5. Total Maximum Daily Load(s)

A TMDL prescribes an upper limit load capacity on discharge of a pollutant from all sources to ensure 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 wasteload allocation (WLA); and nonpoint sources, each of which receives a load allocation (LA). Natural background (NB), when present, is considered part of the LA, but is often considered individually 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 (Water Quality Planning and Management, 40 CFR Part 130) require a margin of safety (MOS) be a part of the TMDL.

Practically, the margin of safety is a reduction in the load capacity 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 load capacity is determined. Then the load capacity is broken down into its components; the necessary margin of safety is determined and subtracted; then natural background, if relevant, is quantified and subtracted; and then the remainder is allocated among pollutant sources. When the breakdown and allocation are completed, the result is a TMDL that must equal the load capacity.

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 for pollutant trading to occur. The load capacity must 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 load capacity 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 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.

Chapter 5 is organized to present and summarize the TMDL calculations and allocations for sediment impaired assessment units associated with Gold Creek, North Gold Creek, Sand Creek, Schweitzer Creek, and the Upper Pack River. Since the TMDLs are established based on land use categories and land management responsibilities, the sediment TMDL required for Hellroaring Creek is incorporated within the TMDL calculations for the Upper Pack River. Likewise while a specific TMDL for McCormick Creek was deemed unnecessary as an outcome of the stressor identification reports, pollutant load reductions for McCormick Creek are nonetheless included in the TMDL calculations for Upper Pack River since the entire Upper Pack River watershed was modeled as one watershed.

Pollutant Trading

Pollutant trading (aka water quality trading) is a contractual agreement to exchange pollution reductions between two parties. Pollutant trading is a business-like way of helping to solve water quality problems by focusing on cost effective, local solutions to problems caused by pollutant discharges to surface waters. Pollutant trading is voluntary. Parties trade only if both are better off as a result of the trade. Trading allows parties to decide how to best reduce pollutant loadings within the limits of certain requirements. The appeal of trading emerges when pollutant sources face substantially different pollutant reduction costs. Typically, a party facing relatively high pollutant reduction costs compensates another party to achieve an equivalent, though less costly, pollutant reduction.

Pollutant trading is recognized in Idaho's Water Quality Standards at IDAPA 58.01.02.054.06. Currently, the Department of Environmental Quality's policy is to allow for pollutant trading as a means to meet total maximum daily loads (TMDLs) thus restoring water quality limited water bodies to compliance with water quality standards. The Pollutant Trading Guidance document sets forth the procedures to be followed for pollutant trading.

Trading Components

The major components of pollutant trading are trading parties (buyers and sellers) and credits (the commodity being bought and sold). Additionally, ratios are used to ensure environmental equivalency of trades on water bodies covered by a TMDL. All trading activity must be recorded in the trading database through the Idaho Clean Water Cooperative, Inc.

Both point and nonpoint sources may create marketable credits. Credits are a reduction of a pollutant beyond a level set by a TMDL. Point sources create credits by reducing pollutant discharges below NPDES effluent limits which are set initially by the waste load allocation. Nonpoint sources create credits by implementing approved best management practices (BMPs) that reduce the amount of pollutant run-off. Nonpoint sources must follow specific design, maintenance, and monitoring requirements for that BMP, apply discounts to credits generated if required, and provide a water quality contribution to ensure a net environmental benefit. The water quality contribution also ensures the reduction (the marketable credit), is surplus to the reductions the TMDL assumes the nonpoint source is achieving to meet the water quality goals of the TMDL.

Watershed specific Environmental Protection

Trades must be implemented so that the overall water quality of the water bodies covered by the TMDL are protected. To do this, hydrologically-based ratios are developed to provide that trades between sources distributed throughout the TMDL water bodies result in environmentally equivalent or better outcomes at the point of environmental concern. In addition, localized adverse impacts to water quality are not allowed.

Trading Framework

In order for pollutant trading to be authorized it must be specifically mentioned within a TMDL document. After adoption of an EPA approved TMDL, DEQ in concert with the Watershed Advisory Group (WAG) must develop a pollutant trading framework document as part of an implementation plan for the watershed that is the subject of the TMDL. The elements of a trading document are described in DEQ's Pollutant Trading Guidance (currently November 2003 Draft) available on the DEQ website at http://www.deq.idaho.gov/water/prog_issues/waste_water/pollutant_trading/pollutant_trading_guidance_entire.pdf. As of this writing the only two watersheds that have yet developed a pollutant trading framework are the Lower Boise River watershed and the Upper Snake Rock/Mid Snake TMDL watershed.

5.1 In-stream Water Quality Targets

The sediment TMDLs in this report address water-quality limited water bodies in the Pend Oreille Subbasin. The goal of a TMDL is to restore the water quality impairment to "full support of designated beneficial uses" (Idaho Code 39.3611.3615). Specifically in the case of sediment TMDLs, sedimentation must be reduced to a level where full support of the beneficial uses is demonstrated using the current assessment method accepted by DEQ at the time the water body is reassessed.

Loading capacities for these sediment TMDLs will be represented in terms of mass per unit of time (tons/ year and lbs/day). The interim goals will be set based on conditions in a reference watershed supporting native fish populations, more specifically, bull trout populations. Bull trout populations serve as excellent indicators of water quality conditions because bull trout are highly sensitive to environmental disturbances at all life stages and long-term population persistence is dependent upon five habitat characteristics; 1) cover, 2) channel stability, 3) substrate composition, 4) water temperature, and 5) availability of migratory corridors (Rieman and McIntyre 1993). As such, the impact of sediment loading on bull trout populations provides a viable measure regarding nonsupport of the narrative water quality standard for cold water aquatic life use.

The final goal will be achieved when biomonitoring demonstrates full support of the cold water aquatic life use and salmonid spawning beneficial use in relation to sediment loading. Sources contributing sediment can be reduced, but a substantial period (perhaps up to 30 years) may be required before beneficial use recovery is achieved.

Design Conditions

Modeled sources of sediment to water bodies within the Pend Oreille Subbasin are all nonpoint sources. Each TMDL addresses the nonpoint sediment yield of each watershed based on land use. Sediment from nonpoint sources is loaded episodically during high discharge events. High discharge events typically occur between November and May at intervals of several years. Critical conditions typically coincide with these large sediment delivery events. The typical minimum return period of the storm events that cause major sediment yield events is 10 to 15 years.

Target Selection

The sediment load capacity at which full support of beneficial uses is exhibited has been set at various levels in TMDLs developed by the DEQ. These have ranged from setting an interim load capacity at the background level for some watersheds in the Coeur d'Alene Lake Subbasin and the Pend Oreille Subbasin to more that 200 percent above background in some areas of the state.

Since numeric sediment criteria do not exist in the Idaho water quality standards for the Pend Oreille Subbasin, a critical step in development of sediment TMDLs is formulation of a rationale for creating a numeric translator for narrative criteria to serve as the water quality target. To determine the most appropriate target, each subbasin must be evaluated on an individual basis. Although it is well understood that streams have the ability to process sediment levels above natural background levels, it is not well understood to what level this is possible before impairment occurs. As a result, the use of a reference watershed was chosen as the method to derive a water quality target or numeric translator.

A reference (condition) stream was chosen to determine the appropriate sediment target to be used. A reference watershed, a watershed known to support a healthy population of bull trout was selected using local knowledge, data, and input from the Pend Oreille Tributary Working Group. Trestle Creek, a tributary to Pend Oreille Lake, was selected as the reference stream for the development of sediment TMDLs for these watersheds in the Pend Oreille Subbasin. Trestle Creek was chosen as a reference watershed because it supports some of the highest numbers of bull trout redds in the Lake Pend Oreille system (Corsi, *et al*. 1998), the stream is exhibiting passing WBAGII scores, and because the stream is considered undisturbed or "least impacted." Table 5-1 provides select land use characteristics in the Trestle Creek Watershed that demonstrate the undisturbed or "least impacted" conditions.

Table 5-1. Trestle Creek - Reference Watershed Characteristics

	Trestle Creek
Watershed Type	Reference Watershed
Watershed (acres)	12,574
Designated Beneficial Uses	CWAL, SS, SRW, SCR
Land Use Types	**% Land Use (acres)**
Forest*	94.0% (11,769)
Recent Harvested Forest (1997-2006)	0.6% (75)
Recent Burned Forest (1997-2006)	0.0% (0)
Pastureland-Permanent	1.0% (129)
Shrubland*	2.4% (299)
Urban or Developed Land	0.32% (40)
Barren	2.6% (323)
Water/Wetlands	0.12% (15)
	Number of Mass Wasting Events
Natural Slides*	0
Anthropogenic Slides	4

* Loads from naturally occurring land use types are not allocated for reductions.

The robust native fish community in Trestle Creek and the undisturbed characteristics (coniferous forest) of the watershed provide an acceptable representation of minimally impacted conditions to which impaired water bodies can be compared. To convert the qualitative and quantitative characteristics (WBAGII scores) of a reference condition watershed into a numeric translator, a method was developed to estimate a percentage above the natural background load of sediment in the Trestle Creek Watershed. This would establish the load capacity or water quality target for similar watersheds not supporting their cold water aquatic life or salmonid spawning uses.

The sediment yield target was derived from the current condition of Trestle Creek by modeling the watershed using the same method and input variables as those used for each impaired water body. Using the modeling approach summarized in Appendix A, sediment yield coefficients were applied to each appropriate land use/land cover category in Trestle Creek and multiplied by the associated acreage. Based on literature values which are provided in Appendix A, it appeared that a sediment yield coefficient of about 0.02 to 0.03 tons/acre/year was on the conservative side of an average for coniferous forestland. A value of 0.0234 tons/acre/year used in previous DEQ TMDL studies was calculated using the WATSED program. Because this value fell within the acceptable range of values, it was chosen as the sediment yield coefficient for calculating the Pend Oreille Tributaries Sediment TMDLs.

A sediment yield value representative of minimally impacted conditions was determined by multiplying the acreage of the watershed by the natural background sediment coefficient. The percentage above natural background was then derived by subtracting natural background conditions from current conditions, dividing by natural background conditions and then multiplying by 100.

$$\text{Percent Above Background (Water Quality Target)} = \frac{\textbf{Current Estimated Load (t/a/yr) - NB (t/a/yr)}}{\textbf{NB}} \times 100$$

The current sediment yield condition (percentage above natural background) of Trestle Creek was then analyzed to determine the most appropriate sediment yield target for the sediment impaired water bodies in the Pend Oreille Subbasin. Once the sediment yield target was defined, all other impaired water bodies within the Pend Oreille Subbasin were analyzed to determine watershed-specific current conditions, load allocations, and load reductions based on target conditions in Trestle Creek.

Through this method, a target of 42 percent above the natural background load was defined. Using this reference watershed approach, it is then assumed that if the sediment-impaired streams in the Pend Oreille Subbasin achieve a sediment yield condition similar to Trestle Creek (42 percent above background), it is anticipated that they ultimately will meet the target necessary to remove sediment as a pollutant source causing nonsupport of beneficial uses.

According to the method outlined above, the 42 percent above background target appears to be reasonable and protective of the beneficial uses of the watersheds in the Pend Oreille Subbasin. Therefore, the target load capacity for the sediment TMDLs in this report is set at 42 percent above natural background conditions.

Sediment Model Development

A method, specific to the Pend Oreille Subbasin, was developed to estimate the sediment load to select streams within this Subbasin. The method was developed to quantify the State of Idaho's narrative sediment water quality standard. The method accounts for all land use types separately. By estimating the existing contributing sediment load by land use types, implementation strategies may be developed to manage sediment loads on a more site-specific basis. All attempts to model sediment load were intended to provide a relative rather than exact sediment yield.

Six different types of modeling or estimation techniques were used to quantify the sediment load to the streams in the Pend Oreille Subbasin, depending on the source of the eroded sediment.

- Sediment yield coefficients, derived from the literature and previous studies, were used to estimate the sediment load from forestland, harvested forestland, burned forestland, shrubland, and urban areas.
- Revised Universal Soil Loss Equation Version 2 (RUSLE 2) estimated erosion from agricultural and permanent pastureland.
- WEPP Roads calculated erosion from roads, paved and unpaved, at stream crossings.
- The McGreer Relationship approximated erosion from roads, other than at stream crossings.
- The Cumulative Watershed Effects reports provided data to estimate the sediment load due to mass wasting (landslides) events.
- Application of best professional judgment was used to estimate stream erosion due to narrowing of the stream channel near roadways (road encroachment).

The results of these models and methods were then synthesized using Excel spreadsheets, one for each watershed, and the existing sediment contribution from each source of sediment was estimated. The natural background sediment load was estimated, and the sediment load capacity of each watershed was approximated. Appendix A contains a detailed description of the modeling methodology and input data used to develop the load capacity and TMDL calculations.

Monitoring Points

The existing DEQ BURP network will be utilized for long- term evaluation of compliance for watersheds exceeding the sediment target. While specific targets for sediment reduction are set as guidelines, beneficial use support status will be determined using the current assessment method accepted by DEQ at the time the water body is assessed. Monitoring will be completed using BURP protocols and other available information to assess support status of beneficial uses. While specific reaches of each water body are impaired by sediment, sediment yield reductions will be required from the entire watershed to ultimately achieve full support status. As a result future monitoring at the water body specific BURP stations listed in Table 5-2 will be critical to understanding movement toward beneficial use support on a long-term basis. The location of each BURP station in Table 5-2 is shown in Section 2, Figure 2-3.

Table 5-2. BURP Monitoring Stations for Long-term Evaluation of Beneficial Use Support

Watershed Name	Assessment Unit	Water Body Name	BURP ID
Gold Creek	ID17010214PN034_02	Gold Creek	1998SCDAB031
North Gold Creek	ID17010214PN025_02 ID17010214PN025_03	North Gold Creek	1994SCDAA014
Sand Creek	ID17010214PN049_02 ID17010214PN049_03	Sand Creek	1998SCDAB016
	ID17010214PN052_02	Schweitzer Creek	1997SCDAA011
Upper Pack River	ID17010214PN041_02	Pack River	2003SCDAA019
	ID17010214PN041_03	Pack River	1998SCDAB029
		Pack River	1994SCDAA008*

* DEQ will determine if the wadable stream or large river protocol is appropriate for beneficial use assessment at this station location.

5.2 Load Capacity

The load capacity of a TMDL designed to address sediment-caused water quality impairment is complicated by the fact that the state's water quality standard is a narrative standard rather than a quantitative standard. In these Pend Oreille Subbasin watersheds, the sediment-impairing beneficial uses is large bedload material in some places, however, most of the sediment-causing impairment is fine sediment. Adequate quantitative measurements of the effect of excess sediment have not been developed. Given this difficulty, an exact sediment load capacity for each TMDL is difficult to ascertain. Attempts to model sediment yield within the each watershed are designed to achieve relative rather than exact sediment estimates.

The natural background sediment rate is the sediment yield within a watershed prior to anthropogenic influences. The natural background sediment load was calculated by multiplying the area of each watershed by the natural background coefficient (0.0234 tons/acre/year), based on forested conditions. The natural background sediment yield coefficient applied within the Pend Oreille Subbasin assumes that each watershed was entirely vegetated by coniferous forest. Table 5-3 summarizes the load capacity of each water body. This calculation establishes the estimated allowable target load or the water quality target for each watershed. In the case of Rapid Lightning Creek, the load capacity is higher than the estimated existing sediment load and therefore a TMDL is not required. (See Appendix A for more detail.)

Table 5-3. Load Capacity Summary

Watershed	Load Type	Watershed Area (acres)	Estimated Existing Load (tons/year)	Natural Background Load (tons/year)	Load Capacity at 42% above Background[1] (tons/year)
Gold Creek	Sediment	7,747	390	181	257
North Gold Creek	Sediment	10,519	762	246	349
Rapid Lightning Creek	Sediment	30,985	1,014[2]	717	1,018
Sand Creek	Sediment	24,209	2,039	562	798
Upper Pack River	Sediment	48,467	2,309	970	1,377

[1]Load capacity=natural background x 1.42
[2]No TMDL is required since Existing Sediment Load is approximately equal to Load Capacity.

Seasonality and Critical Conditions Affecting Sediment Load Capacity

Sediment from nonpoint sources is not delivered to streams seasonally. It is delivered episodically, primarily during high discharge events. These critical events typically occur during November through May; however, such events may not occur for several years. The return time is usually about 10 to 15 years.

Critical conditions are part of the analysis of load capacity. The beneficial uses are impaired due to chronic sediment conditions, further substantiating the need for these TMDLs to address annual 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 can become acute pollution problems. Therefore, it is important to ensure that acute conditions do not occur. The proposed sediment reductions in the TMDL will reduce the chronic sediment load and will also reduce the likelihood that an acute sediment loading condition will exist. It is in this way that critical conditions are accounted for in the TMDL.

5.3 Estimates of Existing Pollutant Loads

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

There are no wasteload allocations for National Pollution Discharge Elimination System (NPDES)-permitted point sources of sediment in the Pend Oreille Subbasin. All sources of sediment to surface waters within the Pend Oreille Subbasin are nonpoint sources. Using the modeling method summarized in Appendix A, natural background loading estimates were derived for each watershed. Then human-caused nonpoint source loading estimates were derived in the same manner. The sediment yield from forestland, burned forestland, harvested forestland, shrubland, urban areas and unpaved and paved roads were estimated using sediment yield coefficients which are listed in Appendix A. The model coefficients used for forestland assume that Forest BMPs and practices in compliance with the Idaho

Forest Practices Act or better are in place for harvest and forest road construction and maintenance. The sediment yields from grassland areas (permanent and agriculture) were estimated using the RUSLE2 erosion model. It was assumed there was no erosion from barren (rock) areas and water.

The sediment yield from roads at stream crossings were estimated using the Water Erosion Prediction Project (WEPP) Roads erosion model, and the sediment yield from other roads were estimated using the McGreer relationship and the CWE scores (if available) for the roads in each watershed. In all cases the sediment yield rates for paved roads were considered to be 50 percent less than the rate used for unpaved roads. The sediment delivered to the streams from mass wasting events was estimated from the CWE Assessment reports (if available), and a unit erosion rate was estimated to predict erosion of streambanks caused by road crossings. Appendix A describes these processes in detail and provides graphic representation of spatial data analysis conducted to calculate land use/land cover loading estimates by watershed. Estimated existing sediment loads expressed as annual averages for all nonpoint sources for Gold Creek, North Gold Creek, Rapid Lightning Creek, Sand Creek, Schweitzer Creek, and the Upper Pack River are summarized by land use/land cover type in Table 5-4.

Table 5-4. Estimated Annual Average Existing Sediment Loads for Each Watershed by Land Type

Land Type	EXISTING SEDIMENT LOAD[1] (tons/year)				
	Gold Creek	North Gold Creek	Rapid Lightning Creek	Sand Creek	Upper Pack River
Forest[2]	151	210	690	376	584
Forest - Harvested	0	435	4	0	398
Forest - Burned	0	0	0	0	0
Grassland-Agriculture	170	0	78	406	0
Grassland-Permanent	0	3	0	261	386
Shrubland[2]	3	1	13	18	241
Urban	18	2	9	465	23
Unpaved Roads	31	72	108	347	255
Paved Roads	0	0	0	73	0
Mass Wasting-Natural[2]	0	0	0	0	34
Mass Wasting-Anthropogenic	0	0	0	0	296
Road Encroachment	17	39	112	93	92
Total Existing Load	**390**	**762**	**1,014**	**2,039**	**2,309**

[1] Existing Sediment Load = Natural Background Load + Human-caused Nonpoint Sources Load
[2] Sediment sources defined as natural.

5.4 Load Allocation

The pollutant load allocation is the load capacity minus a margin of safety and natural background. A pollutant load allocation is composed of the wasteload allocation of point sources and the load allocation for nonpoint sources. Since there are no sediment contributions from NPDES-permitted point sources, the wasteload allocation for all the TMDLs in this document is zero. These sediment TMDLs establish load allocations for nonpoint sources only.

Load allocations and reductions were modeled for each watershed and are summarized in Table 5-5. The allocations and percent reduction goals are based on the modeled estimate of nonpoint source sediment contribution and the watershed-specific reduction necessary to maintain loads below the load capacity, which was set at 42 percent above natural background conditions. (See Appendix A for a more detailed description of the derivation of the load allocations and reductions and a description of the conversion from average annual sediment loads (tons/year) to maximum daily sediment loads (lbs/day).)

Load allocations and percent reduction goals were also calculated for each type of land owner and are summarized in Tables 5-6 through 5-9. Further discussion on steps taken to allocate sediment load between landowners or resource managers along with a detailed breakdown of modeled land use type contribution can be found in Appendix A. The load reduction required for each land owner/resource manager is based on the difference between the estimated existing sediment contribution from each land use within each ownership category and the load capacity of the watershed at 42 percent above natural background. The background load is not treated as part of the load capacity and is not allocated as part of the TMDL..

The Pack River Watershed Council is an active group working in the Pack River watershed to reduce pollutant loads. Their involvement will help to achieve goals outlined in the TMDL. DEQ will also continue to be involved with public and agency groups working to reduce sediment loads within the Pack River watershed. In Tables 5-6 through 5-9 varying time frames (15-30 years) for meeting the pollutant load allocations have been listed. For certain land management categories where sediment load reduction requirements are small ($\leq$5 tons per year) a shorter time frame of 15 to 20 years may be achievable. Land managers should support the premise that pollutant load reductions may be achieved sooner where implementation strategies are targeted in areas where annual average sediment load reductions are 5 tons per year or less.

Table 5-5. Summary of Pollutant Load Reductions Required by Watershed

Watershed	Watershed Area (acres)	a Estimated Existing Load (tons/year)	Estimated Existing Load (lbs/day)	b Load Capacity at 42% above Background (tons/year)	Load Capacity at 42% above Background (lbs/day)	(a-b) Required Sediment Load Reduction (tons/year)	Required Sediment Load Reduction (lbs/day)	(a-b)/a x 100 Percent Load Reduction Required
Gold Creek	7,747	390	6,797	257	4,476	133	2,321	34%
North Gold Creek	10,519	762	13,285	349	6,093	412*	7,192	54%
Sand Creek	24,209	2,039	35,566	798	13,915	1,241	21,650	61%
Upper Pack River	48,467	2,309	40,275	1,364	23,787	945	17,989	41%
Rapid Lightning Creek	30,985	1,014	17,684	1,018	17,757	0**	0**	0%**

*Value varies from difference between column “a” and column “b” due to rounding error.
** Sediment determined not to be a pollutant of concern based on model.

Table 5-6. Sediment Load Allocations and Load Reductions Required for Land Managers in Gold Creek Watershed

Land Managers	Area (acres)	Existing Load (tons/year)	Existing Load (pounds/day)	Required Sediment Load Reduction (tons/year)	Required Sediment Load Reduction (pounds/day)	Time Frame for Meeting Allocations
Private	6,829	352	6,136	124	2,158	30 Years
County (Roads)	0***	10	166	5	94	15 Years
USFS	875	27	477	4	69	15 Years
Total	**7,747***	**390****	**6796****	**133**	**2,321**	

*The State also owns 43 acres in this watershed, but it was not included because they have no required sediment load reduction.
**The State has an existing sediment load of 1 tons/year (17 lbs/day) and a required sediment load reduction of 0 tons/year (0 lbs/day), but it was not included because the required sediment load reduction is 0 tons/year.

*** Note: While roads are present, the acreage for roads is not provided because the area (acreage) is insignificant when compared to the overall area of the watershed.

Table 5-7. Sediment Load Allocations and Load Reductions Required for Land Managers in North Gold Creek Watershed

Land Managers	Area (acres)	Existing Load (tons/year)	Existing Load (pounds/day)	Required Sediment Load Reduction (tons/year)	Required Sediment Load Reduction (pounds/day)	Time Frame For Meeting Allocations
Private	18	2	35	1	20	15 Years
USFS	10,498	760	13,248	411	7,171	30 Years
Total	**10,516***	**762**	**13,284****	**412**	**7,191**	

*The Military also owns 3 acres in this watershed, but it was not included because they have no required sediment load reduction.
**Total value varies from sum of individual values due to rounding error.

Table 5-8. Sediment Load Allocations and Load Reductions Required for Land Managers in Sand Creek Watershed

Land Managers	Area (acres)	Existing Load (tons/year)	Existing Load (pounds/day)	Required Sediment Load Reduction (tons/year)	Required Sediment Load Reduction (pounds/day)	Time Frame For Meeting Allocations
Private	16,523	1,648	28,738	1,075	18,752	30 Years
City of Sandpoint	4,000	164	2,852	55	953	30 Years
County Roads	0***	59	1,037	45	783	30 Years
State - IDL	758	53	916	29	503	30 Years
State – ITD Roads	0***	29	506	22	382	30 Years
BLM	1,997	65	1,128	15	269	30 Years
Total	**24,209***	**2,039****	**35,563****	**1,241**	**21,649****	

*The USFS also owns 931 acres in this watershed, but it was not included because their sediment load reduction is less than 0.5 tons/year.
**The USFS has an existing sediment load of 22 tons/year (386 lbs/day) and a required sediment load reduction of less that 0.5 tons/year (7 lbs/day), but it was not included because the required sediment load reduction is less than 0.5 tons/year. The total value varies from the sum of individual values due to rounding error.

*** Note: While roads are present, the acreage for roads is not provided because the area (acreage) is insignificant when compared to the overall area of the watershed.

Table 5-9. Sediment Load Allocations and Load Reductions Required for Land Managers in the Upper Rack River Watershed

Land Managers	Area (acres)	Existing Load (tons/year)	Existing Load (pounds/day)	Required Sediment Load Reduction (tons/year)	Required Sediment Load Reduction (pounds/day)	Time Frame For Meeting Allocations
Private	7,339	336	5,858	118	2,055	30 Years
County Roads	0**	15	258	9	162	30 Years
State	327	6	104	3	51	15 Years
USFS	40,598	1,946	33,942	814	14,203	30 Years
BLM	203	6	109	1	17	15 Years
Total	**48,467**	**2,309**	**40,272***	**945**	**16,487***	

*Total value varies from sum of individual values due to rounding error.

** Note: While roads are present, the acreage for roads is not provided because the area (acreage) is insignificant when compared to the overall area of the watershed.

Margin of Safety

Federal regulations (40 CFR §130.7(c)(1)) require that TMDLs include a margin of safety. The margin of safety is a conservative measure incorporated into the TMDL equation that accounts for the uncertainty associated with calculating the allowable sediment loading to ensure beneficial uses are attained. EPA guidance allows for use of implicit or explicit expressions of the margin of safety, or both. When conservative assumptions are used in development of the TMDL, or conservative factors are used in the calculations, the margin of safety is implicit. When a specific percentage of the TMDL is set aside to account for uncertainty, then the margin of safety is considered explicit.

Because the measure of sediment entering a stream throughout an entire watershed is a difficult and inexact science, assigning an arbitrary explicit margin of safety would add more error to the analysis. Therefore, the margin of safety for these sediment TMDLs in the Lake Pend Oreille Subbasin is implicit. The margin of safety is derived from conservative assumptions and estimates made in the model construction and application, which results in conservatively high estimates of sediment yield to surface water. Conservative estimates were made in the development of all land use type sediment yield coefficients. The conservative assumptions utilized in the modeling combine to provide an implicit margin of safety that over predicts sediment yield estimates to streams. A summary of the various assumptions that support an implicit margin of safety are provided in Table 5-10. Given the conservative assumptions used in the modeling approach, no additional explicit margin of safety is necessary as part of the TMDL calculations.

Table 5-10. Conservative Assumptions

	CONSERVATIVE ASSUMPTIONS
1	The McGreer relationship, comparing CWE Road Score and road erosion, was developed for roads on a Kaniksu granitic terrain, while it is being applied to a Belt terrain in this study. This overestimates the sediment yield from the roads.
2	Roads, further away than 200 feet from a stream, will have a delivery ratio of 10%.
3	Roads within 200 feet of a stream will have a delivery ratio of 80%.
4	Roads within 200 feet of a stream crossing will have a delivery ratio of 100%, an 8% grade to the stream, and have an insloped bare ditch.
5	Riparian areas have the same erosion rate as forested land. The actual erosion rate is lower because in riparian areas the topography will be flatter and have more grasses that will reduce erosion significantly
6	If the date of the landslide is not know it will be assumed to have occurred 10 years ago and the average annual sediment contribution will be divided by 10 years. In reality, the anthropogenic slides could have occurred 150 years ago. Also, erosion will occur at a much higher rate directly after the event, and as time goes on the rate will decrease. Assuming a straightline erosion rate is conservative.
7	The initial assumption for the sediment yield rate from forested land is 0.0234 tons per acre per year. This was developed for the Belt Supergroup so it is a conservative assumption for this terrain.
8	Assume delivery ratio from forest land to the streams is 100%.
9	Assume erosion from urban area is 0.25 tons per acre per year
10	The natural background sediment yield was based on the assumption that the land cover of each watershed is 100 percent forested.
11	Normally accelerated rates of erosion typically do not persist for more than several after revegetation, assigning an above background sediment yield coefficient to harvested forestland is a conservative estimate after several years.
12	Normally accelerated rates of erosion typically do not persist for more than several after revegetation, assigning an above background sediment yield coefficient to historic burns is a conservative estimate after several years.
13	It is assumed that streambank erosion occurs across the full width of a stream channel upstream and downstream of every road crossing
14	It is assumed that all erosion from grassland is delivered directly to a stream.
15	Simulation period of 30 years for WEPP Roads yielded an erosion rate from roads that was higher than average.
16	The Trestle Creek watershed is considered fully supportive of beneficial uses, so the Target % Above Background level was set by trial and error until the allowable sediment load was equal to the existing sediment load.

Seasonal Variation

Sediment from nonpoint sources is loaded episodically, primarily during high discharge events. These critical events coincide with the critical conditions that occur during November through May, generally during the rising limb of the annual hydrograph. Because of the episodic nature of sediment loading and the limitations modeling such events due to the number and uncertainty of factors involved in their occurrence, almost all models estimating sediment load predict average annual loads, which essentially averages high sediment load events with the periods of low sediment delivery (normally during the falling limb of the seasonal hydrograph) to arrive at an average annual sediment load. To estimate the total maximum daily sediment load, a method was developed to convert the average annual load to the total maximum daily load. It was assumed that the proportion of the maximum daily sediment load to the average annual sediment load is identical to the proportion of maximum daily flow to the average annual flow. Using this relationship, the average annual sediment load can be converted to the total maximum daily sediment load, which would occur at the end of May according to the daily flow hydrograph. Thus the seasonal variation in sediment loading is estimated by using the known seasonal variation in water flow. Appendix A discusses this process in more detail.

Reasonable Assurance

Given the large percentage of land in Upper Pack River, Trestle Creek, and North Gold Creek watersheds and other portions of the Pend Oreille Subbasin under USFS management, a high priority has been placed on forest management to improve bull trout habitat which should ensure implementation actions to reduce sediment loading. Sediment loads from private lands can be targeted through incentives provided to private land owners by the Bonner Soil and Water Conservation District and NRCS or grant programs administered by the IDEQ. The management committee formed by the Avista FERC Settlement Agreement has identified several tributaries in the Pend Oreille Subbasin as a priority bull trout restoration area, which should translate to the availability of significant management funds for watershed restoration projects.

Background

The background sediment loads for Gold Creek, North Gold Creek, Sand Creek, and the Upper Pack River are listed in Table 5-11 below. Natural background sediment yield was calculated by multiplying the watershed acreage by the sediment yield coefficient for forested land, and by adding the material contributed to surface waters from a naturally-occurring slide. The background load is not treated as part of the load capacity and is not allocated as part of the TMDL. Any unknown unallocated point sources would be included in the background portion of the load allocation.

Table 5-11. Background Sediment Load

Stream	Natural Background (tons/year)
Gold Creek	181
North Gold Creek	246
Sand Creek	562
Upper Pack River	970

Load Reserve

No part of the load allocation in these sediment TMDLs is held for additional future loading. There is no remaining available load for allocation. All future watershed management activities should be targeted to decrease sediment loads within each watershed.

Construction Storm Water and TMDL Wasteload Allocations

Construction Storm Water

The CWA requires operators of construction sites to obtain permit coverage to discharge storm water to a water body or to a municipal storm sewer. In Idaho, EPA has issued a general permit for storm water discharges from construction sites. In the past storm water was treated as a nonpoint source of pollutants. However, because storm water can be managed on site through management practices or when discharged through a discrete conveyance such as a storm sewer, it now requires an NPDES Permit.

The Construction General Permit

If a construction project disturbs more than 1 acre of land (or is part of larger common development that will disturb more than 1 acre), the operator is required to apply for permit coverage from EPA after developing a site-specific Storm Water Pollution Prevention Plan (SWPPP).

Storm Water Pollution Prevention Plan

To obtain the Construction General Permit (CGP) operators must develop a site-specific SWPPP. The operator must document the erosion, sediment, and pollution controls they intend to use, inspect the controls periodically and maintain appropriate BMPs through the life of the project.

Construction Storm Water Requirements

When a stream is identified as impaired and has a TMDL developed, DEQ will incorporate a gross wasteload allocation for anticipated construction storm water activities. Since there are no construction outfalls, the wasteload allocation for sediment and other pollutants is zero. Typically, there are specific requirements that must be followed to be consistent with any local pollutant allocations. Many communities throughout Idaho are currently developing rules for post-construction storm water management. Sediment is usually the main pollutant of concern in storm water from construction sites. The application of specific BMPs from *Idaho's Catalog of Storm Water Best Management Practices for Idaho Cities and Counties* is one source of information to meet the standards and requirements of the GCP. Local ordinances may have more stringent and site specific standards that are applicable. Permit applicants should contact the Coeur d'Alene Regional Office of DEQ for recommendations of construction BMPs that will be in compliance with the applicable TMDLs.

5.5 Implementation Strategies

DEQ and a designated management agency (DMA) responsible for TMDL implementation will make every effort to address past, present, and future pollution problems in an attempt to link them to watershed characteristics and management practices designed to improve water quality and restore the beneficial uses of the water body. Any and all solutions to help restore beneficial uses of a stream will be considered as part of a TMDL implementation plan in an effort to make the process as effective and cost efficient as possible. Using additional information collected during the implementation phase of the TMDL, DEQ and the DMAs will continue to evaluate suspected sources of impairment and develop management actions appropriate to deal with these issues. Data gaps exist in the Pend Oreille Subbasin sediment model and are not expected to be filled in the near future. However, DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that TMDL goals are not being met or significant progress is not being made toward achieving the goals.

Time Frame

For these sediment TMDLs at the watershed scale, 30 years has been allotted for meeting load allocations. For certain land management categories where sediment load reduction requirements are small ($\leq$5 tons per year) a shorter time frame of 15 to 20 years may be achievable. This timeframe should permit one or two large channel forming events to occur in the stream, which should be needed to remove the excess fine sediment from the stream bottoms.

Approach

TMDLs will be implemented through continuation of ongoing nonpoint source management activities in the Pend Oreille Subbasin. In partnership with the WAG, DMAs and other appropriate managers are expected to:

- Develop BMPs for forestry, road maintenance, agriculture, urban storm water runoff, and bank stabilization to achieve load allocations.
- Adhere to existing sediment TMDL allocations and implementation plans (e.g., Clark Fork/ Pend Oreille Subbasin Assessment and TMDLs, 2001, 2004 Lake Pend Oreille Nearshore TMDL Implementation Plan) for other relevant assessment units that will advance sediment load reductions required by the TMDLs in this report.
- Refine selection and responsibility for the implementation of BMPS in areas currently classified as grasslands (permanent or agricultural) that have been converted or will be to developed land (urban).
- Give reasonable assurance that management measures will meet load allocations through both quantitative and qualitative analyses of management measures.
- Adhere to measurable milestones for progress.
- Implement an effective public education and outreach strategy to improve knowledge of those in the watersheds on how to advance sediment management strategies.
- Develop a timeline for implementation, with reference to costs and funding.
- Develop a monitoring plan to determine if BMPs are being implemented, if individual BMPs are effective, if load allocations and wasteload allocations are being met, and whether or not water quality standards are being met.

The designated management agencies will recommend specific control actions and will then submit the implementation plan to DEQ. The DEQ will act as a repository for approved implementation plans and conduct 5-year reviews of progress toward TMDL goals.

Responsible Parties

In addition to the designated management agencies, the public, the Pack River Watershed Council, the WAG, and other organizations, will be provided with opportunities to be involved in developing the implementation plan to the maximum extent practical.

Monitoring Strategy

In-stream monitoring of the beneficial uses (cold water and salmonid spawning) support status during and after implementation of sediment abatement projects will establish the final sediment load reduction required by the TMDL. Data quality objectives that support evaluation of BMPs will be defined by DEQ and reviewed with the WAG. Monitoring will be conducted using the DEQ-approved monitoring procedure at the time of sampling. Identical measurements will be made in appropriate reference streams where beneficial uses are supported.

5.6 Conclusions

Based on the results from the modeling of a reference watershed (Trestle Creek), a sediment load capacity target of 42 percent above natural background conditions was set for Gold Creek, North Gold Creek, Rapid Lightning Creek, Sand Creek, Schweitzer Creek, and the Upper Pack River. The natural background sediment load was developed by classifying the land use type as forestland, determining the associated acreage from a geographical information system (GIS) analysis, and multiplying the designated acreage by a sediment yield coefficient specific to forestland. Modeling attempts by DEQ Coeur d'Alene regional office on the Kootenai/Moyie Rivers, St. Joe River, and the Lower Clark Fork River have generated a similar sediment yield target, and have been found to be protective of beneficial uses while allowing for an acceptable margin of safety.

All sediment loads allocated within the Pend Oreille Subbasin are allocated to nonpoint sources. No allocation is allotted for point sources of sediment. Sediment load allocations were allocated to resource managers and landowners based on the amount of sediment load from their land and the modeled land use types within the watershed. This report provides the required outcomes necessary to meet the federal regulations and guidance for TMDLs. The outcomes are summarized in Table 5-12. Since the TMDLs are established based on land use categories and land management responsibilities, the sediment TMDL required for Hellroaring Creek is incorporated within the TMDL calculations for the Upper Pack River. Likewise while a specific TMDL for McCormick Creek was deemed unnecessary as an outcome of the stressor identification reports, pollutant load reductions for McCormick Creek are nonetheless included in the sediment TMDL calculations for Upper Pack River since the entire Upper Pack River watershed was model as one watershed. Any reductions in sediment loading from the McCormick Creek watershed will further advance the sediment load reductions set by the TMDL for Upper Pack River. While only the mainstem of Sand Creek and Schweitzer Creek were validated as impaired, thus warranting TMDLs, additional TMDLs were established for other assessment units in the Sand Creek watershed including Sand Creek (ID17010214NP048_03 and _03a), Jack Creek (ID17010214NP050_02), Swede Creek (ID17010214NP051_02), and Little Sand Creek (ID17010214NP053_02). Sediment reductions in these assessment units will advance the success of achieving the sediment load allocations established for the Sand Creek watershed.

Based on the modeling results and the demonstration that the existing sediment load for Rapid Lightning Creek is below the load capacity, a sediment TMDL is not necessary for this assessment unit. However, Rapid Lightning Creek must still adhere to the sediment allocation established for the watershed in accordance with the Pack River sediment TMDL set forth in the 2001 DEQ *Clark Fork/Pend Oreille Subbasin Assessment and TMDLs* (IDEQ 2001).

Table 5-12. Sediment TMDL Outcomes

Water Body Name	Assessment Unit	Pollutant	TMDL(s) Complete	Recommended Changes to Integrated Report	Justification
Upper Pack River	ID17010214PN041_02 ID17010214PN041_03	Sediment	Yes	Move to Section 4a*	TMDL Completed
McCormick Creek	ID17010214PN042_02	Sediment	No	Remove unknown as pollutant	Stressor ID report verified that sediment was not the cause of nonsupport of CWAL
Hellroaring Creek	ID17010214PN044_02	Sediment	Yes	Move to Section 4a*	TMDL Completed
Sand Creek	ID17010214PN049_02 ID17010214PN049_03 ID17010214PN048_03 ID17010214PN048_03a	Sediment	Yes	Move to Section 4a*	TMDL Completed
Jack Creek	ID17010214PN050_02	Sediment	Yes	Move to Section 4a*	TMDL Completed
Swede Creek	ID17010214PN051_02	Sediment	Yes	Move to Section 4a*	TMDL Completed
Schweitzer Creek	ID17010214PN052_02	Sediment	Yes	Move to Section 4a*	TMDL Completed
Little Sand Creek	ID17010214PN053_02	Sediment	Yes	Move to Section 4a*	TMDL Completed
Gold Creek	ID17010214PN034_02	Sediment	Yes	Move to Section 4a*	TMDL Completed
North Gold Creek	ID17010214PN025_02 ID17010214PN025_03	Sediment	Yes	Move to Section 4a*	TMDL Completed

* Section 4a of the Integrated Report is “Impaired Waters with a Completed TMDL.”