0231	Yes	0.2276	Yes
EF Pine Creek [1.]	Upper	06/23/98	0.0451	No	0.5156	Yes
EF Pine Creek [5.]	above Nabob	8/2000	0.256	Yes	NA	NA
Highland Ck [1.]	Upper	06/24/98	1.2500	Yes	0	Yes
Lake Creek [1.]	Lower	10/25/97	0.2252	Yes	0	No
Lt N.F. of S.F. CdA River [1.]	Lower	07/12/99	N.D.	No	0.1953	No
Moon Creek [1.]	Upper	07/08/97	0.2316	Yes	0	Yes
Nine Mile Ck [2.]	NP-P2	09/12/95	2.0221	No	1.7157	No
Nine Mile Ck [2.]	NP-P1	09/12/95	1.5625	Yes	0.5208	No
Pine Creek [6.]	below Amy	8/2000	0.086	Yes	NA	NA
SF CdA River [2.]	Pine Ck to Mouth	07/26/93	0.0044	Yes	0	NA
SF CdA River [2.]	Pine Ck to Mouth	08/13/93	0.0020	Yes	0	NA
SF Cd'A River [5.]	Near Pinehurst	8/2000	0.003	No	NA	NA
SF CdA River [4.]	Elizabeth Park	Aug-93	0.0014	Yes	0	NA
SF CdA River [1.]	Above Wallace	08/20/98	0.0947	No	0	NA
SF CdA River [1.]	Big Creek to Pine Creek	08/19/98	0.0037	No	0	Yes
SF CdA River [1.]	Canyon Ck to Ninemile Ck	08/19/98	0.0085	No	0	Yes
SF CdA River [1.]	Ninemile Ck to Placer Creek	08/19/98	0.0085	No	0	Yes
SF CdA River [1.]	Placer Creek to Big Creek	08/19/98	0.0219	No	0	NA
Trapper Creek [1.]	Lower	06/25/98	0.0793	Yes	0.5549	Yes
Two Mile Creek [1.]	Upper	06/29/98	0.6838	Yes	4.4160	No

Note: 1.–IDEQ BURP data; 2.-IDEQ Hartz 1993a; 3.-IDEQ Hartz 1993b; 4.-IDFG; 5.-USGS; 6.-NRDA; N.A. – not assessed.

- Sedimentation Data

Inspection of the South Fork and the Coeur d'Alene River provides abundant evidence suggesting bed load sediment has increased in the South Fork. Numerous large alluvial bars are present in the South Fork below the Canyon Creek confluence. Newly deposited bars are present along the floodplain of the South Fork. The gravel and cobble in transport is deposited eventually at the grade break in the river system that is located in the Coeur d'Alene River between Kingston and Cataldo. In this reach of the Coeur d'Alene River the channel is braided through the deposited alluvium. Historical descriptions of the Coeur d'Alene River do not include the current sediment bars and braided channels (Russell 1985). The fine sediment is primarily silt. This sediment is rapidly mobilized in the higher gradient channels (Rosgen B) of the subbasin for deposition down stream in the Coeur d'Alene River (USDA 1994).

Riffle Armor Stability Indices

A more quantitative index of streambed instability is the riffle armor stability index (RASI)(Kappesser 1993). The measurement consists of a 200 particle count and size measurement on a transect across a stream riffle using the methods of Wolman (1954). With this information, a particle size distribution curve is developed for the riffle. A RASI involves an additional measurement of the thirty largest particles found deposited on the point deposition bar located immediately downstream of the riffle. The RASI value is the percentage of particles in the distribution curve smaller than the mean size of the largest particles deposited on the point bar. Since the largest particles on the point bar represent the largest stream bed particles moved by the stream during the most recent channel altering event, the RASI provides an assessment of the percentage of the stream bed materials mobilized during the event. A RASI value provides an assessment of relative streambed stability. Values in the range of 28-60 with a mean of 44 have been found in non-managed streams of the upper St. Joe River basin, which are believed to have high relative stability. These watersheds have very few or no roads, virtually no timber harvest and the last general disturbance of the area was the 1910 wildfire. Streams of managed watersheds with appreciable forest harvest and road infrastructures provide RASI values in the range of 66-99 with a mean of 82. These streams are believed to have streambed instability (Cross and Everest 1995; DEQ 2000b).

Riffle armor stability was measured on several tributaries to the South Fork by the Forest Service (Lider, unpublished data) and DEQ (Hartz 1993b). These measurements are summarized in Table 10. Riffle armor stability measurements are uniformly high with the lowest mean value at 75. These measurements are indicative of instability of the streambeds of the tributaries.

Residual Pool Volume

The amount of pool volume in streams can be estimated using residual pool volume measurements. Residual pool volume is the volume a stream pool would occupy if the stream reached a zero discharge condition. Under this condition, water would not flow over stream riffles, stream runs would hold little water, and the pools would make up the majority of the wetted volume of the stream. Residual pool volume is calculated using a box model from measurements of average pool depth, average pool width, pool length, and average pool

Table 10: Riffle armor stability indices for segments of the South Fork Coeur d'Alene River Subbasin.

Stream	WBID Number in 17010302	RASI Range	RASI Mean	Data Source
Bear Creek	020	97-99	98	IDEQ
Pine Creek	001	96-100	98	IDEQ
East Fork Pine Creek	004	96-97	96	IDEQ
Trapper Creek	005	92-97	95	IDEQ
Montgomery Gulch	001	96-98	97	IDEQ
Moon Creek	008	87-96	90	IDEQ
Two Mile Creek	001	60-86	75	USFS
Lake Creek	009	78-100	88	USFS
Placer Creek	010	88-94	90	USFS
Nine Mile Creek	016	77-92	84	IDEQ
Canyon Creek	015	93-96	94	IDEQ

Note: RASI data developed by U.S. Forest Service (Lider, unpublished data) or DEQ (Hartz 1993b).

tail out depth. Average pool tail out depth is subtracted from average pool depth to develop the third side of the box model. Residual pool volume is normally developed for a reach of stream a multiple of 20 times the bank full width in length. The values are normalized on the basis of pool volume per mile of stream. Residual pool volume increases with stream width. For this reason, residual pool volume values must be stratified by stream width to assess the relative amount of pool volume.

Residual pool volume data for the water quality limited segments has been stratified by bank full stream width (Table 11). Pool volume data of reference streams, which have low road densities, are provided for each stratification class allowing the interpretation of the values of the water quality limited segments. Reference streams in the North Fork Coeur d'Alene River watershed are included in the Table 11 (bold). These streams have few impacts and generally high fish densities.

The residual pool volume of most segments is low as compared to reference streams. Values of most South Fork stream segments are approximately ten fold lower than the reference streams. The exceptions are Big Creek, Pine Creek, and the South Fork Coeur d'Alene River. These streams have lower residual pool volume, but by less than ten fold. The residual pool volume data indicates that sedimentation by large particles (cobble) has caused pool filling.

Table 11: Residual pool volume for segments of the South Fork Coeur d'Alene River Subbasin.

STREAM	Bank Full WIDTH (ft)	RESIDUAL POOL VOLUME (ft3/mi)
GOVERNMENT GULCH	4.80	924
MCFARREN CREEK	5.00	1330
MOON CREEK	6.80	3070
SPRUCE CREEK	**8.00**	**19091**
NINEMILE CREEK	8.26	1848
MONTGOMERY GULCH	8.60	5111
TWOMILE CREEK	10.09	1465
WEST FORK MOON CREEK	11.81	1118
HUNTER CREEK	12.17	3238
BEAR CREEK	12.41	1824
BUCKSKIN CREEK	**12.60**	**24345**
PLACER CREEK	13.21	1517
TRAPPER CREEK	13.67	4955
DENVER CREEK	13.89	308
CANYON CREEK	14.50	2871
LAKE CREEK	15.12	1096
LITTLE NORTH FORK SOUTH FORK CDA RIVER	17.36	1639
HIGHLAND CREEK	19.07	668
EAST FORK PINE CREEK	20.12	1266
INDEPENDENCE CREEK	**20.40**	**79701**
EAST FORK BIG CREEK	22.53	2292
NORTH FORK CDA RIVER	**23.90**	**41099**
PINE CREEK	25.50	13528
CALUSA CREEK	25.59	2910
BIG CREEK	25.75	10635
SOUTH FORK CDA RIVER	29.23	45354

Measured Estimate of Sediment Load

The U.S. Geological Survey used in-stream measurements to estimate sediment load passing several stations in the South Fork during water year 1999 for the Coeur d'Alene Basin Remedial Investigation and Feasibility Study (URS Greiner 2001a)(Table 12). Data on the size fraction of the sediment load is available for three tributaries.

Table 12: Sediment estimates for gauging stations in the South Fork Coeur d'Alene River Subbasin for water year 1999.

Stream	Gage location	Total sediment (tons/mi^2)	Fines (tons/mi^2)	Sand (tons/mi^2)	Coarse (tons/mi^2)
Canyon	Mouth	62	32	27	3
Ninemile	Near mouth	34	14	11	9
Pine	Above Pinehurst	37	5	7	26
SF Cd'A River	At Silverton	51*	-	-	-

Estimate tons per square mile ((tons/mi^2) based on 1999 in-stream sediment data and discharge records for water years 1980-1985.

These data are in-stream estimates for a single year. Water year 1999 was statistically average for water yield and did not have large discharge events that would cause movement of large parts of the coarse bed load. Larger estimates would have been developed in years with large discharge events. Some of these data were collected when remedial actions were disturbing the upstream bed (Canyon Creek), while others were collected after recent removals (Ninemile Creek). The preponderance of the fines and sand fraction in the Canyon (95%) and Ninemile (74%) data suggests the problem. Gravel and cobble are the predominant fraction in the streambeds, but is not the predominant fraction detected. Pine Creek sediment is predominantly coarse as expected.

Point Sources of Sediment

Ten permitted discharges have total suspended solid limits ranging from 20 to 70 mg/L. These sources discharged a total of 73.9 tons per year of sediment to the stream based on 1999 and 2001 discharge monitoring records (DMR) (Table 13). All of this sediment is fine material that does not cause pool filling. The sediment from wastewater treatment facilities (50.7%) contains organic matter that is likely a benefit to the South Fork, which has little organic matter input from its impaired riparian communities.

Sediment Modeling

Sediment monitoring in-stream is a very time consuming and costly undertaking. The in-stream sediment data collected by the USGS during four synoptic events in water year 1999 cost $75,000. Sediment monitoring should be conducted for seven years at a site to develop a database that accounts for the variance of discharge affects on sediment yield and transport from year to year. The investment required to conduct sediment monitoring is estimated at $131,250 per site. The time necessary and costs involved do not make sediment monitoring a viable approach. A sediment modeling approach uses coefficients developed over long periods in paired watersheds. A sediment modeling approach is the most time and cost efficient approach to estimating sediment for the purposes of TMDLs.

Table 13: Permitted sediment discharges to the South Fork Coeur d'Alene River Subbasin.

Permitted Discharge	Average[1] Discharge (MGD)	Average Supended Solids Discharged (mg/L)	Average Daily Sediment Load (lb/d)	Average Annual Load (tons/yr)
Page	2.20	10.2	186.8	34.1
Mullan	0.24	4.1	8.2	1.5
Smelterville	0.12	11.0	11.0	1.9
Coeur/Galena 001	0.91	3.2	24.2	4.3
Coeur/Galena 002	0.42	2.1	7.3	1.3
Coeur/Caladay	0.18	0.7	1.0	0.2
Lucky Friday 001	1.06	4.1	36.2	6.8
Lucky Friday 003	0.97	2.6	21.0	3.9
Sunshine	1.17	6.0	58.4	12.6
Central Treatment Plant	2.20	2.1	38.5	7.3
Total	9.47	-	392.6	73.9

[1] data from DMR for 1999 through 2001.

Land Use Data

Sediment loading occurs from the entire watershed. It is not necessarily restricted to the water quality limited segments of the South Fork Coeur d'Alene River Subbasin. In the following tables, sediment load is analyzed based on all contributing watersheds to the subbasin. Sediment yield is estimated from land use data developed from U.S. Forest Service (USFS) and IDL geographic information system (GIS) timber stand coverage and delineation of urban-suburban lands along the river bottom. Fire and road coverages developed by the USFS and Bureau of Land Management (BLM) were used to develop data on areas that received two wildfires and the forest road mileage and densities. After assessment by IDL specialists, cumulative watershed effects (CWE) scores and land failure yield estimates were developed. Highway land use acreage was estimated based on the road length (GIS road coverage) and the known right of way width. Mine waste pile area and length of stream encroachment was developed from BLM coverages of mine waste deposits. These values are reported on Table 14.

Table 14: Land use of watersheds of the South Fork Coeur d'Alene River Subbasin.

Watershed	**Upper SF Cd'A**	**Canyon Creek**	**Ninemile Creek**	**Placer Creek**	**Middle Gulches**	**Big Creek**	**Terror Gulch**	**Moon Creek**	**Montgomery Creek**	**Lower Gulches**	**Pine Creek Headwaters**	**EF Pine Creek**	**Pine Creek Sidewalls**	**Bear Creek**
Conifer forest (acres)	31,735	12,132	6,803	10,011	13,905	20,197	1,600	4,752	3,778	6,922	15,724	16,102	9,304	6,623
Non-stocked forest (acres)	178	1,407	447	0	2,608	548	270	884	930	7,261	2,513	3,089	3,189	581
Double Wildfire Burn (acres)	25.4	0	0	5,560	0	2,865	0	308	0	0	157	1,513	0	0
Urban-Suburban (acres)	206	20.8	2.7	10	1,252.1	154	11.3	3.3	88.6	2,322.4	0	0	544.8	0
Highway (acres)	482.9	151.0	63.2	21.8	613.6	208.2	34.3	96.0	119.1	701.0	0	34.4	284.1	14.2
Forest road (miles)	180.7	92.8	66.7	41.4	97.2	88.7	11.9	22.4	31.5	120.7	84.8	63.6	118.2	48.7
Average road density (miles/mile^2)	3.5	4.3	5.8	2.6	3.4	2.7	3.9	2.5	4.1	4.5	3.0	2.1	5.7	4.3
Road Crossing Number	163	114	62	37	99	53	7	15	28	109	47	43	81	37
Road Crossing Frequency	1.5	2.7	2.9	1.0	1.5	0.7	0.8	0.7	1.4	1.4	1.0	0.6	1.6	1.6
Encroaching road (miles)	6.5	4.4	4.0		5.9	4.0	0.5	0.9	1.1	6.2	1.9	2.9	2.7	1.7
CWE Score	16.5[1]	17.8	15.5	16.5[1]	10.3	10.0[1]	9.9	9.9	11.9	13.4	28	11.7	11.4	10.2
Encroaching mine waste piles (miles)	0.1	2.2	1.2	0	2.6	0	0	0.3	0	0.2	0	2.4	0.2	0
Mine waste piles (acres)	9.4	75.9	39.4	0	140.2	0	1.0	8.1	0	14.2	0.2	63.4	7.5	0

Data taken from CDASTDS, IDPNFIRE, CDAROADS, and IDL databases cut for specific sub-watersheds. [1]Assumed value from adjacent watersheds

Sediment Yield and Export

Sediment yields were developed separately for forest, mined, and urban land types (Table 15). Sediment contribution from road surfaces, mass failures, road encroachment, and stream bank erosion were modeled with a separate set of algorithms. Mining features such as tailings ponds and waste rock piles that encroach on the stream channels and floodplains were treated as encroaching roads. Sediment yield to the stream system was assumed to be 100%. Model assumptions and documentation of the sediment model are provided in Appendix A.

Direct delivery of sediment from stream bank erosion is not a large factor in the Rosgen B channels of the South Fork Coeur d'Alene Subbasin (Golder, 1998). The model reports this factor as zero. No grazing is practiced in the subbasin and features that formerly had bank erosion (tailings deposits) have been removed in recent years. Bank and bed erosion does occur where roads and towns encroach on the floodplains. These areas are treated in the model with the estimation of sediment yield caused by encroaching features.

Table 15: Estimated sediment yield coefficients for forestland, mined lands, and highways uses on the Belt Super-group terrain.

Landuse type sediment export coefficient	**Belt Super-group precambrium meta sediments**
Unconfined mill tailings deposits (tons/acre/year)	0.100
Conifer forest (ton/acre/year)	0.023
Non-stocked forest and waste rock piles (tons/acre/year)	0.027
Double wildfire burn (ton/acre/year)	0.004
Urban-Suburban (ton/acre/year)	0.050
Highway (tons/acre/year)	0.019

Sedimentation Estimates

Sedimentation estimates were developed by addition of the various sediment yields prorated for delivery to the channels (Table 16). Copies of the Excel model spreadsheets are available in Appendix B.

Table 16: Estimated sediment delivery to the South Fork Coeur d'Alene River Subbasin.

Watershed	Upper SF Cd'A	Canyon Creek	Ninemile Creek	Placer Creek	Middle Gulchs	Big Creek	Terror Gulch	Moon Creek	Montgomery Creek	Lower Gulches	Pine Creek Headwaters	EF Pine Creek	Pine Creek Sidewalls	Bear Creek
Conifer forest (tons/year)	729	279	156	230	320	465	37	109	87	159	362	370	214	152
Unstocked Forest (tons/year)	5	38	12	0	70	15	7	24	25	196	68	83	86	16
Unconfined mine waste pile erosion (tons/year)	1	8	4.0	0	14	0	0	1	0	1	0	6	1	0
Urban-Suburban (tons/year)	10	3	1	0	63	8	1	0	4	116	0	0	27	0
Highways (tons/year)	9	3	1	0	12	4	1	2	2	13	0	1	5	0
Double Wildfire Yield (tons/year)	0	0	0	22	0	11	0	1	0	0	1	6	0	0
Road Crossings (tons/year)	44.5	35	16	10	17	9	1	4	6	26	32	8	15	6
Road Failures (tons/year)	0	0	0	0	0	0	0	0	0	0	928	0	0	5
Road & Mine encroachment (tons/year)	89	80	52	37	158	60	4	11	9	145	22	67	36	26
Total (tons/year)	889	443	241	301	654	571	51	152	133	657	1412	542	385	194

Total estimated annual sediment delivery to the South Fork Coeur d'Alene River from nonpoint sources is 6,623 tons per year. The total sediment load is 6,699 tons per year, when the permitted discharge load is added. The natural background sediment yield is based on the assumption that the watershed is forested in at least seedling and sapling trees. The mid-range value of the sediment yield coefficient is multiplied by the entire watershed acreage to develop a background sediment yield of 4,399 tons per year. An annual excess of 2,300 tons of sediment per year is estimated by this method to be delivered to the river. The sedimentation for the entire watershed is 52% above estimated natural sedimentation. The percentage above background sedimentation for major watersheds ranges from 15% to 237% (Table 17). Sedimentation rates in excess of 50% of natural sedimentation may be sufficiently high to exceed water quality standards (Washington Forest Practices Board 1995). The value is deceiving, because it has been annualized. Massive sediment delivery to the system occurs during high discharge events typically associated with rain on snow conditions. These events have 10 to 15 year return times. It is a better estimate that 23,000 to 34,500 tons of excess sediment are delivered to the river during some single large events. The river exports the sediment during the periods between the large discharge events.

Table 17: Estimated background and sediment delivery to sub-watersheds of the South Fork Coeur d'Alene River Subbasin.

Watershed	Upper SF Cd'A	Canyon Creek	Ninemile Creek	Placer Creek	Middle Gulchs	Big Creek	Terror Gulch	Moon Creek	Montgomery Creek	Lower Gulches	Pine Creek Headwaters	EF Pine Creek	Pine Creek Sidewalls	Bear Creek	SF Cd'A River
Total Nonpoint Source sediment (Tons/year)	889	443	241	301	654	571	51	152	133	657	1412	542	385	194	6625
Sediment Discharged	12.2	0	0	0	18.4	0	0	0	0	43.6	0	0	0	0	74
Total Sediment	901	443	241	301	672	571	51	152	133	701	1412	542	385	194	6699
Background sediment yield (Tons/year)	750	317	168	231	426	486	44	132	113	396	420	334	307	166	4399
Percent above background	20.2	39.7	43.4	30.2	57.8	17.6	14.8	15	17.7	76.9	236.7	22.1	25.4	16.7	52.2

Canyon, Ninemile, and Pine Creeks have modeled sediment yield per square mile of 21, 21, and 25 tons per square mile, respectively. The USGS measured sediment yield in these watersheds during water year 1999 (URS Greiner 2000a) (Table 12, page 30). The measured values in Table 12 are of the same range as the model predictions, but the modeled predictions are 1.5 to 3 times lower.

There are two explanations for the differing results between in-stream estimates (Table 12) and model estimates (Table 17). In-stream sediment data was collected as remedial work proceeded in Canyon Creek (1999) and only a few years after remedial actions in Ninemile Creek. These actions included considerable disturbance of the streambed. The high percentage fines and sand in the Canyon (95%) and Ninemile (74%) suggest this explanation. Sediment yielded to streams by the predominant erosion mechanisms is primarily coarse material in these watersheds. The sediment load composition is more typical of Pine Creek, where 32% of the sediment was fines and sand. The second explanation is reduced yield in recent years. The remedial actions described in Section 4 (page 42) were implemented to reduce metals, but had an added result of sediment yield reduction. The removal and stabilization of tailings piles and waste rock at the Interstate, Success, Gertie, and several other sites, the capping of tailings piles and the removal of tailings contaminated sediments from at least 12 miles stream shore have reduced sediment yield to the streams. The BLM mine features database provided sediment yields from mine waste piles and contaminated sediment model inputs. The inputs were updated to take into account the remedial actions described in Section 4. Since these actions have occurred in the past eight years, the actual transport of sediment measured in-stream may not yet reflect the lessened sediment yield of the landscape.

The model results only estimate the delivery of sediment to the river system. The transport of sediment in the South Fork watershed and export of sediment from the watershed is not addressed. The riffle armor stability and residual pool volume data indicate the current sediment load destabilizes the channels. Sediment loads associated with the large fire event of 1910 are likely still present to some extent in the channels. Alterations of floodplain function in many locations have removed the buffering capacity of the channel system. Even after sedimentation rates to the watercourses are reduced dramatically, it will take a substantial period (10-50 years) for the current sediment load of the river to be exported or placed in stable deposits.

Status of Beneficial Uses

Impairment of cold water biota and salmonid spawning in the South Fork Coeur d'Alene River and some of its tributaries by the metals and sediment loads is indicated by the fish density and age class data. Metals and sediment impacts to the beneficial of the listed waters cannot be completely segregated. However, the residual pool volume data demonstrate that excess sedimentation is part of the problem. Sediment is filling pools to the detriment of the trout. The sediment monitoring data at selected locations in the South Fork watershed indicates that in stream sediment load even during an "average" year is 1.5 to 3 times the background level of sediment yield. Sediment modeling of the basin supports this conclusion. The biological and sedimentation data indicate that the listed segments of the South Fork Coeur d'Alene River and its tributaries with the exception of Moon Creek are limited by excess sedimentation. Fish density, residual pool volume, and sediment model data do not indicate a sediment limitation of Moon Creek. Since sediment is yielded to the lower segments of the South Fork from its entire watershed, the sediment TMDL must address the entire watershed.

<u>Conclusions</u>

All sediment-listed segments of the South Fork Coeur d'Alene River Subbasin are impaired by excess sedimentation with the exception of Moon Creek. Exceedance of the narrative sediment standard is evident in the listed segments and likely others. The critical sedimentation feature is filling of pools by cobble size material. Model results suggest that sediment yield to the system has been curtailed in the past eight years by remedial activities. The Bear, Big, Moon, and Montgomery Creeks and the Upper South Fork watersheds appear to have lower levels of sediment yield based on modeling. However, these watersheds do yield sediment to the South Fork and must be considered in any loading analysis. The loading analysis must be completed basin wide. Since the sediment modeling composes the loading analysis, it is described in Section 2.3 (pages 30-37).

The critical discharge period is the high discharge event, typically associated with a "rain on snow" climatic event. Since sediment is yielded primarily during these large events it is erratic and episodic. For the purposes of a TMDL, sediment loads are stated as tons per year.

Biological, pool volume and the sediment model indicate the unknown pollutant listed for the East Fork Ninemile Creek is sediment. Earlier assessment by DEQ (1998) demonstrates that the metals, cadmium, lead, and zinc are also pollutants. Biological, pool volume and model results indicate that sediment is not impairing Moon Creek.

2.4 Data Gaps

The major data gap is additional in-stream measurement of sediment load. Sufficient measurements were made to assess the accuracy of the model results in the remedial investigation.

3. Subbasin Assessment – Pollutant Source Inventory

Several sources of sediment exist in the valley, including the natural source at approximately 14.7 tons per square mile per year. All the significant sources of sediment are nonpoint sources.

3.1 Sources of Pollutants of Concern

Pollutant sources of sediment are discussed in the following sections. Sediment is yielded to the subbasin from a large number of sources, including the natural erosion rate.

Point Sources

Point sources of sediment include the wastewater treatment facilities and mills. The South Fork Wastewater Treatment District, the City of Smelterville, three mine mills and the Central Treatment Plant discharges have total suspended solids limits In a range of 20 – 70 mg/L. These sources are potentially 7% of the sediment load based on their permits. During the period of 1999 through 2001, their average sediment load was 73.9 tons per year or 1.1% of the sediment load (see Section 2.3, page 30). Compared to sediment loads modeled and verified with in-stream measurements the point source loads are small. The permitted point sources of metals and other pollutants were listed in Table 3 (Section 1.3, page 15). Sixty point sources of metals exist that are not currently permitted. (DEQ-EPA 2000). Since these are ground water sources, none are sediment sources.

The entire subbasin has been considered under CERCLA (Superfund) for impacts of trace metals. Functionally, the site has been interpreted as those locations where the contaminants (trace metals) have come to rest.

Nonpoint Sources

The majority of the land use of the subbasin is forestlands (Figure 3, page 11). Mine and mill site infrastructures, town sites and roads constrain streams leading to sediment yield. These are the two major sources of nonpoint source sedimentation in excess of the natural background erosion rate.

- The meta-sedimentary rocks of the Proterozoic Belt Super-group terrain yield sediment at a natural rate of 0.023 tons per acre per year (14.7 tons per year per square mile). Mass wasting is not a typical feature of the Belt terrain. It can occur on glacial till deposits of valley bottoms. Mass wasting is directly estimated in the CWE process. Little mass wasting was found in the subbasin.

- Timber harvest is a source of sediment, while the cut area remains not stocked with timber species. Once a stand of seedlings and saplings is re-established, the same excess sedimentation from the harvest alone does not occur. Timber harvest, forest fires and smelter fumes (sulfur dioxide gas) deforested a large area of the South Fork Subbasin near Kellogg. Smelter fumes retarded reforestation until 1981 and soil impacts still inhibit reforestation on slopes above the smelters. These areas are not stocked and have higher sediment yield.

- Sediment yield from waste rock piles at mine sites is low; however sedimentation from unconfined tailings deposits can be significant. Sediment is loaded by overland flow, streamside erosion (gradient constraint), and mass wasting.

- Timber harvest and mine site roads are a significant source of sediment. These can yield surface sediment, trigger mass wasting or constrain streams and accelerate erosion. County and state roads and highways can also constrain streams accelerating erosion.

- Urban and suburban areas are a source of sediment. Most urban and suburban areas are in the valley bottoms where slopes are low. These areas are a minor source of sediment yield.

Pollutant Transport

Sediment is delivered to the stream system primarily during high precipitation-high discharge events or rapid snowmelt events. Under these conditions large volumes of sediment move in the stream systems. These conditions develop stream power and stage heights capable of channel alteration. Sediment trapped in upper low order watersheds moves quickly to the higher order streams of the subbasin. Areas where stream gradient is constrained by roads, mine facilities or towns have rapid erosion from bed and/or banks. The gradient of the South Fork Subbasin is sufficient for sediments finer than sand to be flushed to the Coeur d'Alene River (USDA 1994). The eroding substrates of the subbasin are 65 – 75% particles larger than fine sand with a substantial portion of this material at least cobble size. These sediments remain in the South Fork and its lower gradient tributaries where the impact to the beneficial use as pool filling is greatest. A sufficient sediment transport model has not been developed for the South Fork nor have any been found applicable in the remedial investigation process (URS Greiner 2001).

3.2 Data Gaps

The major data gap in sediment pollution is not the sources but rather the transport of sediment in-stream. As a result of the metals contamination of a portion of the subbasin, the sources of metals and sediment are well understood.

Point Sources

Point discharges that have and do not have permits have been monitored in the subbasin. These traditional discrete sources have not been found to be a large sediment source. No data gaps have been identified.

Nonpoint Sources

Nonpoint sources have been modeled rather than measured. Existing in-stream monitoring supports model results; however, additional in-stream monitoring would be of value. Such monitoring is quite expensive (see Section 2.3, page 30). It is unlikely that this data gap will be filled. Model results are the best available information.

4. Subbasin Assessment – Summary of Past and Present Pollution Control Efforts

The wastewater and metals point sources in the watershed were brought under regulation of the National Point Discharge Elimination System (NPDES) during the 1970s. Eleven mining point discharges and three municipal wastewater discharges have been permitted. Most of the permits that are still active are in the process of revision and are expected to be issued early in 2002.

Remedial work on the initial phase of Bunker Hill remedial action is nearly complete. A remedial plan and record of decision were completed in September 1992. A yard removal consent order is being implemented to remove contaminated yards for replacement with clean yard materials. Playgrounds have received similar treatment. A hillside treatment consent order is being implemented to terrace denuded hillsides to slow erosion; fertilize slopes; plant trees, shrubs, and grass; construct check dams to trap eroding materials; and channelize some stream reaches to retard surface water infiltration in the metals-contaminated substrates. The smelter complexes have been demolished and principal threat materials placed in a lined and capped repository. Tailings contaminated sediments have been removed from the South Fork in the Central Impoundment Area and Smelterville Flats reaches. Similar removals have occurred in Government Gulch and Bunker, and Milo Creeks. These materials have been capped in a reshaped Central Impoundment Area. Mine waste rock dumps including the Page and Arizona deposits have been stabilized. Additional phase I work will involve upgrade of the Central Treatment Facility that processes Bunker Hill mine water and replacement of street, sewage collection, and drainage infrastructure.

Additional removal actions have occurred outside the Bunker Hill site area. Tailings deposits at Elizabeth Park and the Success site have been stabilized to prevent mass wasting into the South Fork and East Fork Ninemile Creek. Flood plain sediments contaminated with tailings have been removed from 3.5 miles of Ninemile Creek, 6 miles of Canyon Creek, 1 mile of Moon Creek, and 2 miles of the South Fork in the Osburn Flats reach. Tailings piles have been removed to repositories at the Interstate Site in Ninemile Creek; Dickens Mill Site in Moon Creek; and the Douglas, Denver, Liberal King, and Amy-Matchless Mill sites in the East Fork Pine, and Pine Creeks. Waste rock piles have been stabilized at the Standard-Mammoth, Sydney, and Gertie sites. Removals of metals from ground water seeps and mine adit with semi-passive treatment technologies are in demonstration at the Success and Gem adit sites.

The objective of the majority of the remedial work in the South Fork Coeur d'Alene Subbasin has been to reduce metals concentrations and loads in the streams. The work completed has incorporated removal of sediment sources and re-establishment of channel morphology and structure. Tailings removal either from flood plains or from streamside deposits and waste rock deposit stabilization directly affect sediment yield. The remedial work has not addressed the impacts of forest harvest roads and other infrastructure. Although the remedial activities to date are a good start, these actions are not expected to fully address sediment yield. The forest harvest roads and other infrastructure must be addressed to control sediment yield.

All forest practices conducted in the subbasin are regulated under the Idaho Forest Practices Act Rules and Regulations. These rules are in part best management practices designed to abate erosion and retard sediment delivery to the streams. All Forest Service harvests must meet the INFISH guidelines. These guidelines prescribe 300 feet wide buffers for streams with fishery uses.

5. Total Maximum Daily Load

A TMDL prescribes an upper limit on discharge of a pollutant from all sources so as to assure water quality standards are met. It further allocates this load capacity (LC) among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a waste load allocation (WLA); and nonpoint sources, which receive a load allocation (LA). Natural background (NB), when present, is considered part of the load allocation, but is often broken out on its own because it represents a part of the load not subject to control. Because of uncertainties regarding quantification of loads and the relation of specific loads to attainment of water quality standards, the rules regarding TMDLs (40 CFR § 130) require a margin of safety (MOS) be a part of the TMDL.

Practically, the MOS is a reduction in the load capacity that is available for allocation to pollutant sources. The natural background load is also effectively a reduction in the load capacity available for allocation to human made pollutant sources. This can be summarized symbolically as the equation: LC = MOS + NB + LA + WLA = TMDL. The equation is written in this order because it represents the logical order in which a loading analysis is conducted. First the LC is determined. Then the LC is broken down into its components: the necessary MOS is determined and subtracted; then NB, if relevant, is quantified and subtracted; and then the remainder is allocated among pollutant sources. When the breakdown and allocation is completed we have a TMDL, which must equal the LC.

Another step in a loading analysis is the quantification of current pollutant loads by source. This allows the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary in order for pollutant trading to occur. Also a required part of the loading analysis is that the LC be based on critical conditions – the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both LC and pollutant source loads vary, and not necessarily in concert, determination of critical conditions can be more complicated than it may appear on the surface.

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

5.1 Instream Water Quality Targets

The in-stream water quality target for the South Fork Coeur d'Alene River TMDL is full support of the cold water designated use (Idaho Code 39.3611, 3615). Specifically, sedimentation must be reduced to a level where the stream can re-establish residual pool volume and trout density in the range of 0.1-0.3 trout per square meter found in control streams (DEQ 2001c). Unfortunately, a defensible mathematical relationship between residual pool volume and fish density has not been developed for this or other watersheds. The TMDL will develop loading capacities in terms of mass per unit time. The interim goals will be set based on watersheds supporting cold water use and final goals established when bio-monitoring establishes full support of the cold water use. The sources yielding sediment to the system can be reduced, but a substantial period (20-30 years) will be required for the stream to clear its current sediment bed load and create pools.

Design Conditions

Point sources are not the major sources of sediment to the South Fork Coeur d'Alene Subbasin, but are a significant source. The permitted facilities can discharge an average 12.5 million gallons per day (7.32 cfs). Based on the average permit limits for total suspended solids (Table 21), the potential discharge load is 470 tons per year. This level is 7% of the total load of 6,699 tons per year (Table 17). Actual discharge is a fraction of this (1.1%; Table 13, page 31).

The TMDL addresses the point and nonpoint sediment yield to the subbasin. Point discharge of sediment is relatively constant. Sediment from nonpoint sources is loaded episodically, primarily during high discharge events. These critical events occur during the November through March period, but may not occur for several years. The return time of the largest events is 10-15 years (DEQ 2001c). The key to nonpoint source sediment management is implementation of remedial activities prior to the advent of a large discharge event.

Seasonality and Critical Conditions

The condition for sediment delivery and additional sedimentation of the streams of the South Fork Coeur d'Alene Subbasin is the high discharge event. The flood frequency analysis and history indicate that extreme high discharge events occur at 10 to 15-year intervals (section 2.3; page 22; DEQ 2001c). Lesser high discharge events yield less sediment to the system. The largest high discharge events of record are "rain on snow" events that occur between November and March of any given year. However, these events may not occur for several years. As an example no major rain on snow events occurred between November 1990 and mid-February 1995 in the Coeur d'Alene Basin. After the 1995 event, two additional events occurred in 1996, one the third largest event on record, and then no event occurred of any size until January 2002. Thus the most likely situation for sediment loading is episodic not seasonal. High discharge does occur seasonally with the spring snowmelt. These seasonal high discharges are not the large discharge events triggering high sediment yields that develop under rain on snow conditions. With this understanding of sedimentation events, the sediment yield reductions required by the TMDL will be realized when the critical discharge event occurs.

Critical conditions are part of the analysis of loading capacity. The beneficial uses in this subbasin are impaired due to chronic sediment conditions. Due to the chronic condition, this TMDL deals with yearly sediment loads. The concept of critical conditions is difficult to reconcile with the impact caused by sediment. The critical condition concept assumes that under certain conditions, chronic pollution problems become acute pollution problems and therefore we need to ensure that acute conditions do not occur. The proposed sediment reductions in the TMDL will reduce the chronic sediment load and also reduce the likelihood that an acute sediment loading condition will exist. It is in this way that we have accounted for critical conditions in the TMDL.

Target Selection

The TMDL applies sediment allocations in tons per year and calculates sediment reduction goals. Since the lower reaches of the South Fork are impaired by sediment, reduction will be required from many sub-watersheds of the basin. The implementation plan may apply surrogate measurement of success. Residual pool volume is the surrogate measure that is best related to fish requirements and fish density increase.

Several watersheds (Big, Terror, Moon, Montgomery, and Bear Creeks) of the subbasin are at levels of sediment contribution that are 20% or less above background. These watersheds have high residual pool volume and fish populations that are at the density of control areas (0.1-0.3 trout/m^2). Further reductions of sediment yield will be required from the remaining watersheds that are above 25%. Reductions from the middle and lower gulches area must be tempered with the fact that infrastructure such as Interstate 90 and the towns of Wallace, Osburn, and Kellogg will not be removed. Reductions in these watersheds of 75% to 100% of the current yield is likely the best that can be achieved without removal of the existing infrastructure.

Based on those watersheds where cold water use is supported and residual pool volumes are adequate (Upper South Fork, Big, Moon, Montgomery, and Bear Creeks) and tempered by the existing human infrastructure in some watersheds, the interim TMDL goal is set at 25% above background. The goal should be attained following two high flow events after implementation plan actions are in place. This is on an average 30 years. This time is necessary to have the channel forming events to export sediment and to create pool structures.

Monitoring Points

Five points of compliance are set. These are Canyon Creek near its mouth, Ninemile Creek near its mouth, Pine Creek near its mouth, the South Fork at Big Creek and the South Fork at Pinehurst.

Sediment load reduction from the current level (52% above background) toward the 25% above background sediment yield reduction goal is expected to attain a sediment load that is not yet quantified, but will fully support beneficial use (cold water biota). This sediment load will be recognized through monitoring by the following appropriate measures of full cold water biota support:

- three or more age classes of trout, including young of the year,
- trout density levels of 0.1-0.3 fish/square meter,
- presence of sculpin and tailed frogs, and,
- a macro-invertebrate biotic index score of 3.5 or greater.

When the final sediment loading capacity is determined by these appropriate measures of full cold water biota support, the TMDL will be revised to reflect the established supporting sediment yield.

5.2 Load Capacity

The load capacity for a TMDL designed to address a sediment-caused limitation to water quality is complicated by the fact that the state's water quality standard is a narrative rather than a quantitative standard. In the waters of the South Fork Coeur d'Alene River Subbasin, the sediment interfering with the beneficial use (cold water biota) is most likely large bed load particles. Adequate quantitative measurements of the effect of excess sediment have not been developed. Given this difficulty, a sediment loading capacity for the TMDL is difficult to develop. This TMDL and its loading capacity are based on the following premises:

- sediment yield less than 25% above background will fully support the beneficial uses of cold water biota,
- the stream system has some finite yet not quantified ability to process (attenuate through export and/or deposition) a sediment yield rate greater than 25% above background rates,
- beneficial uses (cold water biota) will be fully supported when the finite yet not quantified ability of the stream system to process (attenuate) sediment is met, and
- care must be taken to control factors, such as fish harvest, that may interfere with the quantification of beneficial use support.

The natural background sedimentation rate is the sediment yield prior to development of the subbasin. It was calculated by multiplying the watershed acreage by the sediment yield coefficient for coniferous forests (0.023 tons/acre/year). The estimate assumes the entire watershed is vegetated by coniferous forest prior to development. The calculated estimated value for the entire South Fork is 4,406 tons per year. Thus, the 25% above background sediment yield goal is 5,507 tons per year for the entire watershed. This goal is supported by the sediment yield rates of 15-19% above background modeled for the Upper South Fork, Big, Moon, and Montgomery Creeks watersheds (See Table 16; page 34). These watersheds contain streams that have high residual pool volumes (See Table 11; page 29) and fish densities (See Table 9; Page 26). The goal of 5,507 tons per year is an estimated goal that will be replaced by the final sediment goal, when the criteria for full support of cold water biota designated on the page 47 are met. The loading capacities based on the projected goal at each point of compliance are provided in Table 18. Loading capacities were developed by calculating background sedimentation based on acreage above the point of compliance. An additional 25% of the value was added to develop the loading capacity.

Table 18: Loading capacity at the points of compliance.

Location	Acreage of watershed	Loading capacity at 25% above background (tons/year)
Canyon Creek	13,787	397
Ninemile Creek	7,355	212
Pine Creek	50,855	1,462
South Fork Coeur d'Alene River at Big Creek Bridge	84,232	2,422
South Fork Coeur d'Alene River at mouth.	191,558	5,507

5.3 Estimates of Existing Pollutant Loads

Point sources of sediment are from the 9 permitted facilities and the Central Treatment Plant. As stated in Section 5.1 the point sources at maximum permitted discharge account for 470 tons per year of fine sediment. This amount is potentially 7% of the load. The actual average discharge for the past three years is 74 tons per year or 1.1% of the load. The sediment discharged is fine sediment that does not interfere with the cold water use. DEQ believes that current sediment discharge limits are adequately protective of the designated uses. The actual discharge is 16% of that potential under the permits. Thus a small reserve can be created from the permitted discharges by uniformly removing 10% of their potential sediment loading. The waste load allocation is set at the existing potential discharge 470 tons per year. However reducing the allocated waste load to each source by 10% creates a reserve of 47 tons per year and a daily discharge 1.55 MGD. The TSS limit is not lowered in the permits, the discharge volume is.

Nonpoint sources of sediment yield were estimated in Section 2.3 (Table 17; page 36). These estimates are made using the assumptions and model approach fully documented in Appendix A. The model spreadsheets are provided in Appendix B. Loading rates are based on land use; road, and mine facility impacts (see Section 2.3; Table 14; page 32) and Appendices A and B). Estimated sediment loads from the watersheds above the points of compliance are shown in Table 19.

The loading area of various sources is provided in Table 20. It is assumed for the purposes of these calculations that the loading from roads is directly proportional to the area in a specific land use.

Table 19: Sediment loads from nonpoint sources in South Fork Coeur d'Alene Subbasin.

Load Type	Location	Load	Background	Estimation Method
Sediment	Canyon Creek	443	317	Model
Sediment	Ninemile Creek	241	169	Model
Sediment	Pine Creek	2,339	1,171	Model
Sediment	South Fork Coeur d'Alene River at Big Creek Bridge	2,544	1,937	Model; Discharge records
Sediment	South Fork Coeur d'Alene River at mouth	6,678	4,399	Model; Discharge records

Table 20: Sediment loading proportion based on area in various land uses.

Watershed	Canyon Creek		Ninemile Creek		Pine Creek		South Fork Coeur d'Alene River at Big Creek Bridge		South Fork Coeur d'Alene River at mouth	
	acres	%	acres	%	acres	%	acres	%	acres	%
Timber Lands	13,539	98.1	7,250	98.5	49,921	98.2	81,096	96.3	183,493	95.9
Mined Lands	76	0.6	39	0.5	71	0.1	266	0.3	359	0.2
Urban Lands	21	0.2	2.7	0.1	545	1.1	1,503	1.8	4,616	2.4
Paved Roads	151	1.1	63	0.9	310	0.6	1,367	1.6	2,823	1.5
Total	13,787	100	7,355	100	50,856	100	84,232	100	191,291	100

5.4 Pollutant Allocation

The pollutant allocation is comprised of the loading capacity minus the margin of safety and the background. A pollutant allocation would be comprised of the waste load allocation of point sources and the load allocation of nonpoint sources. Since the point sources are negligible, the sediment TMDL has a waste load allocation set at 90% of the current permit levels. From the 10% load removed from each point source, a small reserve is created.

Margin of Safety

The permit limits of the point sources are set conservatively providing a margin of safety. The margin of safety is implicit in the model used. The model is estimated to be 231% conservative when applied on the Belt terrain (Appendix A). This level of conservative assumptions provides an over-estimation of sediment yield. The over-estimation is the implicit margin of safety. Given the conservatively high estimations developed by the model no additional explicit margin of safety is deemed necessary.

Background

The background for each watershed is shown in Tables 17 and 19. The background is treated as part of the loading capacity and is allocated as part of the loading capacity below. Any unknown unallocated point sources would be included in the background portion of the allocation.

Reserve

A reserve waste load is allocated for future point discharge. The reserve is modest amounting to a discharge of 20 mg/L total suspended solid and 1.55 MGD (Table 21). This is a reserve of 47 tons/year. The reserve is developed from the existing permitted sources by trimming each waste load allocation by 10%. Data developed from discharge monitoring reports of calendar years 1999-2001 demonstrate that these sources discharged only 15.7% of the load allocated to them in their existing permits (Table 13; page 31). The 10% load reduction to the permitted sources can be met by trimming water discharge limits rather than total suspended solids limits. The Page and Mullan wastewater treatment facilities should trim discharge as these facilities deal with the inflow and infiltration of their collection systems.

Remaining Available Load

The remaining available load is allocated between the point sources (waste load allocation) and the nonpoint sources (load allocation).

Waste Load Allocation

The waste load allocation of the point sources is set at the current permit limits. A small reserve is included in the waste load allocation. These are provided in Table 21.

Load Allocation:

The load allocation is shown in Table 22a-e. The allocation is based on the modeled estimate of nonpoint source sediment contribution of 5,036 tons per year (Estimated sediment load (5,507) –waste load allocation (471) and a reduction to 25% above background exclusive of the point sources contribution. The exclusion of the point sources is based on the fact that these sources discharge fine sediment, while coarse sediment appears to be interfering with the cold water use by filling pools. The margin of safety is applied to the allocations at the points of compliance. The allocation includes the background sediment yield that is shown in Table 18. A 15-year time frame is provided to meet allocations in the tributary watersheds, while a 30-year time frame is provided in the main channel of the South Fork. These time frames permit one and two large channel forming events to occur in the tributaries and main stem, respectively.

Table 21: Waste load allocation to the Permitted Point Discharges of the South Fork Coeur d'Alene River Subbasin.

Permitted Discharge	**Total Supended Solids Limit (mg/L)**	**Average Discharge (MGD)**	**Revised Discharge Limit (MGD)**	**Annual Average Load**	**Revised Annual Load (tons/yr)**
Page	30	2.8	2.52	127.8	115.0
Mullan	30	0.28	0.26	13.7	12.3
Smelterville	70	0.18	0.23	27.3	24.6
Coeur/Galena 001	20	1.36	1.21	41.0	36.9
Coeur/Galena 002	20	0.53	0.48	16.2	14.6
Coeur/Caladay	20	0.3	0.27	9.1	8.2
Lucky Friday 001	20	1.65	1.48	50.1	45.1
Lucky Friday 003	20	1.26	1.13	38.2	34.4
Sunshine	20	2.8	2.52	85	76.5
Central Treatment Plant	20	2.05	1.85	62.3	56.1
Reserve	20	-	1.55	-	47.0
Total	-	13.21	13.5	470.7	470.7

Table 22: Sediment load allocation and load reduction required at the points of compliance.

a) Canyon Creek Allocation[1]

Source	**Percentage of load source**	**Load allocation (tons/year)**	**Load reduction required (tons/year)**	**Time frame for meeting allocations**
Timber Lands	98.1	389.5	45.1	15 years
Mined Lands	0.6	2.4	0.3	15 years
Urban Lands	0.2	0.8	0.1	15 years
Paved Roads	1.1	4.4	0.5	15 years
Total	100	397[2]	46	-

[1] Allocation for Canyon Creek segment 3525; [2] Loading Capacity with no point sources.

b) Ninemile – East Fork Creek Ninemile Allocation[1]

Source	Percentage of load source	Load allocation (tons/year)	Load reduction required (tons/year)	Time frame for meeting allocations
Timber Lands	98.5	208.8	28.4	15 years
Mined Lands	0.5	1.1	0.1	15 years
Urban Lands	0.1	0.2	0.1	15 years
Paved Roads	0.9	1.9	0.4	15 years
Total	100	212[2]	29	-

[1] Allocation for Ninemile Creek segments 3524 and 5618; [2] Loading Capacity with no point sources.

c) Pine-East Fork Pine Creek Allocation[1]

Source	Percentage of load source	Load allocation (tons/year)	Load reduction required (tons/year)	Time frame for meeting allocations
Timber Lands	98.2	1,435.6	861.2	15 years
Mined Lands	0.1	1.5	0.9	15 years
Urban Lands	1.1	16.1	9.6	15 years
Paved Roads	0.6	8.8	5.3	15 years
Total	100	1,462[2]	877	-

[1] Allocation for Pine Creek segments 3519, 3520, and 3521; [2] Loading Capacity with no point sources.

d) South Fork Coeur d'Alene River at Big Creek Bridge[1]

Source	Percentage of load source	Load allocation (tons/year)	Load reduction required (tons/year)	Time frame for meeting allocations
Timber Lands	96.3	1,600	191.2	30 years
Mined Lands	0.3	5.0	0.6	30 years
Urban Lands	1.8	29.9	3.6	30 years
Paved Roads	1.6	26.6	3.2	30 years
Total	100	1,661.5[2]	198.5[3]	-

[1] Allocation for South Fork Coeur d'Alene segments 3516, 3517, and 3518.
[2] Loading capacity of South Fork at Big Creek (2,422) – loading capacities of Canyon (397) and Ninemile (212) Creeks- waste load allocation (151.5).
[3] Load reduction of South Fork at Big Creek (122) – loading capacities of Canyon (46) and Ninemile (29) Creeks + wasteload allocation (151.5)

e) South Fork Coeur d'Alene River at mouth[1]

Source	Percentage of load source	Load allocation (tons/year)	Load reduction required (tons/year)	Time frame for meeting allocations
Timber Lands	95.9	1,431.6	282.6	30 years
Mined Lands	0.2	3.0	0.6	30 years
Urban Lands	2.4	35.8	7.1	30 years
Paved Roads	1.5	22.4	4.4	30 years
Total	100	1,492.8[2]	294.7[3]	-

[1] Allocation for South Fork Coeur d'Alene segments 3513, 3514. And 3515 and Government Gulch 5084.
[2] Loading capacity of South Fork at mouth (5,507) – loading capacities of Canyon (397), Ninemile (212), Pine (1,462) Creeks and the South Fork above Big Creek (1,661.5)- waste load allocation (319.2)
[3] Load reduction of South Fork at mouth (1,171) – loading capacities of Canyon (46), Ninemile (29), Pine (887) Creeks and the South Fork above Big Creek (233.5) + waste load allocation (319.2)

Reasonable Assurance of Load Allocation Implementation

The federal government manages 51.7% of the land in the South Fork Coeur d'Alene River Subbasin. The state manages an additional 3.9%. A CERCLA remedial action is planned to address mining impacts in the watershed. The CERCLA actions must address the TMDL as an applicable regulatory requirement assuring that sediment as well as metals is addressed. Federal land management actions make sedimentation reduction a priority. IDL has been directed by a gubernatorial executive order to implement state developed TMDLs on lands that they manage directly or oversee implementation of the Forest Practices Act. These actions will provide reasonable assurance that the load allocations will be implemented. The CERCLA action, federal management direction and executive order should assure implementation plan development. The plan will be implemented based primarily on the budgetary constraints of the federal and state agencies.

Monitoring Provisions

In-stream monitoring of the beneficial use (cold water biota and salmonid spawning) support status during and after implementation of sediment abatement projects will establish the final sediment load reduction required by the TMDL. In-stream monitoring, which will determine if the threshold values identified in Section 5.1 (page 47) have been met, will be completed every year on a randomly selected 1% of the watershed's Rosgen B channel types. Monitoring will assess stream reaches of at least 40 times bank full width in length. These reaches will be randomly selected from the total stream channel in B types until at least 5% of these channels have been assessed after five years. Identical measurements will be made in appropriate reference streams where beneficial uses are supported. Data will be compiled after five years. The yearly increments of random testing that sum to 5% of the stream after five years should provide a database not biased by transit fish and macroinvertebrate population shifts. Based on this database the beneficial use support status will be determined.

Feedback Provisions

When beneficial use (cold water use) support meets the full attainment level, further sediment load reducing activities will not be required in the watershed. The interim sediment loading capacity will be replaced in a revised TMDL with the ambient sediment load. Best management practices for forest and mining practices will be prescribed by the revised TMDL with provisions to maintain erosion abatement structures. Regular monitoring of the beneficial use will be continued for an appropriate period to document maintenance of the full support of the beneficial use (cold water biota).

If the sediment reduction goal is met, but the recovery of the beneficial use does not occur an additional sediment reduction would be required. Since the South Fork Coeur d'Alene River watershed contains a large amount of infrastructure in narrow valleys (Interstate 90, Kellogg, Wallace, industrial facilities, and transportation corridors), the social and economic impacts of further reductions would require assessment. This analysis would be completed in a use attainability assessment to determine if the beneficial uses of the stream are attainable given the level of development.

5.5 Conclusions

The assessment of the South Fork Coeur d'Alene Subbasin shows by a preponderance of fisheries, residual pool volume, and sediment modeling results that the South Fork Coeur d'Alene River below the Canyon Creek confluence and Canyon, Ninemile, and Pine Creeks have sediment impairment of the cold water use. Moon Creeks, which is also listed, does not have the impairment when assessed with the identical indicators. Sediment model results are 1.5 to 3 times lower than in stream measurements. The estimations in stream were likely shifted upwards by the remedial work that disturbed the stream beds while the estimates were in progress. The model results are lower as a result of the incorporation of improvements made as part of metals remedial actions.

A sediment TMDL is prepared for the South Fork Coeur d'Alene River below the Canyon Creek confluence, Canyon, Ninemile, and Pine Creeks. The TMDL sets a goal of 25% above natural background sediment yield based on sediment yield from watersheds of the subbasin fully supporting cold water beneficial use. A loading capacity is set based on this goal. An implicit margin of safety of 231% is applied in the sediment model. The waste load allocation to point discharges is set at the current level. The loading capacity is allocated on a land use basis between timber harvest, mining, urban-suburban, and paved road land uses.

The upper two segments of the Coeur d'Alene River (NF-SF Confluence to French Gulch, 17010303 4021 and French Gulch to Skeel Gulch 17010303 4018) have accumulated sediment from the North and South Forks of the Coeur d'Alene River. Immediately below Skeel Gulch, the gradient of the river is 0.045% and hence the river is incapable of transporting particles larger than fine sand. The sediment loads of the North and South Fork have their origin in a combined 1,193 square mile watershed, while the watershed of the river immediate to the upper two segments is a 25 square mile watershed. The watersheds of the North and South Forks of the Coeur d'Alene River are 98% of the source area, while those immediate to the river are 2%. Clearly the sediment load to the upper segments of the Coeur d'Alene River is from the two tributary watersheds not from the small immediate watershed of these two segments.

The North Fork TMDL sediment limitations will reduce a sediment load estimated at 134% above background (30,379 tons per year) to 50 % above background (19,641 tons per year). This level of reduction should over time decrease the sediment load to the Coeur d'Alene River by an equal amount. The South Fork Coeur d'Alene sediment TMDL limitations will reduce a sediment load estimated at 52% above background (6,699 tons per year to 25% above background (5,507 tons per year). Again this benefit will be transferred over time to the upper two segments of the Coeur d'Alene River. An over estimation of the sediment yield of the remaining 25 square mile watershed of the upper two Coeur d'Alene River segments is 800 tons per year. This is 117% above the 368 tons per year background level from an area that contains some roadless lands. Given this assumption, the segments would have sediment levels in the range of 47% above background ([19,641 t/yr +5,500 t/yr+500 t/yr]/17,929) after the limitations of the North and South Fork TMDLs are realized. The levels of reductions from the majority of the watershed (98%) will reduce the sediment level of the Coeur d'Alene River over time to sediment levels (47% above background or less) that are expected to support its beneficial uses.

6.0 Response to Public Comment

The South Fork Coeur d'Alene Sediment Subbasin Assessment and TMDL package went out for public review and comment on December 26, 2001 for a thirty-day period. The comment period was public noticed in three local papers: Shoshone News Press, Coeur d'Alene Press and Spokesman Review. The TMDL package was placed in three libraries (Wallace, Kellogg and Coeur d'Alene) identified in the public notices and the documents were made available electronically on the DEQ and Coeur d'Alene Basin Citizens' Advisory Committee (CAC) web sites. Upon request of three groups the comment period was extended an additional thirty-days to February 27, 2002. During the comment period public meetings to discuss the TMDL package were held with Shoshone Natural Resource Coalition Science Committee (January 7, 2001), CAC (January 9, 2001) and the Panhandle Basin Advisory Group (January 15, 2001). At the end of the comment period eight letters of comment were received which contained 87 distinct substantive comments. The comment resulted in 29 separate revisions of the subbasin assessment and TMDL.

A comment requested development of a reserve in the waste load allocation to account for future development. A reserve of 27 tons per year and 1.55 MGD was developed by a 10% reduction in the allocated waste load to the current permitted discharges. A white paper on the reserve creations was sent to the permit holders on March 29, 2002. A meeting on the issue was held with the permit holders on April 4, 2002. At the meeting and in two written communications the permit holders understood the value of a reserve to provide flexibility to the Silver Valley economy. Permit holders did voice some concern that the volume of their discharge would be curtailed up to 10% from existing permit limits.

A response to comment is organized into technical comment, those pertaining to social and legal issues, and text comments.

6.1 Technical Comments

Comment 1: The model is over conservative. It is not appropriate to use cumulative conservatism. It is probable that the real sediment levels is below 50% above background. Since valid water quality criteria already have a margin of safety any additional MOS simply compounds the inherent MOS in the criteria.

Response 1: The model is designed to estimate sediment based on estimations of the processes yielding sediment to a watershed. These are estimations and those estimations are designed to err in a conservative manner. The only assumption that provides a large single error is the extrapolation of a relationship built between cumulative watershed effects road score and sediment yield that was developed on more erosive granite terrain. This information is the best available and must be used. The result is a large conservatism in the estimates, however where actual in stream measurements have been made, these estimates and the model results compare relatively well (see Appendix A).

Comment 2: Even though DEQ staff indicated the need for modest sediment reductions for encroaching road and road crossings, given the large number of road crossings and miles of encroaching roads, the opportunity exists for numerous road closures.

Response 2: The document assesses the beneficial uses and the pollutant loads of the basin. The TMDL allocations set the sediment limits. An implementation plan that will be developed after subbasin assessment and TMDL EPA approves documents will decide how the sediment limits are to be met. The model certainly points to road crossings and encroaching facilities including roads as prime sediment sources. The implementation plan will plan how these sources will be further assessed and addressed. Road closure is not the only alternative as assumed.

Comment 3: Much of the sediment argument is based on lack of appropriate habitat and is not solely a roads issue. It is noted expert testimony from Steve Werner that included Post Falls Dam; railroad construction; highway construction, urbanization, logging, resource management (introduced species), natural conditions and EPA/DEQ contributions as other impacts.

Response 3: The subbasin assessment examines the state of the beneficial uses, the sediment impacts to the water bodies and the sediment loads. DEQ agrees that several other factors including metals concentrations affect the beneficial uses. However, the case is made that one of the factors is the pollutant of concern, sediment. This TMDL can only address this pollutant of concern, sediment, and not the many other factors. DEQ has been clear that restoration of the uses will require more than the sediment reductions estimated by the TMDL. DEQ urges that both remedial plans and TMDL implementation plans be broad enough to address many of these other impacts.

Comment 4: It is noted "young" (page 8) salmonids are found in the South Fork Coeur d'Alene River below Wallace.

Response 4: The term young used on page 8 was too generic. The more precise language "young of the year" has been inserted. DEQ agrees that juvenile trout are found below Wallace.

Comment 5: Exception was taken to Bull Trout extirpation and no bull trout streams found. It was pointed out that Superfund used this as a pretext for CERCLA action. Hecla is not aware of any evidence that bull trout are either native to or present in any of the areas addressed by the draft TMDL. Please provide evidence. (Page 8 Fisheries and aquatic fauna).

Response 5: The general view of fish biologists is that the South Fork Coeur d'Alene River was within the predevelopment range of the Bull Trout. Maclay (1940) reported bull trout present in tributaries to the South Fork Coeur d'Alene River. An earlier report, Ellis (1940) reported no fish in the main stream South Fork from Canyon Creek to the North Fork confluence. Since no individuals have been identified in the many electrofishing efforts in the South Fork and its tributaries, it is the general opinion of fish biologists that the species has been extirpated from the watershed. We believe the assessment is accurate in terms of current bull trout distribution.

Comment 6: It is not appropriate to use 1990-1993 data for fishery. This data (p 26; Table 9) does not account for natural recovery. It seems likely new data would change conclusions and recommended course of action.

Response 6: More recent data from the USGS NAQW Program have been incorporated in the subbasin assessment, while older 1990 data is removed. The 1993 data was retained for comparison to 1998 DEQ data and 2000 USGS data. Comparison of 1993 to 1998 and 2000 data does not support the comment contention that the fishery is recovering in the South Fork below Wallace.

Comment 7: The data in Table 12 (page 30) are inadequate to establish sediment levels in stream. The state had inadequate funding for in-stream monitoring.

Response 7: The state is aware that inadequate funding is available to monitor sediment in-stream. This point is made on the bottom of page 30 and is the justification of the modeling approach. The data in Table 12 is used to compare with the model results and the differences in both estimates noted. A subbasin assessment and TMDL must use the best available data. Ignorance is no an excuse under regulation to delay development of the documents.

Comment 8: The model is nothing more than spreadsheet based on conservatism. There is no evidence of verification of model accuracy.

Response 8: Model verification is provided in the text by comparison to the data in Table 12 and by reference to measured values elsewhere in the basin; notably the North Fork Coeur d'Alene River (page 37; DEQ 2001c). Both measured and modeled values are estimates. The text compares the values in this light (page 37).

The model is run on an Excel spreadsheet platform. Many models use Excel and Access as convenient and publicly available platforms where all the calculations can be followed if the reviewer has the software. The Excel model runs are available upon request of DEQ.

Comment 9: The sediment model addresses only sediment yield not fate and transport. Many past actions have loaded sediment in the river. Sediment loaded from past actions and channelization are destabilizing the river. The TMDL must deal with the sediment load in-stream.

Response 9: The model estimates the sediment sources. It is generally acknowledged that plausible sediment fate and transport models are not available for this watershed. The fate and transport is not as important as the sediment yield. Only by removal of the load supply will the streams be able to use its stream power to effectively deal with the existing in stream load. TMDLs deal with load contribution to a water body, not the transport of the load from the water body.

Comment 10: Page 37 states the two pollutants (metals and sediment) impacts cannot be distinguished. It is no time to implement a new TMDL. Determine actual impacts first.

Response 10: The subbasin assessment makes the case that sediment as well as metals impair the listed water bodies of the South Fork Coeur d'Alene Subbasin. Metals do not contribute to loss of residual pool volume but sediment does. The statement in the subbasin assessment (page 37) correctly notes that basin wide these two pollutant impacts can not be segregated.

Further study as noted in the response to comment 9 is not an option the state has.

Comment 11: The data supporting model validation is not provided on page 34.

Response 11: These data are provided by comparison of Table 12 (page 30) with the model results and further by materials in Appendix A, where model results and measurements in the North Fork Coeur d'Alene watershed are provided. Although both in-stream estimates and modeled estimates are estimates these compare well. Where poor comparisons are found (Canyon and Ninemile Creeks; Table 12) the in-stream estimates are higher. The reasons these estimates are high are explained on page 37.

Comment 12: The comment disagrees with model assumptions of 100% delivery and road encroachment within 50 feet. It is stated that this makes the model even more conservative.

Response 12: Any model uses basic assumptions. The assumptions in the model including that noted in the comment were developed by a technical advisory group of hydrologists and sedimentologists representing state and federal agencies, companies and environmental groups. This and all other assumptions are the best professional judgement of the technical advisor group.

Comment 13: The background based on total acreage and hypothetical sedimentation estimations without detailed studies. It is inappropriate to issue this TMDL. Please release the detailed DEQ data for public scrutiny.

Response 13: The background sedimentation rate is based on a simple assumption of a fully forested watershed and the mean export coefficient for Belt Supergroup terrain. The U.S. Forest Service using monitored sediment data from research watersheds located in the Belt terrain develops these export coefficients. These watersheds have either low or no entry. These are the identical sediment yield coefficients used by the Forest Service, Idaho Department of Lands and private timber firms to model the impact of forest harvest projects. They constitute the best available information of sediment export per acre of forested lands. The watershed acreage is developed from referenced GIS coverages. DEQ believes these data provide the best estimate of background conditions.

Comment 14: Concern is stated that the model is biased against roads. The county is directly affected because many county roads are adjacent to streams. The county is uncertain how the TMDL will affect its future road maintenance responsibilities. If responsibilities are increased and revenues (from forest harvest) decline how will the county address clean water responsibilities.

Response 14: We respectfully disagree that the model is biased against roads. The model has three modules that independently estimate sediment yield from land use, roads and direct bank erosion. The model was modified slightly in the South Fork to account for the infrastructure such as channelized stream, mining facilities, etc. It is true that road crossings and encroaching facilities (roads and others) were identified by the model as the major sources. This is because these features are in sufficient input numbers to drive the model.

Its should be noted that TMDL goal was adjusted upwards to address infrastructure in Silver Valley (towns, highways county roads). It is expected these features cannot be addressed without major social and economic disruption. EPA did not object to this adjustment.

Comment 15: The belief is stated that the TMDL should focus on flood prevention rather than roads. Floods often beyond the control of man cause the sedimentation.

Response 15: Large discharge events (floods) that the comment correctly identifies as part of the natural environment are the vectors of a great deal of sediment loading. The regulations and TMDL are however clear; sediment is the pollutant of concern not water or floodwaters. Some of this sediment loading is from natural sources during flood events. Additional loading is from man created sources. It is this sediment that the TMDL addresses.

Comment 16: Modeled results are used rather than real information and accepted science. Unrealistic demands are chosen legal goals rather than reasonable reachable objectives; legal and bureaucratic barriers prevent consideration and cooperation. This is a one dimensioned analysis with no consideration and coordination with local government.

Response 16: The reasons that modeled results are used are explained in the subbasin assessment (Sediment Modeling; page 30). The state does not have the funds or the time to use a monitoring approach. We respectfully disagree that sediment modeling is not a scientific approach. Quite to the contrary it uses scientific results developed locally (export coefficients) and elsewhere to estimate sediment yields. This is the same science and approach the Forest Service and IDL use to estimate the sediment impacts of timber sales. One outcome of good basic science is the ability to model, apply, and predict rather than to measure everything. In this case as with timber sales, it is the only cost and time effective approach.

The goal of the TMDL were purposely adjusted to account for Silver Valley infrastructure that will likely not be moved because the socioeconomic impacts would be too great. The goal is higher than the modeled export for some developed watersheds in the subbasin that have housing, roads and complete forest access and entry. For this reason we believe the goals are realistic.

Comment 17: The comment points out that the streams are in much better shape than they have ever been and that no additional steps should be taken to control stream sediment.

Nature can take care of any additional remediation given enough time. All work of DEQ and EPA in the Silver Valley should stop.

Response 17: We agree that the waters of the South Fork Coeur d'Alene River and many of its tributaries are in better condition than they have been since settlement of the area. We agree that this recovery is in part attributable to natural attenuation. However, we believe it is also in large part due to institution of wastewater treatment of human waste and mine waste in the 1970's and removal of many metals and sediment sources during the 1990's. The fact is that State and Federal law requires the waters to meet specific standards. The South Fork and many of its tributaries do not meet those standards. Since they do not and are not expected to in a reasonable time frame, State and Federal law require that pollutant load limits be set that when met are expected to meet the specific water quality standards. As a governmental agency, DEQ is required to comply with the law.

Comment 18: There needs to be reserve (waste load) allocation set aside for new point sources like mines. As written the regulation could prevent development of a new mine.

Comment 18: DEQ agrees. A reserve waste load allocation has been placed in the TMDL. This allocation is large enough for 1 source discharging at the permit limits of the Lucky Friday. This waste load was drawn from the point source by reducing the waste load allocated to each by 10%. This is justified because the permitted sources currently discharge 15.7% of the potential load provided them by the current permit limits.

Comment 19: The executive summary does not define a clear avenue to allow delisting in the future when fish and bug goals are met; when the river or large sections are no longer impaired.

Response 19: Language was placed in the executive summary (page xii) to clarify when the TMDL is met and the stream should be delisted.

Comment 20: The comment suggests a geologic model of erosion rates that indicates a much higher natural erosion rate than that used. A rationale for this approach is supplied.

Response 20: We find the geologic model interesting, but respectfully disagree that a geologic model of erosion rates is appropriate. Over the long span of geologic time, erosion rates have varied greatly. For example, when glaciers during the Pleistocene covered the Coeur d'Alene Mountains, erosion rates would have been quite high indeed. The base sediment yield rates used on forestland are developed by the Forest Service from actual sediment measurements made on watersheds with low levels of disturbance. We did modify the export coefficients to address erosion of unconfined tailings piles (higher values) and waste rock piles (very low values). These estimates were based on the best professional judgement of hydrologists familiar with the district.

Where we have had the opportunity to validate the model with actual measured estimates. These measured estimates and the model estimates are within the same range but as expected not the same.

Comment 21: A questionable procedure for determining the amount of dissolved metals in a water sample results in some of the mass reported in the dissolved category and the sediment (sic) category. This is double counting.

Response 21: Since the "dissolved metals" is a functional definition, (those metal bearings compounds and colloids capable of passing a 0.45 micron filter) some solids are indeed characterized as dissolved. Therefore, there is some double accounting in the estimates. However, with all due respect, the amount double accounted is infinitesimal as compared to the sediment loads in the basin. Sediment loads are in the range of 6-7 thousand tons. The error identified likely accounts for no more than a few pounds.

Comment 22: Concern is stated that the high discharge (rain on snow event) is not adequately addressed. Several studies are cited that were developed in other locations. It is argued that if the rain on snow event is the dominant factor in sediment transport the state should look for ways to reduce this factor. It is argues that rain on snow events have increased since the 1940's when timber extraction has occurred. It is argues trees and large brush increase transpiration and lessen runoff.

Response 22: Large discharge events, among these rain on snow events, are the major sediment transport events. The discharge these develop are not however the pollutant of concern. Sediment is the pollutant of concern and it is sediment yield that loads sediment to the system. It is important that sediment loading is decreased.

Analysis in adjacent watersheds indicated that the flood frequency and magnitude has not increased during the era of clear cutting (DEQ 2001c). This analysis used data from one station in the South Fork Coeur d'Alene River and two stations downstream. It appears based on this to be applicable to the South Fork. The flood frequency and magnitude analysis does not indicate the rain on snow event is a sediment source but it is certainly a loading mechanism from disturbed areas.

Although removal of transpirational demand increases discharge as stated, the increase is expressed in the base flow not during high discharge runoff.

Comment 23: Pre-and Post BMP projects are not distinguished by the model.

Response 23: We agree that pre and post BMP projects are not differentiated by the model. Information of this type for particular features on the ground is not available especially on private lands. The fact that features constructed under BMPs are not accounted for adds to the conservatism of the model predictions, it does not detract.

Comment 24: Sediment sources include 'mine waste piles" (Key Findings, page xi). It is argued that waste rock piles are not a sediment source. It is suggested that a table should be inserted to show that "mine waste piles" are a small source. A table of percent contribution from potential sources should be presented.

Response 24: Mine waste piles was broadly used in this summary and in the assessment. These included waste rock piles that were given low export coefficients and also unconfined tailings piles as those at the Success, the Highland Surprise and Douglas sites. Unconfined tailings piles were given high export coefficients, while waste rock piles were treated as forestland with insufficient forest cover (see page 33). The relative contribution of mine features as well as other landscape features is provided in Table 16 (page 34). The purpose of the statement in the Key Findings section is to list those features contributing to sediment yields. Mining features are among these sources. The language was clarified throughout the document to differentiate between mining features.

Comment 25: Notably absent from the list of sediment sources is material already in the streambed and banks of the floodplain (Key Findings, page xi). How can the monitoring provisions discussion page 53 mean anything if the monitoring is simply monitoring existing bed loads and deposited material?

Response 25: The model is dealing with sediment sources that yield to the stream system and not with the current load entrained in the stream or its floodplain. All TMDLs deal with pollutant in-stream by decreasing the pollution loading from point and nonpoint sources. The fact that pollutant is entrained in the system does not negate the requirement to control the sources. It is commonly accepted that if sources are controlled, excess sediment will be exported over time to achieve a new dynamic equilibrium.

Comment 26: Is low diversity of macroinvertebrates and low trout abundance documented in all 14 streams of the watershed (Key Findings, page xi)?

Response 26: Low trout densities are found in all the streams except Moon Creek; low macroinvertebrate scores are found in streams below mining impacts.

Comment 27: "A waste load allocation is provided at the level of the current permitted discharges." (Key Findings, page xi) Is this the permitted or the actual discharge level?

Response 27: This was at the current permitted levels. However, in response to two comments concerning the actual load for permitted sources (comment 38) and a comment requesting a waste load reserve for future growth (comment 18), this has been altered. In the analysis of the level of sediment discharge by point sources it was found to be 15.7% of that provided by the current permits. Creating a waste load allocation that reduced the potential load of each permitted source by 10% created a reserve. This freed up 47 tons per year and 1.55 MGD for the reserve. Since the permitted sources are discharging a little over 15% of the potential load permitted and this approach withdrew 10%, a buffer equivalent to 75% of the current potential load remains.

Comment 28: What is meant by "It is assumed that encroaching roads and mine facilities are proportional to the land area of these uses." (Key Findings, page xii).

Response 28: The sentence is intended to mean that the amount of encroaching forest road or mining facility is assumed to be proportional to the acreage in forest land or mining land use for the purposes of the load allocation. The wording was clarified to indicate that for purposes of the load allocation, the amount of encroachment of a particular use (forest or county roads, mining facilities) is assumed proportional to the land area in these uses.

Comment 29: Habitat modification must be included as a limiting factor for trout population (page 17 first paragraph).

Response 29: Habitat alteration was added as a contributing factor for Canyon Creek. This section is listing the "pollutants of concern" for which the streams were listed. Canyon Creek is the only stream with habitat alteration listed.

Comment 30: The draft TMDL mentions data sources from the RI/FS used in the draft TMDL. Comments submitted by and on behalf of Hecla on the draft RI/FS are part of the public record and are incorporated here by reference (page 30, last paragraph).

Response 30: DEQ noted that Hecla's comments on the Coeur d'Alene Basin RI/FS are added as part of the public record.

Comment 31: The draft TMDL makes the assumption that metals levels in the streams are due solely to mining impacts. It is well known that natural levels of metals in mineralized areas can impair a fishery. Further DEQ has no evidence that such conditions did not exist in the areas prior to mining activities. DEQ does have evidence of metals on native streambed materials indicating high levels of metals in Canyon and Ninemile Creeks. Natural levels of metals must be recognized as potential sources of metals.

Response 31: Both DEQ and EPA acknowledge that metals concentrations in the mineralized area of the South Fork Coeur d'Alene watershed are greater than those encountered in non-mineralized areas. This issue is addressed in depth in the supporting documentation of the Coeur d'Alene Basin Metals TMDL. The most in depth study cited in the document indicates that metal concentrations were higher in the waters, but only by a small amount (Maest and Ralston 1999). For example the background level of zinc in the mineralized zone was in the range of 16 ug/L. Although higher than measured in non-mineralized zones, background metals concentrations pre-development are not estimated to be above the federal freshwater criteria or state standards.

Comment 32: For the different biological parameters used, there needs to be a frank discussion of the limitations and inaccuracies of these types of measurements (page 23 1st and 2nd bullets under "Biological and Other data").

Response 32: We agree these methods have limitations and that the reader should be aware of these limitations. We do not however want to bog readers down in an in depth discussion of these limitations. A notation of the limitations was made in the text with references to in depth discussions of limitations in EPA Rapid Bio-assessment and Water Body Assessment Guidance documents.

Comment 33: It is noted the descriptive information concerning sediment in the channel and floodplain of the river. It is argued that this is historic loading and that it is entirely possible that absent this historic loading the sediment sources would not be affecting the river (page 27 Sedimentation data).

Response 33: The historic sediment loading has impaired in part the beneficial uses of the South Fork and some of its tributaries. However, information developed from a rationale model of sediment yield indicates that current loading maintains this situation.

Comment 34: Riffle Armor Stability Indices (RASI) is only an indication of what is in the bed load not what is being added to the floodplain materials (Page 27).

Response 34: We agree that riffle armor stability only measures sediment in stream. It is used in the subbasin assessment to demonstrate in part the in-stream impairment of uses.

Comment 35: This measurement cannot be used to verify a sediment problem. The comparison to" reference streams" is meaningless since channelization is not fully considered (Pages 27-29 Residual Pool Volume).

Response 35: Residual pool volume is a valid measure of the impact of sediment (large grain size sediment) in filling pools. The comparison to reference streams is valid. Channelization is not a natural feature and is not exempt from scrutiny by the subbasin assessment. It is a factor that may not be altered due to overriding socio-economic reason. The sediment TMDL recognizes this fact and raises the TMDL goal accordingly to account for both the presence of channelization and infrastructure that cannot be altered economically.

Comment 36: The page 29 narrative on "Measured sediment load data speaks of actual measurements but the referenced Table 12 is "Sediment Estimates" Hecla concurs with DEQ criticism of measurements and cites more in its RI/FS comments (pages 29 & 30).

Response 36: This language was be clarified. The measurements made by USGS like all "sediment measurements" are indeed better characterized as estimates due to the state of the art of in-stream sediment measurement. The language "measured estimates" was used to make this differentiation.

Comment 37: - The TMDL discusses USGS "synoptic" sampling events. Hecla has attached comments on EPA's draft RI/FS questioning whether or not these sampling events were truly "synoptic" - please review these comments (page 29 last paragraph).

Response 37: In some aspects, Hecla's Remedial Investigation Report comments mirror DEQ's stated concerns about the USGS measured estimates of sediment for Ninemile and Canyon Creek during water year 1999.

Comment 38: The comment states dismay that the permit limits rather than the actual Discharge Monitoring Reports (DMR) were used to calculate the sediment load from the point sources. It is pointed out this adds to the conservative estimates (Page 31, Table 13).

Response 38: The permit limits were used because mill operation is currently at a very low level and the permit limits will be used for the allocation in any case. The actual DMRs were used in the final draft and note made of the actual permit limits loads for reference. Analysis did highlight the very small amount of the potential discharge that the wastewater treatment plants and the mills are actually using. Based on the documented low level of TSS discharge and the request by another comment that a reserve be created, 10% of the potential waste load created by the permits was removed from each point discharges waste load allocation and placed in a reserve of some 47 tons per year.

Comment 39: Exception is taken by the comment to mining features such as waste rock piles or tailing ponds being treated as encroaching roads (page 31 first paragraph).

Response 39: Where waste rock piles and tailing ponds encroach on the floodplain of a stream, these features function like roads by changing the stream gradient. These are hard features that are protected from erosion and thereby alter the stream's ability to come to natural gradient. In response the stream erodes banks and channels. The model accounts for this erosion.

Comment 40: The table does not appear to match the narrative. Are "mill tailings deposits" tailings ponds or historically discharged tailings on the floodplain (Page 33, Table 15).

Response 40: Mill tailings waste piles are tailings piles that are unconfined in a tailings pond. Some part of these are located in floodplains while others are not (i.e. Success Pile). The language was inspected for uniformity and changed if needed to "unconfined tailings."

Comment 41: The comment takes exception to the use of the Washington Forest Practices Board Guideline of 50% of natural background, while DEQ ignores Idaho sediment regulations (page 35).

Response 41: Since the Idaho sediment standard is narrative, it is appropriate to interpret it with other measures. The Washington Board of Forestry is the only regional published reference relating sediment yield with water quality standards. The subbasin assessment and TMDL use this reference as a screen and local modeled sediment yield from watersheds with low development as filters. It is the level of sedimentation from local watersheds with light development that are used as the final benchmarks.

Comment 42: The comment notes the episodic loading of sediment and asks how much of this is floodplain loading. The comment states that the annualized estimates of load grossly overestimates sediment load and asks if DEQ thinks it can control episodic loading. The point is made that episodic sediment loading is an act of God exempt from the CWA.

Response 42: The subbasin assessment correctly notes that sediment yield and transport is episodic. The sediment yield modeled is not from floodplain deposits but sediment loaded to the stream system. Since TMDL loading capacity and allocations are stated in mass per unit time, it is necessary to annualize the data based on the average return time of large discharge events. The TMDL addresses sediment that will be loaded because of human influences. Just because the loading mechanism, the large discharge event cannot be controlled, it does not follow that sediment sources cannot be controlled. These sources in the form of unnecessary road crossings, encroaching roads and facilities or non-stocked forest acres can be controlled.

Comment 43: The comment notes the statement that the majority of the land of the subbasin is forest land and mined lands and refers to Figure 3; page 11. The figure does not show mined lands. From the information on page 49 mined lands are less than 0.1% of the land base. A table is suggested on page 49 to show the categories and percentage of the land base. Does the last sentence of this paragraph refer to mined and forest lands or town sites and roads? Hecla strongly disagrees if the former.

Response 43: The text used the term "mined lands" to refer to mine features. The comment correctly points out that mined lands are small. Nevertheless the impact of mine features (tailing ponds, unconfined tailings and mine infrastructure) are not small.

The reference to Figure 3 will be placed after forestlands. When the last sentence is viewed with the corrected language ("mine features"), we believe the final statement of the paragraph is correct.

Comment 44: Hecla understands that logging and forest fires "deforested a large part of the South Fork Subbasin and not smelter fumes. Smelter fumes helped prevent re-growth of forest (page 39, last bullet).

Response 44: Logging, forest fires and smelter fumes deforested the slopes in the vicinity of Kellogg. Live trees stood behind the zinc plant in the late fifties and sixties. In fairness the language will be changed to reflect all three caused deforestation while smelter fumes inhibiting re-growth of the forest.

Comment 45: Clarify that "tailings deposits" refers to historic tailings discharged to the floodplain and not tailings ponds (page 40, first bullet).

Response 45: The word" unconfined" was used to modify tailings. As stated earlier unconfined tailings are not restricted to the flood plain (See response to comment # 40).

Comment 46: Hecla is not aware of mine site roads that are a significant source of sediment. The locations and sediment data is requested (page 40 second bullet).

Response 46: Among the roads inventoried are some roads serving mine and mill sites. Roads serving mine facilities may at the same time be timber haul roads or county roads. Given the multiple use of roads the model did not attempt to segregate their use. The model did calculate the sediment yield from such road features based on the inventory. No monitored data was developed for the reasons outlined on page 30 of the subbasin assessment. The model data is available on a sub-watershed basis in Table 16 (page 34), however the GIS coverage CDAROADS would require inspection in detail to identify mine site roads. This GIS coverage is available from DEQ or the Forest Service.

Comment 47: The draft TMDL states that a sufficient transport model has not been developed or identified yet the TMDL relies on modeled rather than monitored data.

Response 47: This is correct a sufficient sediment fate and transport model has not been developed. DEQ believes that the sediment yield model is sufficient and that sediment yielded is the sediment loading to the stream system.

Comment 48: It is noted that sediment values at Harrison are not valid for comparison to the South Fork (Model verification).

Response 48: The comment has identified an error in Appendix A. Data is available from the Enaville monitoring station on the North Fork. This model verification is appropriate for the South Fork. This error was corrected to reflect the analysis of the Enaville data.

Comment 49: A section on seasonal variations should be included.

Response 49: The seasonal variation section was developed and placed in the TMDL.

Comment 50: Provide citation on transport and downstream deposition of fine sediment to the Coeur d'Alene River. It would be helpful to include references to data and/or excerpts of modeling from the RI/FS to support the discussion of the transport and downstream deposition of fine sediment (Section 2 p.24-25, section 2.3).

Response 50: The subbasin assessment cites the Coeur d'Alene River Basin Study of NRCS and the USFS (USDA 1994).

Comment 51: Provide a brief discussion that demonstrates that combined reductions in sediment loading in the South Fork and North Fork Coeur d'Alene Rivers are sufficient to meet requirements in the approved TMDL for the main stem Coeur d'Alene River.

Response 51: The discussion developed for the North Fork sediment TMDL is applicable to the South Fork sediment TMDL. This discussion was placed in the TMDL.

Comment 52: Provide citation supporting conclusion that stream bank erosion is not a problem in Rosgen B channels. It would be helpful to include a citation to the GIS fieldwork, which supports the conclusion that stream bank erosion is not a problem in Rosgen B channel types (Section 2, p.31, paragraph 2, Section 2.3).

Response 52: A study commissioned by the SVNRT demonstrated that bank erosion of the Rosgen B channels primarily of the lower of SF Cd'A River is not a large factor. The Golder and Associates study (1999) is cited.

Comment 53: It appear that Moon Creek is anticipated to be delisted for sediment and that the unknown pollutant in the East Fork Ninemile Creek determined to be sediment. During the next 303(d) round the rationale and the data should be included to ensure appropriate evidence is available to support the listing change (page xi paragraph 2).

Response 53: Idaho has in its 303(d) listing process a mechanism to take the data and rationale from the South Fork Coeur d'Alene Sediment SBA and place these in the 303(d) listing process. The text will be corrected to state that metals also impair the East Fork Ninemile Creek.

Comment 54: Sediment yield exceeding 50% above background" should be changed to 61% based on the recalculation of point source contributions to sediment yield (Page xi paragraph 2).

Response 54: The language was changed to read "the sediment yield was modeled at 52% above background exceeding the 50% above background benchmark above which water quality impairment may occur". The assessment of point discharges based on the discharge monitoring records shifted the model from 61% to 52% above background.

Comment 55: Since adaptive management strategy approach is being used for sediment we recommend including a reference to reasonable assurance of TMDL implementation, section 5.4. (page xi paragraph 3). This will help provide the reader a complete picture of the adaptive management strategy.

Response 55: A reasonable assurance section is present in the TMDL. A reference to the reasonable assurance and its nature was made in the "Key Findings" section.

Comment 56: Do flood frequency and history indicate that clear cut logging practices have not altered the discharge frequency or magnitude (Section 2 p.21 paragraph 3 section 2.3).

Response 56: Analysis in adjacent watersheds (North Fork Coeur d'Alene River) indicated that the flood frequency and magnitude has not increased during the era of clear cutting. This analysis used data from one station in the South Fork Coeur d'Alene River and two stations downstream. It appears based on this to be applicable to the South Fork. See also response to comment 22.

Comment 57: Since an adaptive management approach is being used, we recommend that potential future actions be outlined, in the event that interim goals are insufficient to meet water quality standards. This discussion may be appropriate in the reasonable assurances section (Section 5 p.42, paragraph 1 section 5.1).

Response 57: Language was placed in the reasonable assurances section that indicates should the goal of full support not be met, the state will require an additional reduction of sediment load and reallocation based on this lower loading capacity. If this is not feasible for social or economic reasons, a use attainability assessment would be completed.

Comment 58: It would be helpful if you explain the basis of choosing trout density range of 0.1-0.3 trout per square meter as water quality progress (Section 5 p 42. Paragraph 1 , section 5.1).

Response 58: Language was added that demonstrates that 0.1-0.3 trout per square meter are found in streams of the Coeur d'Alene Basin fully supporting fishable populations.

Comment 59: The last line indicates that more refinement of the TMDL will be completed. We recommend these future actions be described in more detail (Appendix A p 77 paragraph 2).

Response 59: The text misunderstood. The section is dealing with the sediment model and its verification. Additional verification will occur as more measured estimate data becomes available. The TMDL would not likely change.

Social and Legal Comments:

Comment 1: The public comment period should not have coincided with the EPA proposed plan comment period. The comment states this is the same draft TMDL developed in 1997. Those concerned about road closures and private property rights have not been informed of the potential major impacts. A request is made that the comment period be extended to March 29, 2002. The comment period timing restricted the county's ability to respond to the sediment TMDL. The regulated community was not provided sufficient time to review and comment on the TMDL. The thirty-day extension granted was insufficient.

Response 1: The Department regrets that the comment period for the South Fork Coeur d'Alene Sediment TMDL overlapped with that of the Proposed Plan for the Coeur d'Alene Basin Metals Issues. However, the EPA provided a 120-day comment period from October 29, 2001 to February 26, 2002, while DEQ provided a 60-day comment period from December 26, 2001 to February 27, 2002. Even though both document are highly technical this is a considerable period for comment. The state's comment period was over twice that required by the Administrative Procedures requirements. The state is required to meet a court ordered schedule for TMDL completion. The South Fork TMDL is slightly behind that schedule due to the longer time frame provided for comment. In light of the court ordered schedule and the documents out for public review, DEQ provided as much time as feasible for public comment.

Comment 2: The Kootenai-Shoshone SCD should be more involved in the SBA and allocations.

Response 2: The Kootenai-Shoshone Soil Conservation District and its partners the NRCS and SCC have worked with DEQ on TMDLs in the past. Their involvement has been on agricultural lands and with bank erosion issues. These two issues are of little importance in the South Fork Subbasin, because no agricultural land is present and areas of bank erosion have been largely addressed along the streams. If the expertise of the District or its partners the NRCS and SCC is needed DEQ will turn to this valuable resource.

Comment 3: The concerned is expressed on behalf of ATV and off road vehicle users that TMDL will result in road closures. As a businessman that is dependent on multiple use, the writer is concerned about road and trail closures. If forest roads are closed (by the TMDL) forest harvest jobs will be lost. The process has no consideration for the impact to local economies.

Comment 3: The documents assess the beneficial uses and the pollutant loads of the basin. The TMDL allocations set the sediment limits. An implementation plan that will be developed, after EPA approves these documents, will decide how the sediment limits are to be met. The model certainly points to road crossings and encroaching facilities including roads as prime sediment sources. The implementation plan will clarify how these sources will be further assessed and addressed. Road closure is not the only alternative available to address these problem areas. Most often roads closed on state and federal lands are not forest haul roads but rather old roads typically not in this use. As decisions are made on roads in the implementation plan and resulting actions, the public use and interest in these roads will be one factor addressed.

Comment 4: There is little consensus on the positive effects of this TMDL. The State and EPA are setting local government up to fail.

Response 4: The TMDLs (South Fork Coeur d'Alene Sediment TMDL included) simply set the water quality load goals based on the water quality standards and the state of the water bodies. The implementation plan outlines those actions that will be taken to meet the load goals. This implementation plan can be fashioned by all involved to meet the public's water quality goals as well as the public's other numerous needs to live and work in the Silver Valley.

Comment 5: The Executive Summary at page x misrepresents the Congressional intent of the CWA in this manner is misleading and gives the impression of boundless authorities.

Response 5: DEQ disagrees it has misrepresented the intent and scope of the CWA. The stated objective of the CWA, set forth in § 101(a), is to restore and maintain the chemical, physical and biological integrity of the nation's waters. Water quality standards (WQS) established by states and tribes are required to, among other things, serve the purposes of the CWA, as set forth in Clean Water Act, § 101(a). See 33 U.S.C. § 1313(c), Clean Water Act, § 303(c); Idaho Mining Association v. Browner, 90 F. Supp.2d.1078 at 1080, 1087 (D. Id. 2000).

Comment 6: Executive Summary at page x - DEQ discusses the requirements of both a "list" and TMDLs required by CWA section 303(d).DEQ does not accurately reflect either the plain meaning or the Congressional intent of CWA Section 303(d). The law clearly directs two distinct and separate list and corresponding TMDLs (CWA Sections 303(d)(1) and (d)3). The comment argues that a TMDL under 303(d)(1) is only required for water impaired by point sources of pollutants.

Response 6: DEQ disagrees that 303(d)(1) only requires TMDLs for waters impaired by point sources. The court in Pronsolino v. Marchus, 91 F. Supp.2d.1337 (ND CA 2000) confirmed 303(d) requires TMDLs for waters impaired by nonpoint sources. See also 40 C.F.R. 130.2 and 130.7. Moreover, the Idaho state legislature has directed DEQ to develop TMDLs for point and nonpoint sources. Idaho Code § 39-3611.

Comment 7: Executive Summary, page x first paragraph - the draft TMDL states "For waters identified on the list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants , set at a level to achieve water quality standards" According to CWA 303(d)(1), the water quality standard must be "applicable". There is no "sediment" water quality standard "applicable" on either the state or federal level. The comment also argues that DEQ failed to comply with the state Administrative Procedures Act in establishing sediment criteria that can be used for the basis of a TMDL.

Response 7: DEQ disagrees there are no applicable criteria for sediment in the WQS. The CWA and federal regulations clearly authorize both narrative and numeric WQS. The Idaho WQS have a narrative criteria for sediment set forth in IDAPA 58.01.02.200.08. DEQ further disagrees with Hecla that the reference in the narrative criteria to the limitation on nonpoint source restrictions set forth in the WQS at § 350 means that there are no applicable sediment criteria. § 350.02 does not void the application of narrative sediment criteria or provide that there can be no violation of WQS with respect to nonpoint sources. To the contrary, this section provides the enforcement remedy and the process available when there is a violation of the criteria. Thus, this section provides, in part, the framework for TMDL implementation with respect to certain nonpoint source actions.

DEQ disagrees it has failed to comply with the Idaho Administrative Procedures Act in adopting the sediment criteria. The sediment criteria is part of the state WQS, which have been adopted as rules of the agency pursuant to and in full compliance with the provisions of the state Administrative Procedures Act.

Comment 8: Key Findings, page xi -is low diversity of macroinvertebrates and low trout abundance documented in all 14 streams of the watershed? These biological parameters are being used as *de facto* water quality standards- I.e. in an attempt to show that the applicable water quality standard is not being met. This is a direct violation of Idaho regulations at IDAPA 58:01.02 053 where the regulations state "These parameters are not to be considered or treated as individual water quality criteria or otherwise interpreted or applied as water quality standards. The comment also suggests that the use of biological parameters is a violation of the Idaho Administrative Procedures Act.

Response 8: DEQ disagrees that the use of biological parameters to determine support status on the South Fork Coeur d'Alene River is somehow a violation of § 053 of the WQS. This section directs DEQ to use aquatic habitat and biological parameters to determine whether uses for a water body are supported. This is consistent with the legislative mandate to use biological and aquatic habitat measures to determine support of uses set forth in Idaho Code §§ 39-3606 and 39-3607. DEQ did exactly what the Idaho Code and the WQS authorize.

DEQ also disagrees the use of biological parameters is a violation of the Idaho Administrative Procedures Act. The Idaho Code directs DEQ to make a determination of support status using such parameters. There is nothing in Idaho Code to suggest DEQ determination of support status must be done through a rule-making. Moreover, the TMDL itself is a plan for the achievement of WQS without the force and effect of law. Therefore, DEQ is not required to go through an Administrative Procedures Act rule-making when it develops the TMDL.

Comment 9: Key Findings, page xi -the draft TMDL states that "The sediment yield of the subbasins was modeled." This approach is not allowed by Idaho regulations. Regulations at IDAPA 58:01.02.200.08 for sediment requires that determination of impairment shall be based upon water quality monitoring and surveillance and the information utilized as described in Section 350. Hypothetical modeling is not authorized.

Response 9: Hecla bases this argument upon language in the narrative sediment criteria that states the following: "Sediment shall not exceed quantities specified in sections 250 and 252, or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in § 350.""

DEQ disagrees that it cannot use modeling to support a TMDL or to determine the support status of a water body. There is nothing in state law or the CWA that prohibits the use of modeling in TMDLs. The narrative criteria's reference to § 350 quoted above indicates the method DEQ should use and the remedies available for enforcement purposes when there is a violation of the sediment criteria. § 350.01b states that the failure to meet WQS for nonpoint sources is not a violation "for the purposes of enforcement." There is nothing in this section or in the narrative sediment criteria that provides there is no violation of WQS for purpose of placing a water body on the 303(d) list, and there certainly is nothing that restricts the use of modeling in the development of a TMDL.

Comment 10: Key Findings, page xi - the draft TMDL states: "The TMDL suggests residual pool volume as a surrogate measure of sediment for the purposes of implementation planning and monitoring" Idaho regulations do not allow for "surrogate" water quality standards at the locations cited in comment 8. Further monitoring is to occur at the nonpoint source for determining BMP effectiveness.

Response 10: DEQ disagrees that it can not use parameters such as pool volume to determine support status of water bodies. See response to legal comments 8 and 9.

Comment 11: Page 1 Introduction. The comment quotes a substantial portion of the first paragraph addressing the goal of the Clean Water Act. The comment takes exception with the language, provides corrected language and asks if DEQ is attempting to stretch the goal of the Clean Water Act. The comment states that DEQ is misstating the CWA by providing that water quality is judged by more than just water chemistry.

Response 11: DEQ disagrees with Hecla's comment. The CWA clearly states that the goal of the CWA is to maintain and restore chemical, physical and biological integrity of the nation's waters. CWA, § 101a. § 303(c) of the CWA also authorizes the use of biological monitoring and assessment and basing standards on such biological monitoring and assessment. Idaho state law also authorizes the Director to review the physical, chemical and biological parameters of a water body to determine the support status. Idaho Code §§ 39-3606 and 39-3607.

Comment 12: Background, First Paragraph - The draft TMDL language gives EPA much more authority under the CWA than the actual law provides. DEQ has conceded "primary" responsibility to EPA, which are actually reserved exclusively to the states by Congress in the CWA.

Response 12: DEQ disagrees with Hecla's comment. The introduction section referenced by Hecla continues with the following: "The Idaho Department of Environmental Quality (DEQ) implements the CWA in Idaho, while the EPA oversees Idaho and certifies the fulfillment of CWA requirements and responsibilities." DEQ has appropriately recognized the role of DEQ and EPA in water quality programs in Idaho.

Comment 13: Page 2 Idaho's role- the draft TMDL presumes anti-degradation is part of the water quality standard. Anti-degradation is a policy statement, not a standard.

Response 13: DEQ disagrees with Hecla's comment. The U.S. Supreme Court in PUD No. 1 of Jefferson County v. Washington Department of Ecology, et al., 114 S.Ct.1900 at 1905 (1994) confirmed that anti-degradation is one component of state WQS.

Comment 14: Page 2 Idaho's Role - the " modified" beneficial use is listed. With all the justification for this use being applicable to the areas affected by this draft TMDL, the applicability of the "modified" use should be discussed in detail.

Response 14: The modified cold water use is not the current designated beneficial use of the South Fork Coeur d'Alene or any of its tributaries. Any further discussion of this use is not relevant at this time. Should modified cold water use be designated, the TMDL would be subject to revision.

Comment 15: Page 25 Riffle Armor Stability Indices (RASI) is only an indication of what is in the bed load not what is being added to the floodplain materials. Again Idaho regulations require monitoring of the actual sediment nonpoint sources, which in turn leads to BMP modifications, if necessary.

Response 15: DEQ disagrees that RASI can not be used to determine the support status of the South Fork CDA River. Please see response to comments 7, 8 and 9.

Comment 16: Page 41 - DEQ cites federal regulation for the MOS rather than Idaho law that requires an "adequate" MOS and also directs that it be no more stringent than the CWA requires.

Response 16: DEQ agrees that both federal and state law require a MOS.

Comment 17: Page 41 Last paragraph - TMDL states "federal rules allow for "other appropriate measures" to be used " and EPA allows for "seasonal and annual loads." The comment objects to the deferral to federal authorities and to EPA rather than to Congress.

Response 17: DEQ agrees that both the CWA and EPA's implementation of the CWA provide for seasonal variations. DEQ's reference to EPA is appropriate because the TMDL must be submitted to and approved by EPA pursuant to the CWA.

Comment 18: Pages 42-48 The comment contents sections 5.1-5.3 are moot because DEQ has not set a modified use and has no numeric sediment standard. The comment concludes the TMDL is by law a 303(d)(3) TMDL.

Response 18: DEQ disagrees there are no applicable sediment criteria. Please see response to comment 7.

Comment 19: Page 49 "Reasonable Assurance" The comment asserts that this concept is not authorized by the CWA and is an attempt of EPA to circumvent the voluntary nature of the nonpoint source program established by Congress at Section 319 via a misrepresentation of the CWA at 303(d)(3).

Response 19: Reasonable Assurance is applied when a less stringent waste load allocation is provided based upon the assumption that a nonpoint source load reduction will occur. In such circumstances, reducing limits in point source discharge permits should be based upon an assurance that state WQS will be met through nonpoint source controls. According to EPA, reasonable assurance may be non-regulatory or incentive based. TMDLs in Idaho will continue to be implemented through the programs of designated agencies, many of which are voluntary with respect to nonpoint sources of pollutants.

Comment 20: Pages 55-67 Glossary The comment suggests a disclaimer should be added to clarify that where any of these terms are defined in either law or regulation, the legal definition takes precedent.

Response 20: The Glossary defines terms as used in the document and DEQ believes the terms are consistent with applicable law and regulations.

Text Comments:

Comment 1: Typographical errors were noted on pages 1 (county) and 82 ("average").

Response 1: These typographical errors have been corrected.

Comment 2: The maps are difficult to read.

Response 2: The maps have all been landscaped to make them larger and more readable.

Comment 3: It appears that the footnote under "b) Ninemile Creek-East Fork Ninemile Allocation be changed from Segment 3525 to segment 3524 (Ninemile Creek)(Section 5.4 p.51. Table 22).

Response 3: This typographical error was corrected.

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IPNF Stands
IPNF Roads
IPNF Fires
STATSGO
HUCadmin.shp
county.shp
citybnd.shp
nwstates.shp
owner.shp
state.shp
gage.shp
wqlstr.shp
panstrm.shp
realtime.shp

npdes.shp
lanuse.shp

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Glossary

305(b) Refers to section 305 subsection "b" of the Clean Water Act. 305(b) generally describes a report of each state's water quality, and is the principle means by which the U.S. Environmental Protection Agency, congress, and the public evaluate whether U.S. waters meet water quality standards, the progress made in maintaining and restoring water quality, and the extent of the remaining problems.

303(d) Refers to section 303 subsection "d" of the Clean Water Act. 303(d) requires states to develop a list of water bodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to U.S. Environmental Protection Agency approval.

Adfluvial Describes fish whose life history involves seasonal migration f from lakes to streams for spawning.

Alluvium Unconsolidated recent stream deposition.

Ambient General conditions in the environment. In the context of water quality, ambient waters are those representative of general conditions, not associated with episodic perturbations, or specific disturbances such as a wastewater outfall (Armantrout 1998, EPA 1996).

Anthropogenic Relating to, or resulting from, the influence of human beings on nature.

Anti-Degradation Refers to the U.S. Environmental Protection Agency's interpretation of the Clean Water Act goal that states and tribes maintain, as well as restore, water quality. This applies to waters that meet or are of higher water quality than required by state standards. State rules provide that the quality of those high quality waters may be lowered only to allow important social or economic development and only after adequate public participation (IDAPA 58.01.02.051). In all cases, the existing beneficial uses must be maintained. State rules further define lowered water quality to be 1) a measurable change, 2) a change adverse to a use, and 3) a change in a pollutant relevant to the water's uses (IDAPA 58.01.02.003.56).

Aquatic Occurring, growing, or living in water.

Aquifer	An underground, water-bearing layer or stratum of permeable rock, sand, or gravel capable of yielding of water to wells or springs.
Assemblage (aquatic)	An association of interacting populations of organisms in a given water body; for example, a fish assemblage, or a benthic macroinvertebrate assemblage (also see Community) (EPA 1996).
Assimilative Capacity	The ability to process or dissipate pollutants without ill effect to beneficial uses.
Bedload	Material (generally sand-sized or larger sediment) that is carried along the streambed by rolling or bouncing.
Beneficial Use	Any of the various uses of water, including, but not limited to, aquatic biota, recreation, water supply, wildlife habitat, and aesthetics, which are recognized in water quality standards.
Beneficial Use Reconnaissance Program (BURP)	A program for conducting systematic biological and physical habitat surveys of water bodies in Idaho. BURP protocols address lakes, reservoirs, and wadeable streams and rivers.
Best Management Practices (BMPs)	Structural, nonstructural, and managerial techniques that are effective and practical means to control nonpoint source pollutants.
Biochemical Oxygen Demand (BOD)	The amount of dissolved oxygen used by organisms during the decomposition (respiration) of organic matter, expressed as mass of oxygen per volume of water, over some specified period of time.
Biota	The animal and plant life of a given region.
Biotic	A term applied to the living components of an area.
Clean Water Act (CWA)	The Federal Water Pollution Control Act (Public Law 92-50, commonly known as the Clean Water Act), as last reauthorized by the Water Quality Act of 1987 (Public Law 100-4), establishes a process for states to use to develop information on, and control the quality of, the nation's water resources.

Coliform Bacteria — A group of bacteria predominantly inhabiting the intestines of humans and animals but also found in soil. Coliform bacteria are commonly used as indicators of the possible presence of pathogenic organisms (also see Fecal Coliform Bacteria).

Colluvium — Material transported to a site by gravity.

Community — A group of interacting organisms living together in a given place.

Conductivity — The ability of an aqueous solution to carry electric current, expressed in micro (ì) mhos/cm at 25 °C. Conductivity is affected by dissolved solids and is used as an indirect measure of total dissolved solids in a water sample.

Criteria — In the context of water quality, numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels, and to limit the number of violations per year. EPA develops criteria guidance; states establish criteria.

Cubic Feet per Second — A unit of measure for the rate of flow or discharge of water. One cubic foot per second is the rate of flow of a stream with a cross-section of one square foot flowing at a mean velocity of one foot per second. At a steady rate, once cubic foot per second is equal to 448.8 gallons per minute and 10,984 acre-feet per day.

Erosion — of humans in deforestation, cultivation of the land, overgrazing, and disturbance of natural drainages; the excess of erosion over the normal for an area (also see Erosion).

Discharge — The amount of water flowing in the stream channel at the time of measurement. Usually expressed as cubic feet per second (cfs).

Dissolved Oxygen (DO) — The oxygen dissolved in water. Adequate DO is vital to fish and other aquatic life.

Disturbance — Any event or series of events that disrupts ecosystem, community, or population structure and alters the physical environment.

E. coli	Short for *Escherichia Coli*, *E. coli* are a group of bacteria that are a subspecies of coliform bacteria. Most *E. coli* are essential to the healthy life of all warm-blooded animals, including humans. Their presence is often indicative of fecal contamination.
Effluent	A discharge of untreated, partially treated, or treated wastewater into a receiving water body.
Endangered Species	Animals, birds, fish, plants, or other living organisms threatened with imminent extinction. Requirements for declaring a species as endangered are contained in the Endangered Species Act.
Environment	The complete range of external conditions, physical and biological, that affect a particular organism or community.
Eocene	An epoch of the early Tertiary period, after the Paleocene and before the Oligocene.
Erosion	The wearing away of areas of the earth's surface by water, wind, ice, and other forces.
Exceedance	A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria.
Existing Beneficial Use or Existing Use	A beneficial use actually attained in waters on or after November 28, 1975, whether or not the use is designated for the waters in Idaho's *Water Quality Standards and Wastewater Treatment Requirements* (IDAPA 58.01.02).
Fauna	Animal life, especially the animals characteristic of a region, period, or special environment.
Feedback Loop	In the context of watershed management planning, a feedback loop is a process that provides for tracking progress toward goals and revising actions according to that progress.
Flow	See Discharge.
Fluvial	In fisheries, this describes fish whose life history takes place entirely in streams but migrate to smaller streams for spawning.

Fully Supporting In compliance with water quality standards and within the range of biological reference conditions for all designated and exiting beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2000).

Fully Supporting Cold Water Reliable data indicate functioning, sustainable cold water biological assemblages (e.g., fish, macroinvertebrates, or algae), none of which has been modified significantly beyond the natural range of reference conditions (EPA 1997).

Geographical Information Systems (GIS) A georeferenced database.

Geometric Mean A back-transformed mean of the logarithmically transformed numbers often used to describe highly variable, right-skewed data (a few large values), such as bacterial data.

Gradient The slopes of the land, water, or streambed surface.

Ground Water Water found beneath the soil surface saturating the layer in which it is located. Most ground water originates as rainfall, is free to move under the influence of gravity, and usually emerges again as stream flow.

Habitat The living place of an organism or community.

Headwater The origin or beginning of a stream.

Hydrologic Basin The area of land drained by a river system, a reach of a river and its tributaries in that reach, a closed basin, or a group of streams forming a drainage area (also see Watershed).

Hydrologic Unit One of a nested series of numbered and named watersheds arising from a national standardization of watershed delineation. The initial 1974 effort (USGS 1987) described four levels (region, subregion, accounting unit, cataloging unit) of watersheds throughout the United States. The fourth level is uniquely identified by an eight-digit code built of two-digit fields for each level in the classification. Originally termed a cataloging unit, fourth field hydrologic units have been more commonly called subbasins. Fifth and sixth field hydrologic units have since been delineated for much of the country and are known as watershed and subwatersheds, respectively.

Hydrologic Unit Code (HUC) The number assigned to a hydrologic unit. Often used to refer to fourth field hydrologic units.

Hydrology The science dealing with the properties, distribution, and circulation of water.

Impervious Describes a surface, such as pavement, that water cannot penetrate.

Key Watershed A watershed that has been designated in Idaho Governor Batt's *State of Idaho Bull Trout Conservation Plan* (1996) as critical to the long-term persistence of regionally important trout populations.

Load Allocation (LA) A portion of a water body's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).

Load(ing) The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.

Loading Capacity (LC) A determination of how much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, and a margin of safety, it becomes a total maximum daily load.

Loam Refers to a soil with a texture resulting from a relative balance of sand, silt, and clay. This balance imparts many desirable characteristics for agricultural use.

Macroinvertebrate An invertebrate animal (without a backbone) large enough to be seen without magnification and retained by a 500ìm mesh (U.S. #30) screen.

Margin of Safety (MOS) An implicit or explicit portion of a water body's loading capacity set aside to allow the uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. This is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The MOS is not allocated to any sources of pollution.

Mass Wasting A general term for the down slope movement of soil and rock material under the direct influence of gravity.

Mean Describes the central tendency of a set of numbers. The arithmetic mean (calculated by adding all items in a list, then dividing by the number of items) is the statistic most familiar to most people.

Median The middle number in a sequence of numbers. If there are an even number of numbers, the median is the average of the two middle numbers. For example, 4 is the median of 1, 2, 4, 14, 16; and 6 is the median of 1, 2, 5, 7, 9, 11.

Metric 1) A discrete measure of something, such as an ecological indicator (e.g., number of distinct taxon). 2) The metric system of measurement.

Milligrams per Liter (mg/l) A unit of measure for concentration in water, essentially equivalent to parts per million (ppm).

Million gallons per day (MGD) A unit of measure for the rate of discharge of water, often used to measure flow at wastewater treatment plants. One MGD is equal to 1.547 cubic feet per second.

Miocene Of, relating to, or being an epoch of, the Tertiary between the Pliocene and the Oligocene periods, or the corresponding system of rocks.

Monitoring A periodic or continuous measurement of the properties or conditions of some medium of interest, such as monitoring a water body.

Mouth The location where flowing water enters into a larger water body.

National Pollution Discharge Elimination System (NPDES) A national program established by the Clean Water Act for permitting point sources of pollution. Discharge of pollution from point sources is not allowed without a permit.

Natural Condition A condition indistinguishable from that without human-caused disruptions.

Nonpoint Source A dispersed source of pollutants generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and non-irrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.

Not Assessed (NA) A concept and an assessment category describing water bodies that have been studied, but are missing critical information needed to complete an assessment.

Not Attainable A concept and an assessment category describing water bodies that demonstrate characteristics that make it unlikely that a beneficial use can be attained (e.g., a stream that is dry but designated for salmonid spawning).

Not Fully Supporting Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2000).

Not Fully Supporting Cold Water At least one biological assemblage has been significantly modified beyond the natural range of its reference condition (EPA 1997).

Organic Matter Compounds manufactured by plants and animals that contain principally carbon.

Parameter A variable, measurable property whose value is a determinant of the characteristics of a system; e.g., temperature, dissolved oxygen, and fish populations are parameters of a stream or lake.

pH The negative $\log_{10}$ of the concentration of hydrogen ions, a measure which in water ranges from very acid (pH=1) to very alkaline (pH=14). A pH of 7 is neutral. Surface waters usually measure between pH 6 and 9.

Phased TMDL A total maximum daily load (TMDL) that identifies interim load allocations and details further monitoring to gage the success of management actions in achieving load reduction goals and the effect of actual load reductions on the water quality of a water body. Under a phased TMDL, a refinement of load allocations, waste load allocations, and the margin of safety is planned at the outset.

Point Source A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater.

Pollutant Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

Pollution A very broad concept that encompasses human-caused changes in the environment which alter the functioning of natural processes and produce undesirable environmental and health effects. This includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.

Population A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area.

Protocol A series of formal steps for conducting a test or survey.

Qualitative Descriptive of kind, type, or direction.

Quantitative Descriptive of size, magnitude, or degree.

Reach A stream section with fairly homogenous physical characteristics.

Reconnaissance An exploratory or preliminary survey of an area.

Reference A physical or chemical quantity whose value is known, and thus is used to calibrate or standardize instruments.

Reference Condition	1) A condition that fully supports applicable beneficial uses with little affect from human activity and represents the highest level of support attainable. 2) A benchmark for populations of aquatic ecosystems used to describe desired conditions in a biological assessment and acceptable or unacceptable departures from them. The reference condition can be determined through examining regional reference sites, historical conditions, quantitative models, and expert judgment (Hughes 1995).
Reference Site	A specific locality on a water body that is minimally impaired and is representative of reference conditions for similar water bodies.
Resident	A term that describes fish that do not migrate.
Riffle	A relatively shallow, gravelly area of a streambed with a locally fast current, recognized by surface choppiness. Also an area of higher streambed gradient and roughness.
Riparian	Associated with aquatic (stream, river, lake) habitats. Living or located on the bank of a water body.
Riparian Habitat Conservation Area (RHCA)	A U.S. Forest Service description of land within the following number of feet up-slope of each of the banks of streams: - 300 feet from perennial fish-bearing streams - 150 feet from perennial non-fish-bearing streams - 100 feet from intermittent streams, wetlands, and ponds in priority watersheds.
River	A large, natural, or human-modified stream that flows in a defined course or channel, or a series of diverging and converging channels.
Runoff	The portion of rainfall, melted snow, or irrigation water that flows across the surface, through shallow underground zones (interflow), and through ground water to creates streams.
Sediments	Deposits of fragmented materials from weathered rocks and organic material that were suspended in, transported by, and eventually deposited by water or air.
Species	1) A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2) An organism belonging to such a category.

Stream	A natural watercourse containing flowing water, part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone.
Stream Order	Hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher order streams result from the joining of two streams of the same order.
Subbasin	A large watershed of several hundred thousand acres. This is the name commonly given to 4^{th} field hydrologic units (also see Hydrologic Unit).
Subbasin Assessment (SBA)	A watershed-based problem assessment that is the first step in developing a total maximum daily load in Idaho.
Subwatershed	A smaller watershed area delineated within a larger watershed, often for purposes of describing and managing localized conditions. Also proposed for adoption as the formal name for 6^{th} field hydrologic units.
Surface Water	All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors that are directly influenced by surface water.
Suspended Sediments	Fine material (usually sand size or smaller) that remains suspended by turbulence in the water column until deposited in areas of weaker current. These sediments cause turbidity and, when deposited, reduce living space within streambed gravels and can cover fish eggs or alevins.
Threatened Species	Species, determined by the U.S. Fish and Wildlife Service, which are likely to become endangered within the near future throughout all or a significant portion of their range.

Total Maximum Daily Load (TMDL) A TMDL is a water body's loading capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual basis. TMDL = Loading Capacity = Load Allocation + Waste Load Allocation + Margin of Safety. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

Total Suspended Solids (TSS) The dry weight of material retained on a filter after filtration. Filter pore size and drying temperature can vary. American Public Health Association Standard Methods (Greenborg, Clescevi, and Eaton 1995) call for using a filter of 2.0 micron or smaller; a 0.45 micron filter is also often used. This method calls for drying at a temperature of 103-105 °C.

Tributary A stream feeding into a larger stream or lake.

Turbidity A measure of the extent to which light passing through water is scattered by fine suspended materials. The effect of turbidity depends on the size of the particles (the finer the particles, the greater the effect per unit weight) and the color of the particles.

Waste Load Allocation (WLA) The portion of receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Waste load allocations specify how much pollutant each point source may release to a water body.

Water Body A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.

Water Column Water between the interface with the air at the surface and the interface with the sediment layer at the bottom. The idea derives from a vertical series of measurements (oxygen, temperature, phosphorus) used to characterize water.

Water Pollution Any alteration of the physical, thermal, chemical, biological, or radioactive properties of any waters of the state, or the discharge of any pollutant into the waters of the state, which will or is likely to create a nuisance or to render such waters harmful, detrimental, or injurious to public health, safety, or welfare; to fish and wildlife; or to domestic, commercial, industrial, recreational, aesthetic, or other beneficial uses.

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 Criteria	Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, or industrial processes.
Water Quality Limited	A label that describes water bodies for which one or more water quality criterion is not met or beneficial uses are not fully supported. Water quality limited segments may or may not be on a 303(d) list.
Water Quality Limited Segment (WQLS)	Any segment placed on a state's 303(d) list for failure to meet applicable water quality standards, and/or is not expected to meet applicable water quality standards in the period prior to the next list. These segments are also referred to as "303(d) listed."
Water Quality Standards	State-adopted and EPA-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.
Watershed	1) All the land which contributes runoff to a common point in a drainage network, or to a lake outlet. Watersheds are infinitely nested, and any large watershed is composed of smaller "subwatersheds." 2) The whole geographic region which contributes water to a point of interest in a water body.
Water Body Identification Number (WBID)	A number that uniquely identifies a water body in Idaho ties in to the Idaho Water Quality Standards and GIS information.
Wetland	An area that is at least some of the time saturated by surface or ground water so as to support with vegetation adapted to saturated soil conditions. Examples include swamps, bogs, fens, and marshes.
Young of the Year	Young fish born the year captured, evidence of spawning activity.

Appendix A. Sediment Model Assumptions and Documentation

Sediment Model Assumptions and Documentation

Background:

Sediment is the pollutant of concern on the majority of the water quality limited streams of the Panhandle Region. The lithology or terrain of the region most often governs the form the sediment takes. Two major terranes dominate in northern Idaho. These are the meta-sedimentary Belt Supergroup and granitics present either in the Kaniksu batholith or in smaller intrusions as the Round Top Pluton and the Gem Stocks. In some locations Columbia River Basalt formations are important, but these tend to be to the South and West primarily on the Coeur d'Alene Reservation. Granitics weather to sandy materials with a lesser amount of pebbles or larger particle sizes. Pebbles and larger particle sizes with significant amounts of sand remain in the higher gradient stream bedload. The Belt terranes produce both silt size particles and pebbles and larger particle sizes. Silt particles are transported to low gradient reaches, while the larger sizes comprise the majority of the higher gradient stream bedload. Basalts erode to silt size and particles similar to the Belt terranes, but the large basalt particles are less resistant, weathering to smaller particles.

Any attempt to model the sediment output of watersheds will provide, relative rather than exact, sediment yields. The model documented here attempts to account for all significant sources of sediment separately. This approach is used to identify the primary sources of sediment in a watershed. This identification of primary sources will be useful as implementation plans designed to remedy these sources are developed. The approach has the added advantage of identifying to the state of the technology all of the sources. If additional investigation indicates sources quantified as minor are not, the model input can be altered to incorporate this new information.

Model Assumptions:

Land use and sediment delivery:

RUSLE is the correct model for pasture. RUSLE accounts for production and delivery of sediment. Sediment modeled by RUSLE is fine.

Sediment yield coefficients measured in-stream on geologies of northern and north central Idaho covers production and delivery of sediment from forested areas. These sediment yield coefficients reflect both fine and coarse sediment.

Sparse and heavy forest of all age classes including seedling-sapling should be given mid range of the sediment yield coefficient for the geologies, while areas not fully stocked by Forest Practices Act standards are given the upper end of the range.

Sediment yield coefficients can be modified within the range observed to estimate highway corridor land use and the effects of repeated wild fires.

Double burned areas have eroded significantly to the stream channel but are not now eroding; a residual sediment load in the channels is possible from previous catastophic burns.

Erosion from stream bank lateral recession can be estimated with the direct volume method (Erosion and Sediment Yield in Channels Workshop 1983).

Road sediment production and delivery:

Road erosion using the CWE approach should be limited to the 200 feet of road on either side of road crossings, not to total road mileage.

The use of the McGreer relationship between CWE score and road surface erosion is a valid estimate of road surface fines production and yield. In the case of Belt terrane, it is a conservative (overestimate) estimate.

CWE data collected for actual road fill failures and sediment delivery reflects the situation throughout the watershed. Since the great majority of road failures occur during episodic high discharge events with a 10 - 15-year return period, road failures reflect the actions of the last large event and must be divided by ten for an annualized estimate.

Fines and coarse loading can be estimated for stream reaches where roads encroach on the stream using estimated erosion rates on defined model cross-section. Erosion resulting from encroachment occurs primarily during episodic high discharge events with a 10 - 15-year return period, road encroachment erosion must be divided by ten for an annualized estimate.

Failing road fill and eroding bank is composed of fines and coarse material. The proportions of fines and coarse material can be estimated from the soil series descriptions of the watershed.

Sediment Delivery:

100% delivery from forestlands with sediment yield coefficients measured in-stream on geologies of northern and north central Idaho.

100% delivery from agricultural lands estimated with RUSLE

100% delivery from all road miles up to 200 feet from a stream crossing as estimated by the McGreer relationship.

Fines and coarse materials are delivered at the same rate from fill failures and from erosion resulting from road encroachment and bank erosion.

Model Approach:

The sediment model attempts to account for all sources of sediment by partitioning these sources into broad categories.

Land use is a primary broad category. It is treated separate from other characteristics as stream bank erosion and roads. Land use types are divided into agricultural, forest, urban and highways.

Agriculture may be subdivided into working farms and ranches and small ranchettes, which currently exist on subdivided agriculture land. Sediment yields from agricultural lands that receive any tillage, even on an infrequent basis are modeled with the Revised Universal Soil Loss Equation (RUSLE). Sediment yields were estimated from agricultural lands (rangeland, pasture and dry agriculture) using the Revised Universal Soil Loss Equation (RUSLE) (equation 1)(Hogan 1998).

Equation 1: $A = (R)(K)(LS)(C)(D)$ tons per acre per year where:

: A is the average annual soil loss from sheet and rill erosion
: R is climate erosivity
: K is the soil erodibility
: LS is the slope length and steepness
: C is the cover management and
: D is the support practices.

RUSLE does not take into account stream bank erosion, gully erosion or scour. RUSLE applies to cropland, pasture, hayland or other land that has some vegetation improvement by tilling or seeding. Based on the soils, characteristics of the agriculture and the slope, sediment yields were developed for the agricultural lands of each watershed. RUSLE develops values that reflect the amount of sediment eroded and delivered to the active channel of the stream system annually.

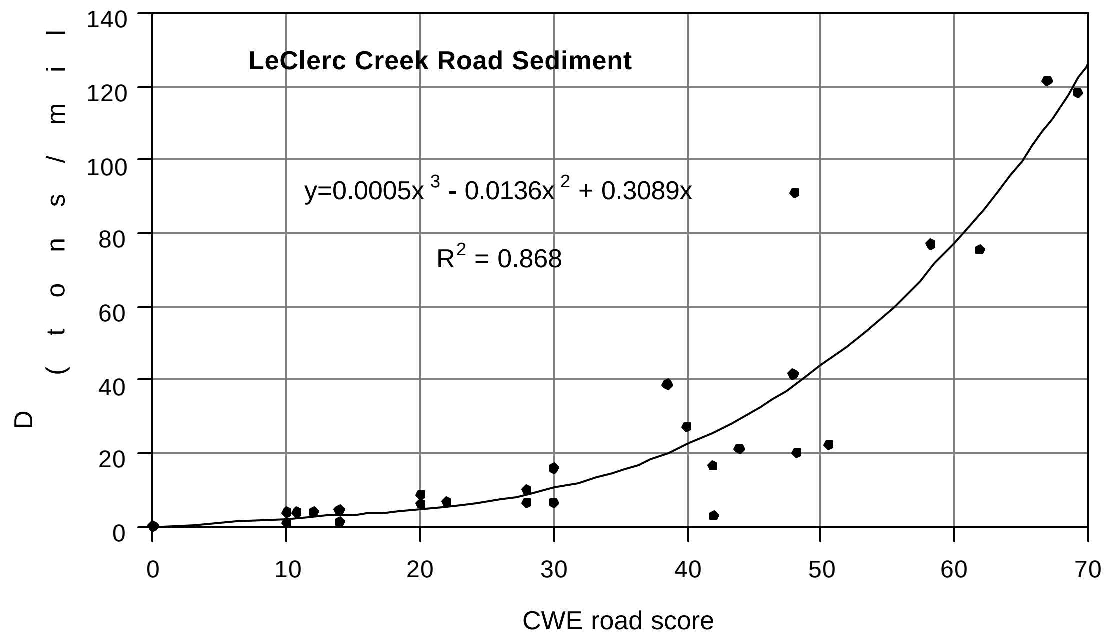
Forestlands and some land in highway rights of way are modeled using the mean sediment export coefficients measured in-stream on geologies of northern and north central Idaho (USFS 1994). The values developed by these sediment yield coefficients are sediment eroded and delivered to the stream courses annually. Forestlands that are fully stocked with trees are treated with the median coefficient for sediment yields ascribed to that terrane. Lands not fully stocked by Idaho Forest Practices Act standards are assigned the highest coefficient of the range. Paved road rights of ways are assigned the lowest coefficient of the range. Areas that were burned by two large wild fires as delineated in IPFIRES are adjusted by a coefficient that is the difference between the highest value of the coefficient for the geologic type and the median.

All coefficients are expressed on tons per acre per year basis and are applied to the acreage of each land type developed from Geographical Information System (GIS) coverages. All land uses are displayed with estimated sediment delivery. Land use sediment delivery is totaled.

Roads are treated separately by the model. Forest haul roads are differentiated from county and private residential roads. County roads often have larger stream passage structures and are normally much wider and have gravel or pavement surfacing. Private residential roads are often limited in extent, but can have poor stream crossing structures. Sediment yields from county and private roads are modeled using a newer RUSLE model (Sandlund 1999). Road relief, slope length, surfacing, soil material and width were the most critical factors. The sediment yield was applied only to the two hundred feet on either side of stream crossings. Failure of county and private road fills was assumed nonexistent, because such roads are often on gentler terrane. As a consequence, road fill failures are rare.

Forest roads were modeled using data developed with the cumulative watershed effects (CWE) protocol. A watershed CWE score was used to estimate surface erosion from the road surface. Forest road sediment yield was estimated using a relationship between CWE score and the sediment yield per mile of road (Figure 1). The relationship was developed for roads on a Kaniksu granitic terrane in the LaClerc Creek watershed (McGreer 1998). Its application to roads on Belt terrane conservatively estimates sediment yields from these systems. The watershed CWE score was used to develop a sediment tons per mile, which was multiplied by the estimated road mileage affecting the streams. In the case of roads, it was assumed that all sediment was delivered to the stream system. These are conservative estimates of actual delivery.

Figure 1: Sediment export of roads based on Cumulative Watershed Effects scores.

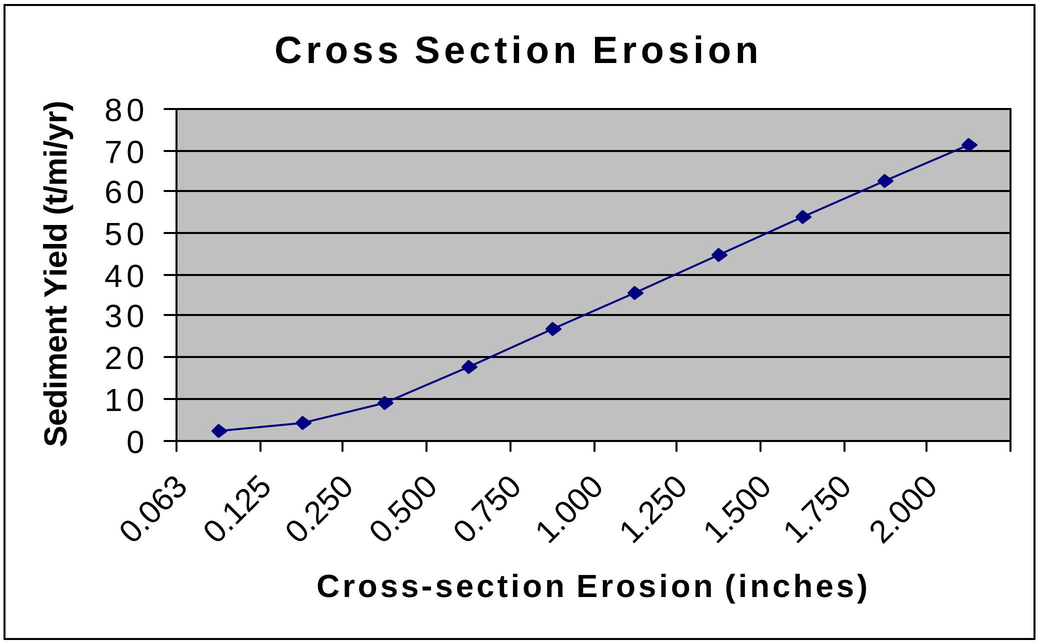


Forest road failure was estimated from actual CWE road fill failure and delivery data. These data were interpreted as primarily the result of large discharge events which occur on a 10 - 15-year return period (McClelland et. al 1997). The estimates were annualized, by dividing the measured values by ten. The data are typically from a subset of the roads in a watershed. The sediment delivery value was scaled using a factor reflecting the watershed road mileage divided by the road mileage assessed. The sediments delivered through this mechanism contain both fine (material including and smaller than pebbles) and coarse material (pebbles and larger sizes). The percentages of fine and coarse particles were estimated using the described characteristics of the soils series found in the watershed. The weighted average of the fines and coarse composition of the B and C soil horizons to a depth of 36 inches was developed using the soils GIS coverage STATSGO, which contains the soils composition data provided by Soils Survey documents. The B and C horizons= composition was used because these are the strata from which forest roads are normally constructed. Based on the developed soil composition percentage and the estimated probable yield, the tons of fine and coarse material delivered to the streams by fill failure was calculated. This approach assumes equal delivery of fine and coarse materials.

Roads cause stream sedimentation by an additional mechanism. The presence of roads in the floodplain of a stream most often interferes with the streams= natural tendency to seek a steady state gradient. During high discharge periods, the constrained stream often erodes at the roadbed, or if the bed is armored, erodes at the opposite bank or its bed. The erosion resulting from a road imposed gradient change results in stream sedimentation. The model assumes the roads causing gradient effects to be those within fifty (50) feet of the stream. The model then assumes one-quarter inch erosion per lineal foot of bed and bank up to three feet in height. The one-quarter inch cross-section erosion is assumed to be uniform over the bed and banks. The erosion rate was selected from a model curve of erosion in inches compared to modeled sediment yields from a channel ten feet in width (Figure 2). The stream cross-section used was based on the weighted bank full width for all measurements made of streams in the Beneficial Use Reconnaissance and Use Attainability programs. In the case of the North Fork the weighted mean was 54.9 feet (table appended). The erosion is from the soil types in the basin with the weighted percentages of fine and coarse material. A bulk soil density of 2.6 g/cc is used to convert soil volume into weights in tons. The tons of fine and coarse material are totaled for all road segments within 50 lineal feet of the stream. The bulk of this erosion is assumed to occur during large discharge events which occur on a 10 - 15-year return period (McClelland et. al 1997). The estimates were annualized, by dividing the measured values by ten.

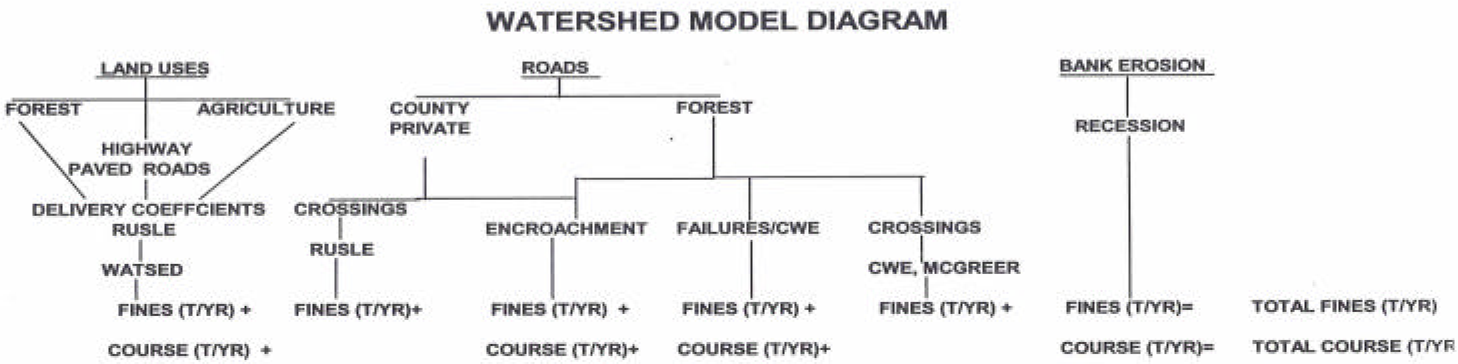
Estimates of bank recession are appropriate primarily along low gradient Rosgen B and C channels Rosgen 1985). The Direct Volume Method as discussed in the Erosion and Sediment Yield Channel Evaluation Workshop (1983) was employed to make the estimates. The method relies on measurement of eroding bank length, lateral recession rate, soil type and particle size to make these estimates. A field crew collected these data. The fine and coarse material fractions of the bank material based on STATSGO GIS coverage are used to estimate fine and coarse material delivery to the stream. These values are added into the watershed sediment load.

Figure 2: Modeled sediment yield from thickness of cross-section erosion.



The model does not consider sediment routing. The model does not attempt to estimate the erosion to streambeds and banks resulting from localized sediment deposition in the streambed. The model does not attempt to measure the effects of additional water capture at road crossings. It is assumed, that on the balance, the additional stream power created by additional water capture over a shorter period would increase net export of sediment, even though some erosion would be caused by this watershed affect.

Model Diagram:



Model Operation:

The model is a simple Excel spreadsheet model composed of four spreadsheets. Key data as acreage and percentages are entered into sheets one and two of the model. County and private road data are supplied in sheet four. The total estimated sediment from the varied sources is calculated in spreadsheet three.

Assessment of Model's Conservative Estimate:

Several conservative assumptions are made in the model construction, which cause its development of conservatively high estimations of sedimentation of the streams modeled. These assumptions are listed in the following paragraphs and a numerical assessment of the magnitude of the conservatism is assigned.

The model uses RUSLE and forest sediment yield coefficients to develop land use sediment delivery estimates. The output values are treated as delivery to the stream. RUSLE assumes delivery if the slope assessed is immediately up gradient from the stream system. This is not the case on the majority of the agricultural land assessed. Estimates made in the Lake Creek Sediment Study indicate that at most 25% of the erosion modeled was delivered as sediment to the stream Bauer, Golden and Pettit 1998). A similar local estimate has not been made with sediment yield coefficients, but it is likely that this estimate would be 25% as well. The land use model component is 75% conservative.

The roads crossing component of the model assumes 100% delivery of fine sediment from the 200 feet on either side of a stream crossing. It is more likely that some fine sediment remains in ditches. A reasonable level of delivery is 80%. The model is likely 20% conservative in this component. On Belt terrain, use of the McGreer model is conservative. Since the sediment yield coefficients measured in-stream for Kaniksu granites is 167% of the coefficient for Belt terrain, this factor is estimated to be 67% conservative.

Road encroachment is defined as 50 feet from the stream, primarily because this is near the resolution of commonly used GIS mapping techniques. Road fifty feet from streams but on side hills would not affect the stream gradient. The model is likely incorrect on encroachment 20% of the time and is conservative by this factor.

Fill failure data is developed from the actual CWE field assessments. The CWE assessment does not assess all the roads in the watershed. The failure rate data is scaled up by the factor of the roads assessed divided into the actual watershed road mileage. The roads assessed are typically those remote from the stream system, which are very unlikely to deliver sediment to the stream. The percentage of watershed roads assessed varies, but it is commonly 60% or less of the watershed roads. The model is 40% conservative in this component.

Table 1 summarizes the conservative assumptions and assesses its numerical level of over-estimation.

Table 1: Estimation of the conservative estimate of stream sedimentation provided by the model.

Model Factor	Kaniksu Granites	Belt Supergroup
100% RUSLE and forest land sediment yield delivery	75%	75%
Crossing delivery	29%	20%
McGreer Model	0%	67%
Road encroachment at 50 feet	20%	20%
Road Failure	40%	40%
Total Assessment of Over-estimate	164%	231%

The model provides an over estimate by factors of 1.6 and 2.3 for the Kaniksu and Belt terrain, respectively. This over estimation is a built in margin of safety 231% for the South Fork Coeur d=Alene River.

Model verification:

Some verification of the model can be developed by comparison of measured sediment load with those predicted by the model. The USGS measured sediment load at the Enaville Station on the Coeur d=Alene River during water year 1999. Based on this measured estimates the sediment load per square mile of the basin above this point was calculated to be 28 tons (URS Greiner 2001a). The middle value of the Belt geology sediment yield coefficient range is 14.7 tons per square mile. The model outputs for several watersheds of the North Fork Coeur d=Alene River are provided in Table 2. The model predicted a sediment yield of 33.6 tons/year for the entire subbasin. The agreement between the measured estimate and the modeled estimates is good.

Table 2: Modeled sediment output from selected North Fork Coeur d=Alene Watersheds.

Watershed	square miles	modeled sediment	tons/square mile
Deer	10.0	153.1	15.3
Alden	7.9	158.5	20.0
Independence	59.5	1,156.1	19.4
Trail	25.2	976.1	38.7
Flat	17.6	711.9	40.5
Prichard	53.6	1,636.5	30.6
Burnt Cabin	28.8	1,325.7	46.0
Skookum	7.1	191.2	27.0
Bumblebee	24.9	901.2	36.2
Streamboat	41.4	1,955.3	47.2
Graham	9.3	138.4	14.9
Little North Fork	169.0	6,769.2	40.0
North Fork Total	903.2	30.369.7	33.6

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Appendix B. Sediment Model Spreadsheets

Sediment Model Spreadsheets: Watersheds of South Fork Coeur d'Alene Subbasin

Land Use														
Sub-watershed	Upper SF	Canyon	Ninemile	Placer	Middle GL	Big	Terror	Moon	Mtgomery	Lower GL	Pine Hdw	EF Pine	Pine SDW	Bear
Forest Land (ac)	31735	12132	6803	10011	13905	20197	1600	4752	3778	6922	15724	16102	9304	6623
Unstocked forest (ac)	178	1,407	447	0	2608	548	270	884	930	7261	2513	3089	3189	581
Double Fires (ac)	25.4	0	0	5560	0	2865	0	308	0	0	157	1513	0	0
Urban-suburban (ac)	206	20.8	2.7	10	1252.1	154	11.3	3.3	88.6	2322.4	0	0	544.8	0
Highway (ac)	482.9	151	63.2	21.8	613.6	208.2	34.3	96	119.1	701	0	34.4	284.1	14.2
Mine waste piles (ac)	9.4	75.9	39.4	0	140.2	0	1	8.1	0	14.2	0.2	63.4	7.5	0
Road Data														
Forest roads (mi)	180.7	92.8	66.7	41.4	97.2	88.7	11.9	22.4	31.5	120.7	84.8	63.6	118.2	48.7
Ave. road density (mi/sq mi)	3.5	4.3	5.8	2.6	3.4	2.7	3.9	2.5	4.1	4.5	3	2.1	5.7	4.2
Road crossing number	163	114	62	37	99	53	7	15	28	109	47	43	81	37
Road crossing freq.	1.5	2.7	2.9	1	1.5	0.7	0.8	0.7	1.4	1.4	1	0.6	1.6	1.6
Mass Failure (tons/yr)	0	0	0	0	0	0	0	0	0	0	591.1	0	0	10.9
Encroaching Roads (mi)	6.5	4.4	4	3	5.9	4	0.5	0.9	1.1	6.2	1.9	2.9	2.7	1.7
Encroaching mine features (mi)	1.1	2.2	1.2	0	2.6	0	0	0.3	0	0.2	0	2.4	0.2	0
Mean Bankfull width + 2 3' banks	13.1	13.6	11.1	13.9	20.8	16.7	9	9.8	9	25.5	12.9	14.1	13.8	9.6
CWE score	16.5	17.8	15.5	16.5	10.3	10	9.9	16.9	11.9	14.2	28	11.7	11.4	10.2
CWE Surface (tons/mile)	3.6	4	3.4	3.6	2.3	2.2	2.2	3.7	2.6	3.1	9	2.5	2.5	2.3
CWE miles examined (miles)	10	12.1	7.2	10	7.1	10	1.9	2.6	4.1	15.8	5.4	13.5	11.5	11.7

South Fork Coeur d'Alene Subbasin Sediment Yield														
Watershed	Upper SF	Canyon	Ninemile	Placer	Middle GL	Big	Terror	Moon	Mtgomery	Lower GL	Pine Hdw	EF Pine	Pine SDW	Bear
Conifer Forest (tons/yr)(fine)	255.47	97.66	54.76	80.59	111.94	162.59	12.88	38.25	30.41	55.72	126.58	129.62	74.90	53.32
(coarse)	474.44	181.37	101.70	149.66	207.88	301.95	23.92	71.04	56.48	103.48	235.07	240.72	139.09	99.01
Unstoched Forest (tons/yr)(fine)	1.68	13.30	4.22	0.00	24.65	5.18	2.55	8.35	8.79	68.62	23.75	29.19	30.14	5.49
(coarse)	3.12	24.69	7.84	0.00	45.77	9.62	4.74	15.51	16.32	127.43	44.10	54.21	55.97	10.20
Double Fires (tons/yr)(fine)	0.04	0.00	0.00	7.78	0.00	4.01	0.00	0.43	0.00	0.00	0.22	2.12	0.00	0.00
(coarse)	0.07	0.00	0.00	14.46	0.00	7.45	0.00	0.80	0.00	0.00	0.41	3.93	0.00	0.00
Urban-Suburban (tons/yr)(fine)	3.61	0.36	0.05	0.18	21.91	2.70	0.20	0.06	1.55	40.64	0.00	0.00	9.53	0.00
(coarse)	6.70	0.68	0.09	0.33	40.69	5.01	0.37	0.11	2.88	75.48	0.00	0.00	17.71	0.00
Highway (tons/yr)(fine)	3.21	1.00	0.42	0.14	4.08	1.38	0.23	0.64	0.79	4.66	0.00	0.23	1.89	0.09
(coarse)	5.96	1.86	0.78	0.27	7.58	2.57	0.42	1.19	1.47	8.66	0.00	0.42	3.51	0.18
Mine waste piles (tons/yr)(fine)	0.33	2.66	1.38	0.00	4.91	0.00	0.04	0.28	0.00	0.50	0.01	2.22	0.26	0.00
(coarse)	0.61	4.93	2.56	0.00	9.11	0.00	0.07	0.53	0.00	0.92	0.01	4.12	0.49	0.00
Total Yield (tons/yr)(fine)	264.33	114.98	60.83	88.69	167.48	175.85	15.89	48.02	41.54	170.14	150.55	163.38	116.72	58.90
(Coarse)	490.90	213.54	112.98	164.71	311.03	326.59	29.51	89.18	77.15	315.97	279.60	303.42	216.76	109.39
County, Forest and Private Road Sediment Yield														
Watershed	Upper SF	Canyon	Ninemile	Placer	Middle GL	Big	Terror	Moon	Mtgomery	Lower GL	Pine Hdw	EF Pine	Pine SDW	Bear
Forest road														
Surface fine sediment (tons/yr)	44.5	34.55	16.0	10.1	17.3	8.8	1.2	4.2	5.5	25.6	32.0	8.1	15.3	6.4
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	324.9	0.0	0.0	1.6
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	603.4	0.0	0.0	2.9
	31.1	28.0	18.0	13.0	55.2	20.9	1.4	3.7	3.1	50.9	7.7	23.3	12.5	5.1
	57.7	52.0	33.5	24.2	102.5	38.7	2.6	6.8	5.7	94.6	14.2	43.3	23.2	9.5
Total fine yield (tons/yr)	75.5	62.57	34.0	23.1	72.4	29.7	2.6	7.9	8.6	76.5	364.6	31.5	27.8	13.1
Total coarse yield (tons/yr)	57.7	52.04	33.5	24.2	102.5	38.7	2.6	6.8	5.7	94.6	617.6	43.3	23.2	12.4
Total sediment (t/yr)	888.5	443.13	241.3	300.7	653.5	570.9	50.6	151.9	133.0	657.3	1412.3	541.6	384.5	193.8
% FINES^	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
% COARSE	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65

^ from weighted average of fines and stones in soils groups							
	* Uses mass failure and delivery rates developed from CWE protocol pro-rated for road miles and annualized.						
	tons delivered x (road mileage/road mileage assessed)/10 years						
	# Assume: one -quarter inch from three feet banks; density = 2.6 g/cc						
	0.020833	0.25"yr/ 12"					
	8098662	Q24*y*5280*28317cc/ft3*2.6 g/cc = g/10 yr					
	9080000	454g/lb* 2000 lb/t*10 yr					
y*	0.891923	t/mile					

0.023	forest
0.027	non-stocked
0.004	double burn
0.05	Urban-Suburban
0.019	Highway
0.1	Mine waste piles

South Fork Coeur d'Alene Subbasin Sediment Export														
Sub-watershed	Upper SF	Canyon	Ninemile	Placer	Middle GL	Big	Terror	Moon	Mtgomery	Lower GL	Pine Hdw	EF Pine	Pine SDW	Bear
Land use fines export (tons/yr)	264.3	115.0	60.8	88.7	167.5	175.9	15.9	48.0	41.5	170.1	150.6	163.4	116.7	58.9
Landuse coarse export (tons/yr)	490.9	213.5	113.0	164.7	311.0	326.6	29.5	89.2	77.2	316.0	279.6	303.4	216.8	109.4
Road fines export (tons/yr)	75.5	62.6	34.0	23.1	72.4	29.7	2.6	7.9	8.6	76.5	364.6	31.5	27.8	13.1
Road coarse export (tons/yr)	57.7	52.0	33.5	24.2	102.5	38.7	2.6	6.8	5.7	94.6	617.6	43.3	23.2	12.4
Bank erosion fines (tons/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank erosion coarse (tons/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total fines export tons/yr)	339.9	177.5	94.8	111.8	239.9	205.5	18.5	55.9	50.1	246.7	515.1	194.9	144.6	72.0
Total coarse export tons/yr)	548.6	265.6	146.4	188.9	413.5	365.3	32.1	96.0	82.9	410.6	897.2	346.7	240.0	121.8
Total (tons/yr)	888.5	443.1	241.3	300.7	653.5	570.9	50.6	151.9	133.0	657.3	1412.3	541.6	384.5	193.8
Natural Background	750.1	317.1	169.2	231.0	425.9	485.5	44.1	132.1	113.1	396.1	419.5	443.6	306.6	166.0
Percent above background	18.5	39.7	42.6	30.2	53.4	17.6	14.8	15.0	17.7	65.9	236.7	22.1	25.4	16.7

Appendix C. Distribution List

Coeur d'Alene Basin Citizens' Advisory Committee members (25)
Barry Rosenberg and Mike Mihelich, Kootenai Environmental Alliance
Neil Beaver, The Lands Council
Kathy Zanetti, Shoshone Natural Resource Coalition
Coeur Mining Company
Hecla Mining Company
Jennifer Wu, Shiela Eckman, EPA