Cœur d'Alene Lake

Management Plan

2009

Coeur d'Alene Lake Management Plan

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Executive Summary

Coeur d'Alene Lake is an increasingly popular recreational destination, an economic catalyst for Northern Idaho and Eastern Washington and the heart of the local community. The lake is part of the aboriginal homeland of the Coeur d'Alene Tribe, and their Reservation is located around its southern half. Development along the lake's shoreline has been dramatic in recent years, and it now features multiple resorts and an ever-increasing number of homes. Counties, cities, and towns in the Coeur d'Alene Lake Basin are growing, and the lake is a significant factor in that growth.

As a result of historical mining activity in the Silver Valley, millions of tons of metals contaminated sediments (e.g., zinc, lead, and cadmium) are present on the lake bottom. Other human activities around the basin, such as logging, farming, and home building, contribute sediments and nutrients (phosphorus and nitrogen) into the lake, often as a result of natural events such as snow, rain, and floods. Water quality in the lake has generally improved since the mid-1970s as the era of large-scale upstream mining-related activities tapered off, environmental cleanup activities got underway in the Silver Valley, and environmental regulations were implemented throughout the basin. The challenge today is to ensure that land use activity is managed in ways that will protect the lake's water quality.

to protect and improve lake water quality by limiting basin-wide nutrient inputs that impair lake water quality conditions, which in turn influence the solubility of mining-related metals contamination contained in lake sediments.

Authority to manage the lake's water quality rests with the Tribe, State and Federal governments. However, authority to manage activities around the basin that impact water quality in the lake is the responsibility of many other local, state, federal, and tribal agencies. For example, county governments in the basin use their authority under State law to promulgate zoning ordinances that regulate private land uses that can affect water quality conditions in the lake. Federal and State resource agencies also exercise authorities over upland activities that may influence water quality conditions in tributary waters and the lake.

In an effort to address the many issues facing Coeur d'Alene Lake, the Coeur d'Alene Tribe (Tribe) and the State of Idaho Department of Environmental Quality (DEQ) have collaboratively developed the 2009 Lake Management Plan (2009 LMP) with the goal: *to protect and improve lake water quality by limiting basin-wide nutrient inputs that impair lake water quality conditions, which in turn influence the solubility of mining-related metals contamination contained in lake sediments.* The United States Environmental Protection Agency (EPA) assisted the Tribe and DEQ in developing the LMP by convening and participating in an Alternative Dispute Resolution (ADR) process.

Achieving this water quality goal will require concerted, coordinated, and ongoing actions by these government agencies as well as those local, State, and Federal government agencies that manage or regulate activities in the Coeur d'Alene Lake Basin that affects lake water quality. Protecting the lake's water quality depends upon multi-level partnership between governments and the public. Education, understanding, and support from business organizations, environmental groups, and individual residents and visitors are essential. Finally, water quality protection requires funding from diverse sources to support the activities described in the 2009 LMP.

The 2009 LMP reflects the shared view of the Tribe and DEQ that a collaborative, adaptive, and data-driven approach is the best option at this time to manage water quality in Coeur d'Alene Lake. The 2009 LMP comprehensively identifies the actions and substantial resources that will be required to effectively manage Coeur d'Alene Lake and the large quantities of mining-associated hazardous substances in its waters and lakebed sediments. It is intended to serve as a framework for watershed-based lake management that will achieve the primary 2009 LMP goal and management objectives, described in Section 3, through a public-private partnership model.

The scope of the 2009 LMP encompasses the entire Coeur d'Alene Lake Basin. The reason for this is practical: loading of the lake with metals, sediments, and nutrients results from activities that occur around the lake, in upland areas, and along tributary streams and rivers. This scope is essential to effectively address the key influences on water quality. The scope is intended to follow natural boundaries, promote integrated solutions, and maximize the use of available resources to benefit water quality.

The 2009 LMP recognizes the importance of setting priorities to accommodate the challenges posed by the scope and cost of implementing this plan. The LMP approach has therefore been separated into two tiers. Tier I is considered the essential core LMP program that will be the initial focus for funding and implementation. It has the following components:

1) Conduct water quality monitoring and utilize computer modeling to increase scientific understanding of water quality trends
2) Conduct a basin-wide nutrient source inventory to set implementation priorities
3) Use Management Action Tables to coordinate implementation of existing programs with LMP partners
4) Develop and implement an education and outreach program to increase the community's awareness of lake conditions and promote lake stewardship

Tier II of the LMP includes: nutrient reduction projects, special studies, and coordination with TMDL program implementation.

To accomplish these activities, the Tribe and DEQ plan to create a collaborative "Implementation Team" who will provide the leadership to fully implement the 2009 LMP working with basin partners.

The following concepts serve as a basic framework for LMP implementation cost estimates:

- Funding is essential to support core LMP components
- Costs are yearly and long-term
- 5-year plans will identify implementation priorities and funding needs above and beyond core needs

Forward

Nothing in this LMP is or shall be construed to be a waiver of the sovereignty, jurisdiction, ownership or any claim of the Coeur d'Alene Tribe or the State of Idaho. Each party reserves, and nothing in the LMP affects, any rights, powers, and remedies of any Party now or hereafter existing in law or equity by statute, treaty executive order, regulation, court decision or otherwise. The LMP creates no rights in third parties or any right to judicial review.

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Table of Contents

Appendices

List of Figures

List of Figures cont.

List of Tables

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Glossary of Key Terms

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

Aboriginal rights – Aboriginal rights are often viewed as specific rights - rights that are grounded in the specific practices and customs of particular aboriginal peoples.

Algae – Small aquatic plants lacking stems, roots, or leaves that occur as single cells, colonies, or filaments.

Anoxic – The condition in which a water body has become deficient or completely depleted of dissolved oxygen.

Beneficial use – Any of the various uses that may be made of the water, including, but not limited to domestic water supplies, support of cold water aquatic life, salmonid spawning, recreation in and on the water, wildlife habitat, ceremonial, spiritual, and aesthetics.

Benthic flux – The rate that chemicals dissolved in water flow out of or into the bottom of aquatic systems. More specifically, benthic flux (sometimes referred to as internal recycling) represents the transport of dissolved chemical species across the solid-liquid interface at the bottom of aquatic systems. The flux of solutes can be either positive (into the water column from the sediment) or negative (out of the water column into the sediment) and can vary over multiple temporal and spatial scales.

Best Management Practices (BMPs) – Accepted methods for controlling nonpoint source pollution. BMPs may include one or more physical, structural, and/or managerial conservation practices that reduce or prevent pollution from entering a water body.

Bioaccumulation – The process by which a compound from the environment is taken up by and accumulated in the tissues of an aquatic organism, both from water sediments and through food.

Bio-magnification –The increase in concentration of a substance that occurs in a food chain as a consequence of food chain energetics or low (or nonexistent) rate of excretion/degradation of the substance.

CERCLA – Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), on December 11, 1980 and amended the statute in 1986 pursuant to the Superfund Amendments and Reauthorization Act (SARA). Among the statute's provisions, CERCLA established (1) broad Federal authority to respond directly to releases or threatened releases of hazardous substances to the environment that threaten or potentially threaten public health or the environment; (2) prohibitions and requirements concerning closed and abandoned hazardous waste sites; (3) a tax on the chemical and petroleum industries, which expired in 1996 without reauthorization, and whose proceeds funded a trust fund - the "Superfund" – the purpose of which is to finance CERCLA cleanup at hazardous waste sites that have been listed on the National Priorities List; and (4) a liability scheme by which federal, state, and tribal governments can recover their costs in responding to CERCLA hazardous waste sites from those responsible for conditions at those sites.

Chlorophyll *a* – The dominant green, photosynthetic pigment in plants that is one measure of aquatic plant abundance and biomass.

Clean Water Act (CWA) – Formerly titled the Federal Water Pollution Control Act of 1972, the CWA is the primary federal law in the U.S. governing water pollution. The goal of the CWA is to restore and maintain the physical, chemical and biological integrity of the nation's waters so that they can support both the protection and propagation of fish, shellfish, wildlife, and recreation in and on the water. The CWA has grown over the years to incorporate efforts to control both point and non-point sources of pollution as well as shift the focus from being based solely on the chemical constituents found in the water to the overall chemical, physical and biological integrity of the watershed. Major changes were enacted in 1977 when it officially became known as the Clean Water Act. Other changes that have been enacted occurred in 1981, 1987 and 1990.

Designated use – Those water uses identified in water quality standards that must be achieved and maintained as required under the Clean Water Act.

Discharge – In the simplest form, discharge means an outflow. The use of this term is not restricted as to a watercourse or location and it can be used to describe the flow of water from a pipe, channel, or drainage basin. Other words related to discharge are runoff, flow, and yield.

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

ELCOM-CAEDYM model – A computer model made available through the Centre for Water Research at the University of Western Australia that has been developed and applied to examine specific processes and basin scale dynamics in lakes. The 3-dimensional hydrodynamic model, Estuary and Lake Computer Model (ELCOM), was customized to simulate the hydrological regime in Coeur d'Alene Lake including river loading of metals/nutrients and river plume flow through the lake. ELCOM was coupled to the Computational Aquatic Ecosystem Dynamics Model (CAEDYM) to simulate lake processes such as primary production, organic matter cycling within the water column, benthic flux of metal contaminants to/from lakebed sediments, and the interactive effects of dissolved zinc and algal productivity.

Epilimnion – The topmost layer in a thermally stratified lake, occurring above the deeper hypolimnion. The epilimnion is warmer and typically has a higher pH level and higher dissolved oxygen concentration than the hypolimnion. Being exposed at the surface, it typically becomes turbulently mixed as a result of surface wind-mixing. It is also free to exchange dissolved gases (e.g., oxygen and carbon dioxide) with the atmosphere.

Erosion – The wearing away of the landscape by water, wind, ice, or gravity.

Euphotic zone – Measured as the water depth where photosynthetically active radiation is 1% of the light incident on the surface. The euphotic zone is the theoretical upper layer that has sufficient light to support viable photosynthetic activity (plant growth).

Eurasian Watermilfoil (EWM) – A submersed perennial plant that has fine feather-like leaves arranged in whorls of four. The leaf generally has 12 or more leaflet pairs (not to be confused with the native plant Northern Watermilfoil, that has fewer than 12 leaflet pairs). This invasive aquatic noxious weed forms very dense mats of vegetation on the water's surface. These mats interfere with water-based recreation such as fishing, boating, water skiing, and swimming. Swimmers have been known to become entangled and drown in these surface mats. The dense mats increase the pH of the water and, under certain circumstances, can reduce the amount of dissolved oxygen, killing fish and other life.

Eutrophic – This term generally refers to a fertile, biologically productive body of water. It contrasts with oligotrophic and means literally, "nutrient rich."

Eutrophication – The natural process by which lakes and ponds become enriched with dissolved nutrients and sediments, resulting in increased growth of algae and rooted aquatic plants and reduced water clarity. Cultural eutrophication is a term for the acceleration of the eutrophication process caused by humans' land use activities.

Flow – The amount of water flowing in a stream or river channel at the time of measurement. Flow is usually expressed as cubic feet per second (cfs).

Geochemical –This term refers to alterations in the earth's crust as a result of chemical changes; focused on the distribution of the earth elements.

Heavy metal-laden sediment – Sediment contaminated with heavy metals such as lead, cadmium, arsenic, zinc, antimony, copper, and mercury.

Hypolimnion – The lowermost, non-circulating layer of cold water in a thermally stratified lake, often deficient in oxygen.

Limnology – The branch of science pertaining to the study of the physical, chemical, biological, and ecological aspects of fresh water; the structure and dynamics of ponds, lakes, streams, and wetlands.

Littoral zone – That portion of a lake or pond extending from the shoreline into the lake to the greatest depth occupied by rooted aquatic plants.

Load – The amount of substance, usually nutrients or sediment, discharged past a point. Load is expressed in amount of weight per unit of time.

Macrophyte – The larger, non-microscopic aquatic plants (often rooted) found in shallow areas of lakes and streams.

Mesotrophic – This term generally refers to a moderately fertile, biologically productive body of water, that means literally, "moderate nutrients."

Metalimnion – Also called the thermocline, the metalimnion is the middle layer of a stratified lake where water temperature changes rapidly with depth (more than 1 °C per meter).

Mixing zone – The portion of water body adjacent to a point source discharge where mixing results in the dilution of the effluent with the receiving water.

Model – A simulation by descriptive, statistical, or other means of a process otherwise difficult or impossible to observe directly. Often, the term refers to results of computerized modeling.

Nitrogen – An essential nutrient for plants and animals. Atmospheric molecular nitrogen comprises 80% of the earth's atmosphere.

Nonpoint source pollution – A dispersed source of pollutants generated from a geographic area when pollutants are dissolved or suspended in runoff and then delivered into receiving waters. Nonpoint sources are without a discernable point or origin. They include, but are not limited to: atmospheric deposition; surface water runoff from agricultural lands, urban areas, or forest lands; and subsurface or underground sources.

Nutrient loading – The addition of nutrients, usually nitrogen or phosphorus, to a water body (often expressed in amount of weight per unit of time). The majority of nutrient loading in a lake usually comes from its tributaries.

Nutrients – Elements or compounds essential to life, including but not limited to, oxygen, carbon, nitrogen, and phosphorus. The term commonly refers to those elements in short supply, such as nitrogen and phosphorus, which can limit growth.

Oligotrophic – Generally refers to a water body with low biological productivity, and is the opposite of eutrophic: literally meaning, "nutrient poor."

Phosphorus – An essential nutrient for plants and animals derived from inorganic phosphate rocks. Phosphorus (a limiting nutrient) often controls phytoplankton growth in lakes.

Phosphorus is incorporated into human-made products such as fertilizers and detergents.

Phytoplankton – Free-floating microscopic (usually) aquatic plants consisting of single cells or filaments, or colonies. Some phytoplankton are flagellated. For example, free-floating diatoms are phytoplankton.

Point source pollution – Pollutants discharged from any discernible, confined, and discrete conveyance, including, but not limited to: any pipe, ditch, channel, sewer, tunnel, conduit, well, discrete fissure, container, concentrated feeding operation, marine vessel or other floating craft.

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

Primary production – The synthesis of organic compounds by green plants in the presence of essential elements (e.g., nitrogen, phosphorus) and light energy.

Receiving waters – Those waters which receive pollutants from point or nonpoint sources.

Riparian area – The area of land next to a stream, river, or lake. Maintenance of natural plants in the riparian area serves to protect water temperature and acts like a filter for runoff.

Riverine – Relating to, formed by, or resembling a river.

Sediment – Fragmented organic and inorganic material derived from the weathering of soil, alluvial, and rock materials removed by erosion and transported by water, wind, ice, and gravity.

Senescence – Refers to the biological processes of a living organism approaching an advanced age (i.e., the combination of processes of deterioration that follow the period of development of an organism). In Coeur d'Alene Lake the term is most often used for the annual deterioration of aquatic rooted plants that leads to an organic load to the water column and lakebed sediments.

Sentinel site – A site identified to monitor annual variability and extreme events.

Sewage – The water-carried human and animal waste from residences, buildings, industrial establishments, or other places, together with such infiltrated ground water and surface water as may be present.

Sink – A depression where materials are held (e.g., sediment, nutrients, metals).

STORET – The U.S. Environmental Protection Agency maintains two data management systems containing water quality information for the nation's waters: the Legacy Data Center (LDC) and STORET. The LDC is a static, archived database and STORET is an operational system actively being populated with water quality data.

Stormwater runoff – Surface water runoff is usually associated with urban development, carrying both natural and human-caused pollutants. Stormwater runoff can be conveyed to lakes, ponds, and streams either through point or nonpoint sources.

Stratification – The vertical separation of lake waters into three distinct layers, typically occurring from early summer into fall, due to differences in water density from warm water to cold water. The three layers are the epilimnion, the top of the lake, metalimnion (or thermocline), the middle layer that may change depth throughout the day, and the hypolimnion, the bottom layer.

Suspended sediment – Solids, either organic or inorganic, that are found suspended in a body of water and can be removed by filtration. The origin of suspended matter may be human-made wastes or natural sources such as silt.

Total Maximum Daily Load (TMDL) – A TMDL is a water body’s maximum load capacity for pollutants in which beneficial uses are still fully supported. A TMDL can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual basis. A TMDL can be expressed by the following equation: TMDL (load capacity) = [load allocation (nonpoint source) + waste load allocation (point source) + margin of safety]. In common usage, a TMDL also refers to the written document that contains the statements of loads and supporting analyses, often incorporating TMDLs for several waterbodies and/or pollutants within a given watershed.

Thermocline – A layer within a body of water or air where the temperature changes rapidly with depth.

Treatment in the same manner as a state – Congress amended the CWA by adding Sec. 518, in 1987, to address the roles of Indian tribes. Sec. 518 provides a method for tribes to assume the same duties and authorities as states to develop water quality standards for waters within Reservation boundaries.

Trophic status – This term refers to the nourishment status of a water body, i.e., oligotrophic, mesotrophic, eutrophic.

Turbidity – Cloudiness caused by the presence of suspended solids, such as clay, silt, and microscopic organisms in the water. Turbidity is an indicator of water quality. It can also refer to a scientific measurement of the extent to which light passing through water is scattered by fine suspended materials.

Unstratified – A lake condition of mixed waters, from surface to bottom, with uniform water temperatures throughout (i.e., a lake that is not stratified and lacks definite layers).

Wastewater – Treated or untreated sewage, industrial waste, or agricultural waste, along with such water as is present. Sometimes referred to as effluent.

Water quality – A term used to describe the chemical, physical, and biological characteristics of water with respect to its suitability for a beneficial use.

Water Quality Standard (WQS) – States and Tribes adopted, and EPA-approved, ambient standards for waterbodies. The standards identify those designated uses of a water body and establish the water quality criteria that must be met to protect uses. Standards are legally mandated by the Clean Water Act and are enforceable.

Water Year (WY) – The twelve-month period from October 1 to September 30, typically used by water management agencies and designated by the calendar year in which the water year ends (e.g., WY06 ended on September 30, 2006).

Watershed – An area of land that is drained by a distinct stream or river system and is separated from other similar systems by ridgetop boundaries. The waters of those lands that would drain to a lake (also referred to as the lake “basin”).

Wetlands – Lands where water saturation of the soil for at least part of the year is the dominant factor determining the nature of soil development and the types of plant and animal communities living within the area and the surrounding environment. Other common names for wetlands are sloughs, ponds, swamps, marshes, bogs, and riparian areas.

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Acronyms and Abbreviations

ACOE	U.S. Army Corps of Engineers
ADR	Alternative Dispute Resolution
BEIPC	Coeur d'Alene Basin Environmental Improvement Project Commission (formed in 2002)
BEMP	Basin Environmental Monitoring Program
BMP	Best Management Practices
CBRP	Coeur d'Alene Basin Restoration Project (1991 - 1996)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIA	Central Impoundment Area
CCC	Citizen's Coordinating Council
CCC	Criterion Continuous Concentration (chronic criteria) used only in Appendix A
CLCC	Clean Lakes Coordinating Council
CMC	Criterion Maximum Concentration (acute criteria)
CWA	Federal Clean Water Act
CWE	Cumulative Watershed Effects (IDL protocol)
CY91-92	Calendar Years 1991-1992 sampling from January 1991-December 1992
DEQ	Idaho Department of Environmental Quality
EPA	U.S. Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Acts
FPA	Idaho Forest Practices Act
FTE	Full Time Equivalent
GIS	Geographic Information Systems
IDAPA	Idaho Administrative Procedures Act
IDFG	Idaho Department of Fish & Game
IDHW	Idaho Department of Health and Welfare
IDL	Idaho Department of Lands
IDPR	Idaho Department of Parks & Recreation
IDWR	Idaho Department of Water Resources
INFISH	Inland Native Fish Strategy
kg	kilogram
Legislature	Idaho State Legislature

2009 LMP	2009 Coeur d'Alene Lake Management Plan
LSAS	Large Soil Absorption System
MATs	Management Action Tables
m	meter
mg/L	milligrams per liter
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC/ NAS	National Research Council/National Academy of Sciences
NRDA	Natural Resource Damage Assessment
OU	Operable Unit (as defined under CERCLA)
PHD	Panhandle Health District
ROD	Record of Decision
QAPP	Quality Assurance Project Plan
State	State of Idaho
TAS	Treatment as a State
TLG	Technical Leadership Group
TMDL	Total Maximum Daily Load
Tribe	Coeur d’Alene Tribe
TWG	Targeted Watershed Grant (EPA)
TSS	Total Suspended Sediment
UI - CES	University of Idaho, Cooperative Extension Service
µg/L	micrograms per liter
U of I	University of Idaho
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
WAG	Watershed Advisory Group
WCAC	Washington Citizens Advisory Committee
WQM	Water Quality Management
WQS	Water Quality Standards
WPCA	Water Pollution Control Account
WDOE	Washington Department of Ecology
WWTP	Wastewater Treatment Plant
WY04-06	Water Years 2004-2006 sampling from October 2003-August 2006

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The collaborative team from the Coeur d'Alene Tribe (Phillip Cernera and Rebecca Stevens) and Idaho DEQ (Gwen Fransen and Glen Rothrock), who together drafted the 2009 LMP, would like to acknowledge the unique support provided by several individuals that made completion of this document possible. Michael Harty, who was under contract for mediation services, provided crucial negotiating skills to help the team find agreement and stay on task to meet the ambitious schedule for completing this document. Michael offered sound advice on the structure of the LMP, and produced the initial version of the 2008 Draft LMP, giving the document concise wording and a true collaborative tone. Don Martin and Mark Masarik of EPA, who attended many of the writing sessions, offered valuable input for content and editing, and gave needed advice on EPA perspectives for the LMP. Special thanks go to Don for always having words of encouragement and good cheer during our many long and difficult writing sessions. Last and most, we want to thank Holly LeBret, who works with the Coeur d'Alene Tribe, for her mastery of the computer and Microsoft Word. Her patience with as many as seven people giving verbal sentence suggestions and editing comments, at times all at once, was infinite. Holly's ability to keep track of the numerous versions of the draft LMP, as they materialized, was truly amazing. Her thoughtful suggestions for simplicity and clarity of language made the LMP much more "reader friendly" and understandable for all.

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Section 1: Introduction and 2009 LMP Goal

Coeur d'Alene Lake is an increasingly popular recreational destination, an economic catalyst for Northern Idaho and Eastern Washington and the heart of the local community. The history of the Coeur d'Alene basin is rooted in the relationship of its inhabitants to Coeur d'Alene Lake, its tributaries and rivers (Figure 1). The lake has sustained the Coeur d'Alene Tribe from time immemorial and the non-indigenous settlers since their arrival in the 1850s (Figure 2). The basin's waters were essential to the success of the region's mining, timber, agricultural and hydropower industries during the twentieth century. In particular, mining activities along the South Fork of the Coeur d'Alene River and its tributaries have and will continue to have a significant influence on basin watershed conditions and on the welfare of its inhabitants.

While there have been advancements in mining practices and requirements, significant challenges remain for addressing metals contamination in the basin. Water quality in the lake has generally improved since the mid-1970s, as the era of large-scale upstream mining-related activities tapered off, environmental cleanup activities got underway in the Silver Valley, and environmental regulations were implemented throughout the basin.

Other human activities around the basin, such as logging, farming, wastewater treatment and home building, contribute sediments and nutrients (phosphorous and nitrogen) into the lake, often as a result of natural events such as snow, rain, and floods (Figure 3). Development along the lake's shoreline has changed dramatically in recent years, and features multiple resorts and an ever-increasing number of homes (Figure 4). Counties, cities, and towns in the Coeur d'Alene basin are growing, and the lake is a significant factor in that growth. The challenge today is to ensure that land use activity is managed in ways that will protect the lake's water quality.

The Coeur d'Alene Tribe (Tribe) and the State of Idaho Department of Environmental Quality (DEQ) have collaboratively developed this 2009 Lake Management Plan (2009 LMP) with the goal: *to protect and improve lake water quality by limiting basin-wide nutrient inputs that impair lake water quality conditions, which in turn influence the solubility of mining-related metals contamination contained in lake sediments.* The United States Environmental Protection Agency (EPA) assisted the Tribe and DEQ by convening and participating in an Alternative Dispute Resolution (ADR) process. Achieving this goal will require concerted, coordinated, and ongoing actions by these government agencies as well as those local, State, and Federal government agencies that manage or regulate activities in the Coeur d'Alene Lake Basin that affect lake water quality. Protecting the lake's water quality depends upon multi-level partnership between governments and the public. Education, understanding, and support from business organizations, environmental groups, and individual residents and visitors are essential. Finally, water quality protection requires long-term funding from diverse sources to support the activities described in the 2009 LMP.

The 2009 LMP is intended to serve as a framework for basin-wide lake management that will achieve the goal and objectives described in Section 3 through a public-private partnership

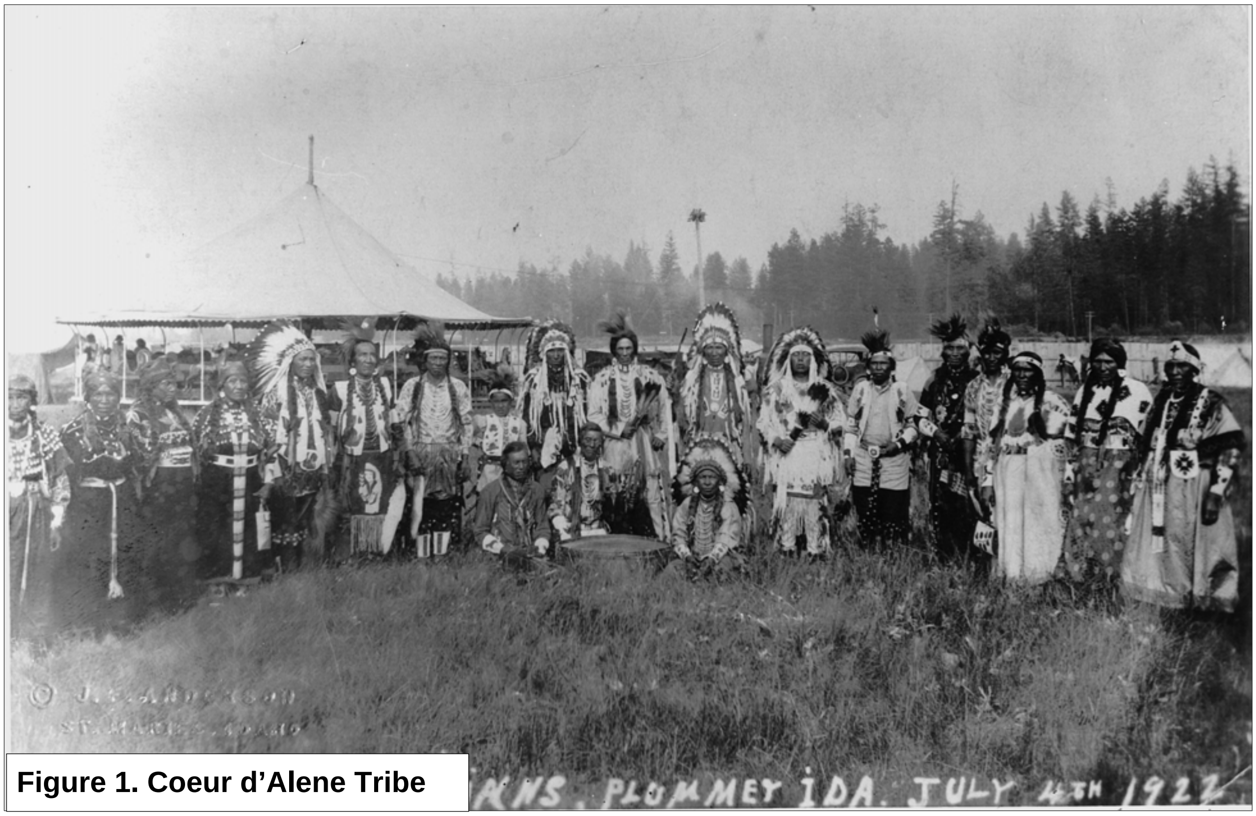

Figure 1. Coeur d'Alene Tribe

Figure 2. Silver Valley Mining & the Effects of Flooding

Figure 3. Flood induced plume, Coeur d'Alene River, May 2008

model. The need for water quality improvement and protection has been historically recognized in prior LMP efforts, in the 2002 Coeur d'Alene Basin Record of Decision (ROD), and recently in the National Research Council of the National Academy of Sciences report (NRC/NAS, 2005), that states: "Lake Coeur d'Alene is not included in the interim action, because its cleanup is to be addressed via a lake management plan… under separate regulatory authorities. Lake Coeur d'Alene will be addressed in a future ROD (EPA, 2004b)."

The 2009 LMP reflects agreement between the Tribe and DEQ, about the state of lake water quality and lake management goals, objectives, and strategies. It is the product of extensive efforts to understand and address the key interests of local, State, and Federal government agencies whose partnership is critical for successful implementation of the plan. It is also the product of efforts to begin partnerships with the business community, environmental groups, and individual citizens to promote education, understanding, and support for effective lake management.

1.1 Organization of the 2009 LMP

The LMP has six sections; each are described briefly below.

Section 1: Introduction and 2009 LMP Goal
This section focuses on a brief description of the basin and its history, including past efforts to implement effective lake management and the circumstances leading to the 2009 LMP, and the LMP Goal.

1933

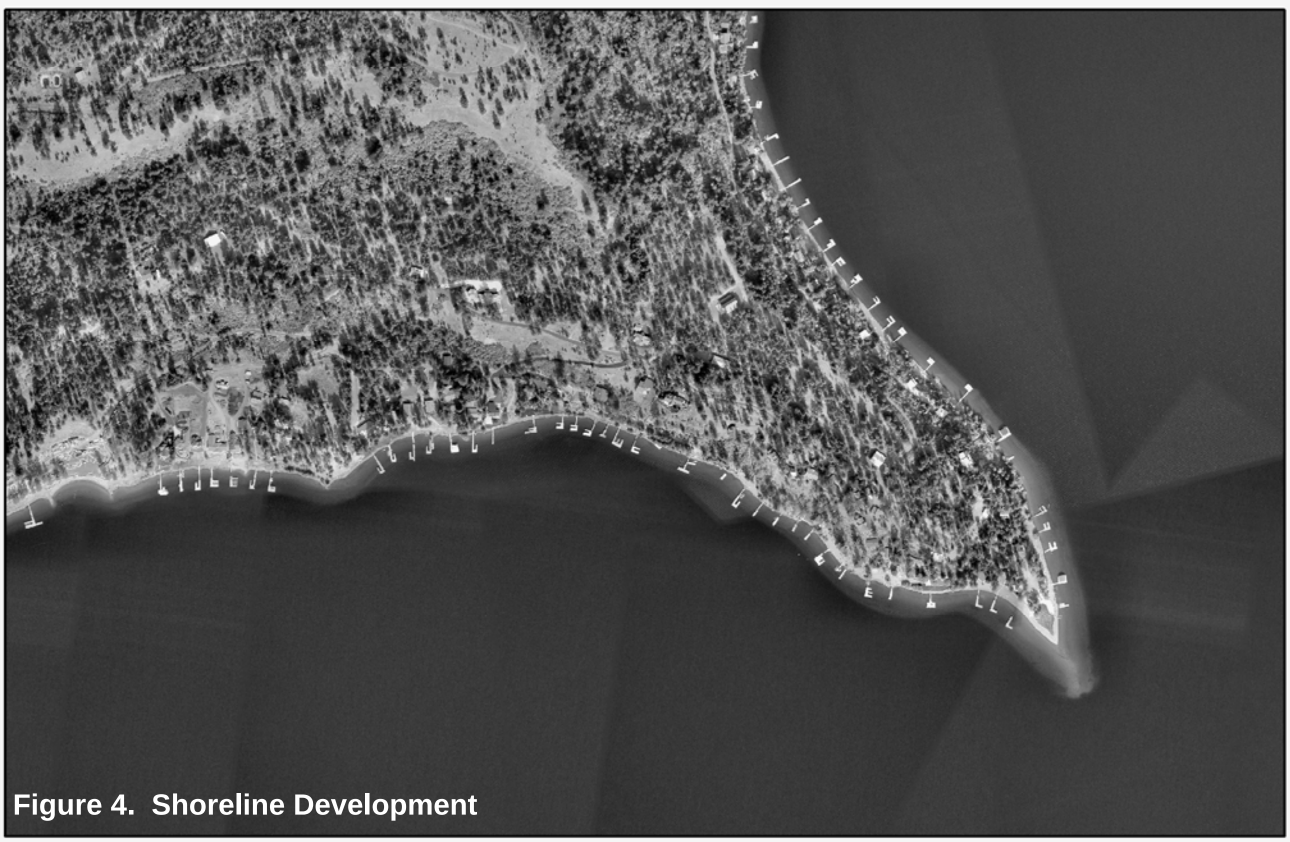

Figure 4. Shoreline Development

2007

Section 2: State of Lake Water Quality
This section presents a summary of the current state of water quality in the lake.

Section 3: Lake Management Objectives and Strategies
The 2009 LMP is organized around five management objectives and strategies to achieve those objectives that are described in this section.

Section 4: Administrative Structures for Lake Management
The 2009 LMP relies on existing structures and authorities and does not propose creation of a new level of government or new laws or regulations. This section describes existing structures and highlights the task of coordinating use of existing legal authorities to support effective lake management.

Section 5: Methods, Performance Actions, and Milestones
This section describes the adaptive management approach that serves as the foundation for the 2009 LMP and identifies specific ways to evaluate progress and adapt to new information or circumstances.

Section 6: Budgets Estimates, Schedules and Contingencies
This section presents a detailed look at estimated costs to implement the 2009 LMP using a tiered approach and an adaptive management model.

1.2 Physical Setting and Historical Background

Coeur d'Alene Lake is located in North Idaho within the Spokane River Basin. The drainage area to the lake is approximately 3,700 square miles, and includes the perimeter lands of Coeur d'Alene Lake, the Coeur d'Alene River subbasin, and the St. Joe/St. Maries rivers subbasin. Surface area of the lake is around 32,000 acres with an approximate volume of 2.3 million acre-feet (Woods and Beckwith, 1997). Maximum depth is 210 feet. The shoreline perimeter is 150 miles. This area is the aboriginal homeland of the Coeur d'Alene Tribe and is the location of their Reservation. Outflow from Coeur d'Alene Lake creates the Spokane River that flows west into Washington State and through Spokane (Figure 5).

From the late 1880s to the early 1980s, the "Silver Valley" was the nation's largest producer of silver, lead, zinc and other metals. The mining and ore-processing methods used to extract this wealth produced large quantities of waste material containing toxic or environmentally hazardous substances such as cadmium, lead, and zinc. Much of this material was directly discharged to, or washed into the South Fork of the Coeur d'Alene River and its tributaries. The beds, banks and floodplains of the Coeur d'Alene River, Coeur d'Alene Lake, and to a lesser extent the Spokane River, contain vast quantities of metals-contaminated sediments that continue to be transported downstream and dispersed by hydrologic processes and floods in the basin. An estimated 75 million metric tonnes of trace-element rich sediments from mining-related activities have been deposited into the lake since the late 19th century (Horowitz et al. 1995, Figure 6). A long-term significant financial commitment will be required to manage metals in place to prevent risk to human health and the environment. If not successful, one alternative could include extensive dredging that may further heighten concerns regarding environmental impacts and financial cost.

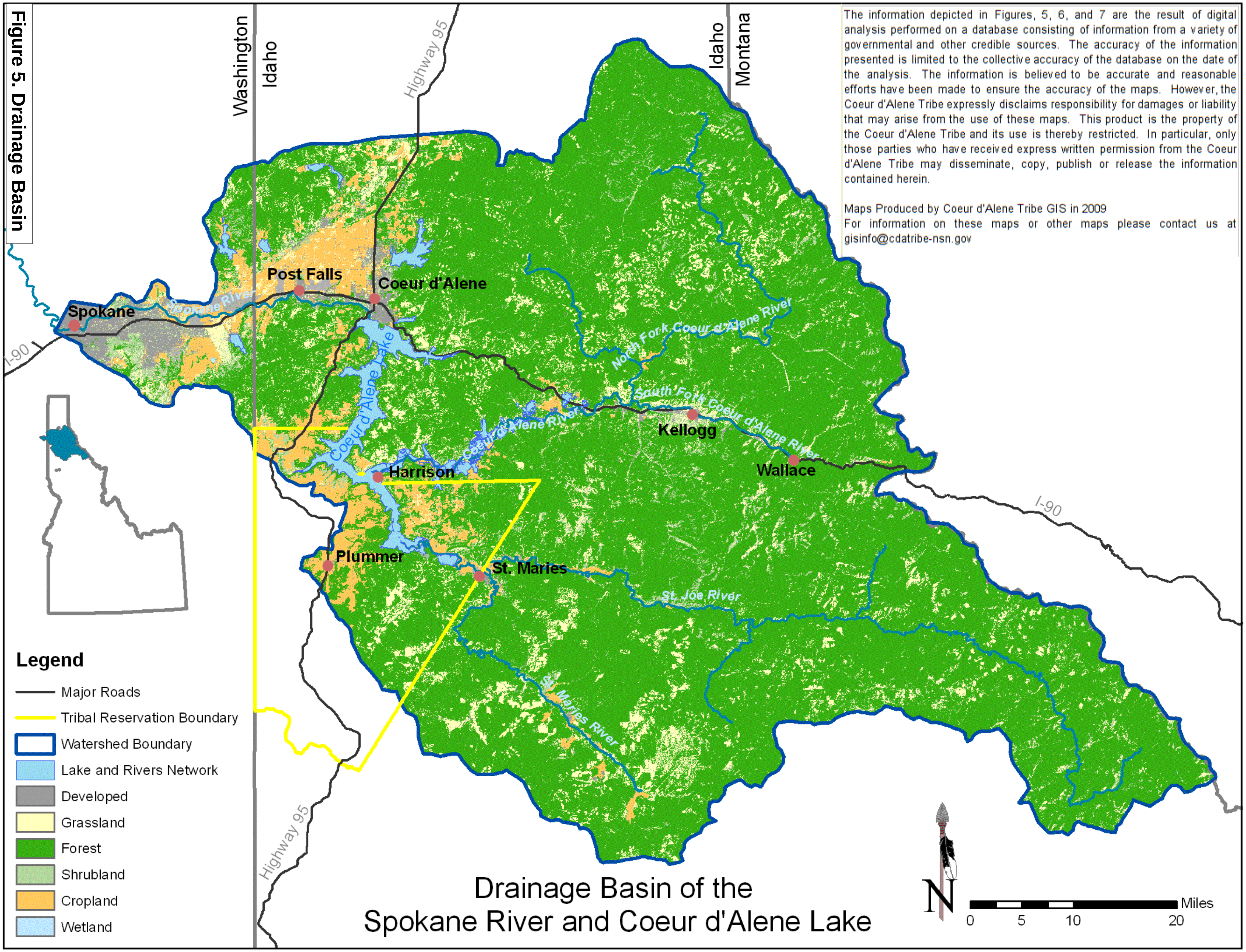

Figure 5. Drainage Basin

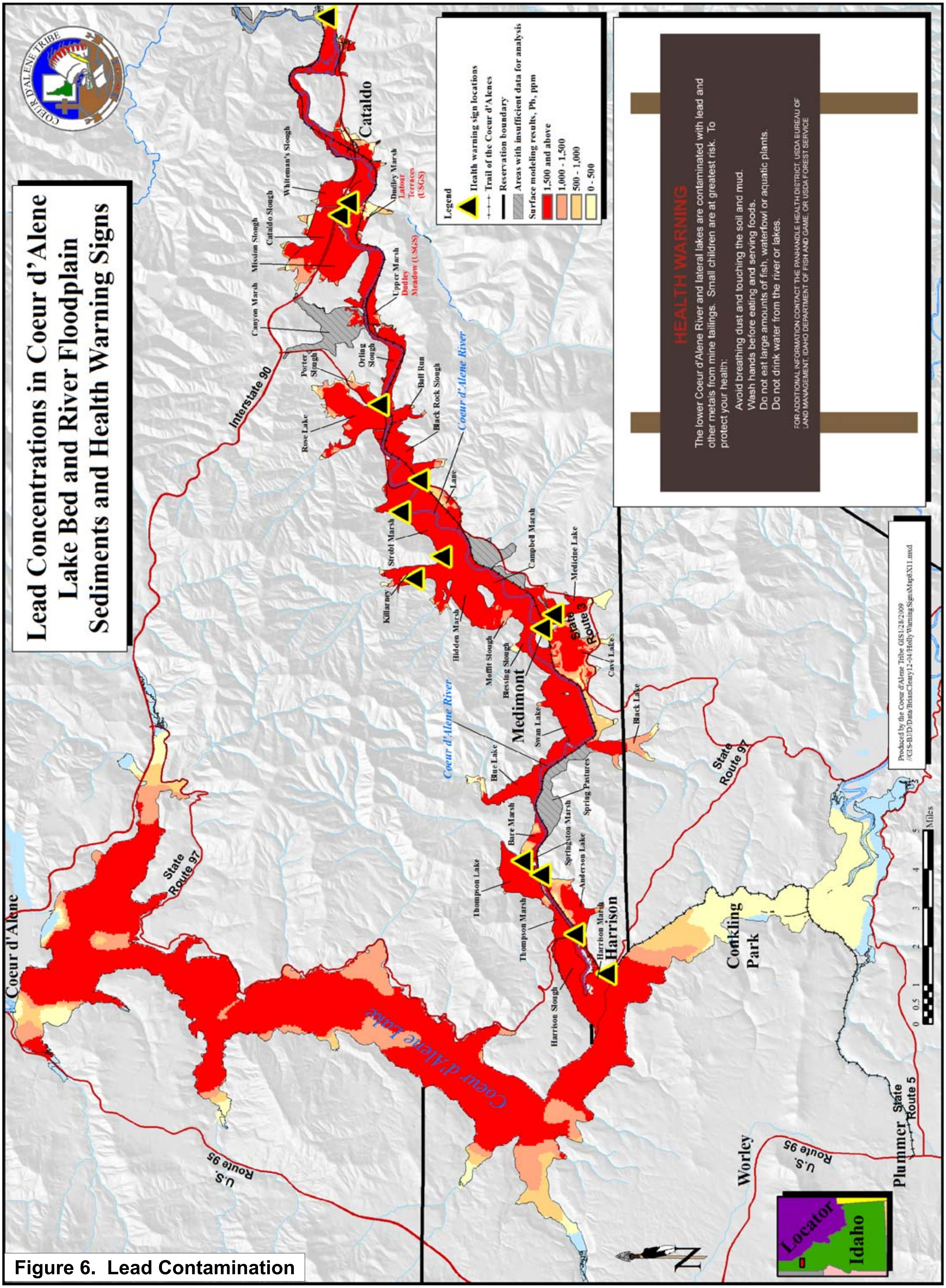

Figure 6. Lead Contamination

Metals present today in the lake sediments, water, and certain flora and fauna, include: mercury, copper, silver, cadmium, arsenic, lead, zinc, antimony, iron, and manganese. Metals also have been transported across Post Falls Dam and down the Spokane River into Washington State in the form of fine-grained sediment and dissolved metals. Transport of metals-contaminated sediment through the Coeur d'Alene Lake/Spokane River Basin is expected to continue for the foreseeable future.

In 1983 the U.S. EPA listed the Bunker Hill Mining and Metallurgical Complex on the National Priorities List (NPL) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), often referred to as Superfund. The Bunker Hill NPL site is in the heart of the Silver Valley and the Coeur d'Alene Lake Basin. EPA and DEQ initially focused their cleanup efforts in a 21-square mile box surrounding Kellogg, addressing potential human health risks associated with lead, cadmium, zinc, and arsenic as determined in the 1991 ROD, Operable Unit 1 (OU1). Non-populated areas were also addressed in the "box" in the 1992 ROD for OU2. Neither of these RODs addressed mining related metals contamination in the lake.

EPA expanded its CERCLA focus outside the original Bunker Hill box in 1998 with a Remedial Investigation and Feasibility Study for OU3. This encompassed areas within the Coeur d'Alene River and tributaries, Coeur d'Alene Lake, and the Spokane River downstream to Upriver Dam in Washington, where hazardous substances have come to be located. EPA issued its Interim ROD for OU3 in September 2002.

Although Coeur d'Alene Lake is within the Bunker Hill Superfund Facility, EPA did not select remedial actions for the lake in the 2002 Interim ROD. EPA deferred a decision on whether to select remedial actions for the lake pending the development and effective implementation of a revised Lake Management Plan (revision of the 1996 LMP). EPA concluded that "…an effective LMP created outside of the CERCLA defined process, using separate regulatory authorities, would reduce riverine inputs of nutrients and metals that continue to contribute to contamination of the lake and the Spokane River."

This ROD also addressed the possibility of future actions. One effect of EPA's decision was to limit its use of funds from the Superfund created under CERCLA to address mining related water quality conditions in the lake. EPA includes lake management in its regular 5-year reviews of ROD implementation progress, most recently in 2005 (EPA, 2005).

During the late 1980s and early 1990s, DEQ, the Tribe, and the United States Geological Survey (USGS) conducted studies of the lake and its surrounding watershed. These studies indicated that overall water quality in the lake was generally good and had improved compared to conditions reported in the mid-1970s by EPA. The improvement in water quality since the mid-1970s made sense, given the improvement in municipal wastewater treatment, continued implementation of the Federal Clean Water Act (CWA), advancement of mining technologies, and the reduction in mining activities in the Silver Valley. Remaining concerns were that Water Quality Standards (WQS) for metals were being violated and that dissolved oxygen depletion in the shallow, southern portion of the lake was routinely observed. Following completion of the USGS 1991-1992 water quality study (Woods and Beckwith, 1997), a *Coeur d'Alene Lake Management Plan* was developed by the Clean Lakes Coordinating Council (CLCC), DEQ, the

Tribe, and numerous advisory groups to address water quality issues identified in the study. The LMP was completed in 1995 and adopted in 1996 (CLCC et al. 1996). The 1996 LMP relied extensively on existing regulatory authorities and voluntary management actions to achieve its water quality goals. No new funding was provided and secure funding commitments to support implementation were lacking. There was no mechanism to track or coordinate voluntary efforts, monitor water quality, evaluate effectiveness of actions taken, or determine and implement additional necessary actions.

There have also been recent significant legal and regulatory actions concerning Coeur d'Alene Lake. The 2001 U.S. Supreme Court decision in *Idaho v. United States* affirmed that the United States, as trustee, and the Coeur d'Alene Tribe, as beneficiary, hold title to the bed and bank of all of the navigable waters lying within current boundaries of the Coeur d'Alene Indian Reservation, which includes portions of Coeur d'Alene Lake and the St. Joe River, and that they are entitled to the exclusive use, occupancy, and right to the quiet enjoyment of those submerged lands. The decision did not address title to the bed and banks of the navigable waters of Coeur d'Alene Lake and the Coeur d'Alene River outside the present Reservation and did not address the bed and banks of the navigable waters claimed by Idaho to be within Heyburn State Park.

The Tribe subsequently promulgated Water Quality Standards under Tribal law, with respect to all Reservation waters. The Tribe also applied for EPA approval to administer Clean Water Act programs under Sections 303(c) (standards) and 401 (certifications) on all Reservation waters so these Tribal standards could be proposed for Federal approval and administration under the CWA. This process is known as "Treatment in the same manner as a State (TAS)." In August 2005, the EPA acted on a portion of that application, approving the Tribe to administer these CWA programs on the waters of Coeur d'Alene Lake and the St. Joe River within the present-day Reservation. EPA's approval did not encompass waters with respect to Heyburn State Park. Consistent with the scope of EPA's approval, the Tribe consulted with the State of Idaho and EPA to develop proposed water quality standards for relevant waters, published these proposed standards for public review and comment, and is in the process of preparing responses to public comments before submitting the proposed standards for EPA approval under CWA Section 303(c). In the interim, EPA continues to refer to the water quality standards under Tribal law to guide its administration of the CWA Section 303(c) program on all Reservation waters (Figure 7).

During 2002, DEQ and the Tribe, in consultation with government agencies and other stakeholder groups, conducted an in-depth evaluation of the 1996 LMP and its implementation. The evaluation took into account the development of new information and recent legal or regulatory decisions. Local, State, and Federal governmental entities participated in this effort, along with industry, business, and environmental representatives. The result was a draft *Coeur d'Alene Lake Management Plan Addendum* (December, 2002), that offered conclusions and recommendations, but was never formalized.

Efforts to collaboratively develop a revised LMP during 2004 that reflected the advice gathered in the 2002 *Draft Addendum* were unsuccessful. There were disagreements on a number of issues, including the level of funding for staffing and implementation projects, and the reliability of that funding into the future. DEQ prepared its own draft LMP update in 2004 that was never

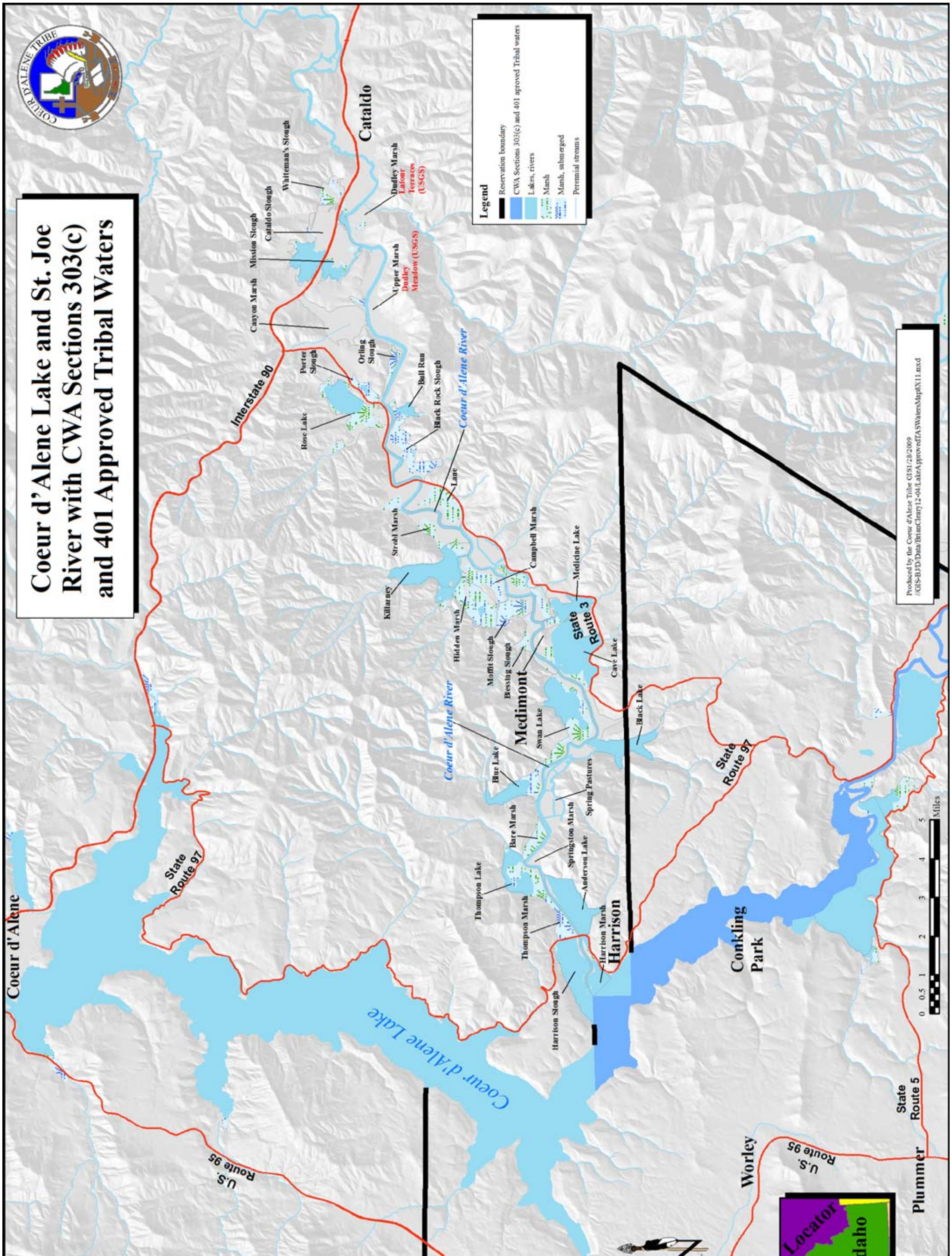

Figure 7. TAS Waters

formalized. The Tribe also prepared its own draft LMP in early 2006 that was never formalized. These disagreements and mutual recognition of the importance of effective lake management, led the Tribe, DEQ, and EPA to enter into a formal Alternative Dispute Resolution process (ADR), facilitated by a professional mediator for the purpose of reaching an agreed upon LMP.

The first phase of the ADR process was an assessment completed by the mediator during 2006. This assessment included more than 40 interviews and other discussions with basin stakeholders. A status report was provided in June 2006. A written report with recommendations was completed in January 2007.[1] The report addressed sources of impasse in prior LMP negotiations, ways to avoid future impasses through design of the negotiation process, and ways to effectively engage other governments and stakeholder groups in moving forward. The report recommended promoting reasonable openness and transparency about the negotiations through briefings and consultation, direct discussions about key interests related to lake management with basin stakeholders, and opportunities for nuanced discussion of issues among the Tribe, DEQ, and EPA as the governments having regulatory authority under the Clean Water Act. DEQ, the Tribe, and EPA jointly adopted many of the report's recommendations, modified others, and began negotiations on the LMP in the spring of 2007 with the assistance of the mediator. The intention was to reach agreement on a draft LMP by using a different approach and avoiding past problems.

DEQ and the Tribe developed a draft outline for the 2008 Draft LMP during the first part of 2007, and along with EPA, reached a technical consensus regarding the current water quality conditions in the lake, addressed in Section 2 and Appendix A. This information was shared with local, State and Federal elected officials, agency representatives, Washington State, business interests, and environmental representatives in September 2007. During October 2007, DEQ, the Tribe, and EPA held a series of direct consultations, in Coeur d'Alene, to explore key interests that should be addressed in the LMP. Only after these consultations did the Tribe and DEQ begin to develop a draft LMP, in January 2008. The 2008 Draft LMP was published in June 2008, followed by a 60-day public comment period. Thirty-three sets of comments were received. DEQ and the Tribe developed a "response to comments" document, published in January 2009. This 2009 final LMP incorporates revisions to the draft LMP as a result of public comments.

The 2009 LMP reflects the Tribe and DEQ's long-held view that a collaborative, adaptive, and data-driven approach is needed to manage water quality in Coeur d'Alene Lake. The 2009 LMP attempts to incorporate the substantive conclusions and recommendations made in the 2002 *Draft LMP Addendum*, within the context of the present environmental, institutional, and socioeconomic situation. The 2009 LMP comprehensively identifies the actions and substantial resources likely to be required for successfully managing Coeur d'Alene Lake and the large quantities of mining-associated hazardous substances in its waters and lakebed sediments.

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[1] The report is entitled "Assessment Report on Prospects for Mediated Negotiation of a Lake Management Plan for Lake Coeur d'Alene," and was prepared by Harty Conflict Consulting & Mediation through a contract with the U.S. Institute for Environmental Conflict Resolution (Institute). The report is available to the public on the Institute's web site: www.ecr.gov

1.3 2009 LMP Goal and Objectives

The goal of the 2009 LMP is to protect and improve lake water quality by limiting basin-wide nutrient inputs that impair lake water quality conditions, which in turn influence the solubility of mining-related metals contamination contained in lake sediments. The nutrients of concern are phosphorus and nitrogen. Increased loads of these nutrients into the lake increase algae and rooted aquatic plant growth through a process known as eutrophication. When this organic material decomposes, the process consumes oxygen dissolved in the water. Acceleration of this process, due to land use and development activities, is termed: cultural eutrophication. Depletion of dissolved oxygen (anoxia) concentrations in lake bottom waters will promote geochemical processes that release certain mining-related hazardous substances from lakebed sediments. Anoxia will also lead to the release of additional nutrients that stimulate production of algae and rooted aquatic plants that can lead to a cycle that is difficult or impossible to interrupt and that has harmful effects on water quality (Figure 8). Management objectives to achieve this water quality goal are listed below and described in Section 3.

1) Improve scientific understanding of lake conditions through monitoring, modeling, and special studies
2) Establish and strengthen partnerships to maximize benefits of actions under existing regulatory frameworks
3) Develop and implement a nutrient reduction action plan
4) Increase public awareness of lake conditions and influences on water quality
5) Establish funding mechanisms to support the LMP goal, objectives, and strategies

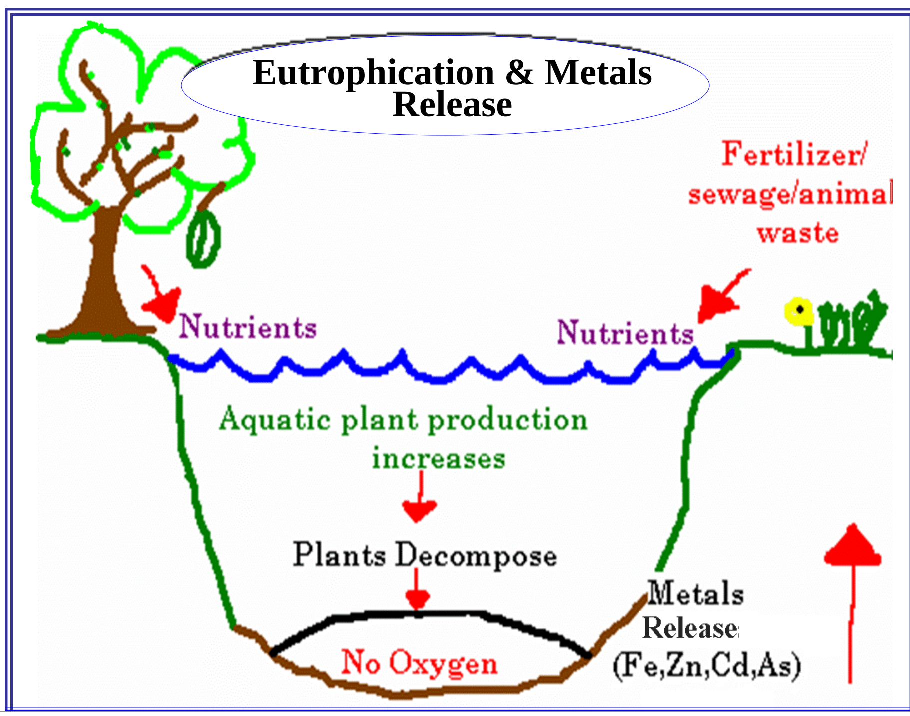

Figure 8. Eutrophication – The natural process by which lakes and ponds become enriched with dissolved nutrients and sediments, resulting in increased growth of algae and rooted aquatic plants and reduced oxygen and water clarity. Cultural eutrophication is a term for the acceleration of the eutrophication process due to man's land use activities. In Coeur d'Alene Lake, lack of oxygen would result in the release of metals.

1.3.1 Basin-wide Scope

Activities throughout the basin influence contributions of metals, sediments, and nutrients. For this reason it is practical to focus on activities that occur around the lake, in upland areas, and along tributary streams. An overly narrow focus on lakeside activities would limit the potential for dealing effectively with the key influences on water quality. The scope is intended to follow natural boundaries, promote integrated solutions, and maximize the use of available resources to benefit water quality. The slack water of the Spokane River, downstream of the lake and above Post Falls Dam, is considered part of the LMP scope.

1.3.2 Lake Management and Partnerships

The Coeur d'Alene Lake Basin is a prime recreational area for Northern Idaho and Eastern Washington, and the lake is its most popular feature. There has been substantial lakeshore development and increased resource use over the past decade, linked to increasing population. As one example, the U.S. Census estimates a 21 percent increase in Kootenai County's population between 2000 and 2006 (Table 1) [2]. This increase in development and population, while signaling a healthy regional economy, brings with it increased challenges for protecting the lake's water quality. State, Tribal, and Federal governments exercise their respective Clean Water Act authorities to manage lake water quality. Local, State, Tribal, and Federal agencies also exercise authorities over upland activities that may influence water quality conditions in tributary waters and the lake. For example, local governments in the basin use zoning ordinances to regulate private land uses that can affect tributary and lake water quality.

Effective lake management depends upon the creation and continuation of effective partnerships across governments. These partnerships must also engage the business community, local residents, advocacy organizations, and even visitors. In short, effective lake management requires a broad-based public and private partnership.

Table 1. Demographic Information[2]

Population	1990	2000	% Increase 1990-2000	2006	% Increase 2000-2006
Coeur d'Alene	24,561	34,527	40.5%	41,328	19.8%
Hayden	4,888	9,167	87.4%	12,349	35.6%
Post Falls	7,349	17,333	135%	24,515	41.5%
Kootenai County	69,795	108,685	55.7%	131,507	21%
State of Idaho	1,006,749	1,293,953	28.5%	1,467,465	13.3%
United States	248,765,170	273,643,273	13.1%	299,389,484	9.4%
Idaho was the fifth fastest growing state in the 1990s, and Kootenai County was the third fastest growing county in Idaho. Source: *U.S. Census Bureau*					

[2] U.S. Census Bureau, State and County QuickFacts, Kootenai County, ID. http://quickfacts.census.go/gfd/states/I6/16055.html

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Section 2: State of Lake Water Quality

2.1 Introduction

A key finding of the ADR assessment report was the need for a consistent description of current water quality conditions in the lake from the Tribe, DEQ, and EPA. A lack of consistency in the past has contributed to public misunderstanding about water quality through conflicting views and messages from different agency staff and technical experts (Harty, 2007). This section contains a summary of water quality sampling data that is intended to describe the current "State of Lake Water Quality." The Tribe, DEQ, and EPA agree on this technical description of the lake's current water quality and trends that form the basis for the 2009 LMP. A detailed State of Lake Water Quality appears in Appendix A.

The Coeur d'Alene Lake system is complex and interconnected, with two major rivers and numerous other tributaries flowing in and mixing with lake waters that then discharge to create the Spokane River. The system is directly influenced by land uses (that are always changing) throughout the Coeur d'Alene Lake Basin (Figure 5). The Tribe and DEQ expect that this section of the LMP – State of Lake Water Quality – will be updated annually and published to promote public understanding of the lake's conditions gained through continued monitoring, studies, and analysis.

2.2 State of Lake Water Quality

Water quality of Coeur d'Alene Lake is highly influenced by two major rivers, the Coeur d'Alene and the St. Joe, that bring in sediments (both rivers), nutrients (both rivers), and metals (Coeur d'Alene River). During years of average water runoff, the combined inflow of the two rivers is about 4.3 million acre-feet (e.g., WY06), while the estimated volume of the lake is about 2.3 million acre-feet, or about half of the total river inflow. Therefore, the lake volume is theoretically replaced twice a year.

Water quality data collected during 1991-92 and 2003-06 has been analyzed with the following key findings:

- *Total phosphorus concentrations* declined throughout the lake based on comparing 1975 data with 1991-92 data. However, total phosphorus concentrations increased lake-wide between 1991-92 and 2003-06, with the southern portion of the lake showing the most pronounced increase.
- *Microscopic algae* (phytoplankton), as measured by chlorophyll *a,* also declined throughout the lake, based on comparing 1975 with 1991-92. However, chlorophyll *a* concentrations increased lake-wide between 1991-92 and 2003-06.
- *Water clarity* throughout the lake improved between 1975 and 1991-92. Water clarity has remained the same since then.

- *Dissolved oxygen* approaches zero in deeper (hypolimnetic) waters during summer months in southern waters. This annual pattern has been evident from 1975 to present. Dissolved oxygen in deeper waters of the northern lake generally remains above 6 mg/L during summer months. This annual pattern has remained the same since 1975.
- *Zinc concentrations* within upper waters of the lake declined between 1991-92 and 2003-06. However, zinc concentrations still consistently violate WQS.
- *Lakebed sediments* are highly contaminated with antimony, arsenic, cadmium, zinc, lead, copper, silver, and mercury; in much of the lake.
- *The nuisance aquatic plant, Eurasian Watermilfoil,* has become established within the southern lake shallows and can be found as dense beds within some areas. Shallow bays of northern waters are at risk of invasion by Eurasian Watermilfoil (EWM)*.

The primary environmental concern in Coeur d' Alene Lake is the potential for release of metal contaminants contained in lake bottom sediments into the water column. To prevent this from occurring, oxygen levels must be maintained in bottom waters. Oxygen is controlled by the amount of decomposition of organic matter (plant and animal) that, in turn, is controlled by the amount of nutrients coming into the lake. The basic strategy of the 2009 LMP is to limit basin-wide nutrient inputs to the lake to prevent this chain of negative water quality events.

Based on the data presented above, a change in lake water quality is occurring. The measured increases in phosphorus concentrations and microscopic algae represent a negative trend. The Tribe and DEQ are concerned about this trend continuing and leading to further water quality degradation.

* The Tribe has an ongoing EWM Control Program in place, working in close coordination with the State of Idaho Department of Agriculture. Cost estimates for continuing and expanding EWM activities are shown in Section 6, Tables 8 and 9.

Section 3: Management Objectives and Strategies

This section describes in detail the five management objectives designed to support the primary 2009 LMP goal, along with rationales and strategies to achieve them. The Tribe and DEQ expect that the 2009 LMP goal and management objectives will be the key reference points for the full range of LMP decision making. They are intended to support the adaptive approach to lake management described in Section 5 of the 2009 LMP, including performance actions and milestones to support accountability. Budget estimates for achieving objectives and strategies can be found in Section 6.

3.1 Objective 1 – Improve Scientific Understanding of Lake Conditions through Monitoring, Modeling, and Special Studies

Rationale

Coeur d'Alene Lake has been the focus of considerable scientific investigation, through routine monitoring and special studies. An improved understanding of water quality trends is emerging, as summarized in Section 2. The complex interactions between the physical lake processes, nutrients, phytoplankton production (microscopic algae growth), and heavy metals require future studies to improve knowledge and the basis for lake management decisions (see Appendix B).

An ongoing science program is needed to ensure that management actions are effective and efficient. The program will be annually evaluated in a collaborative, transparent process. Scientific data will be reviewed, analyzed and reported annually thereby keeping the state of the lake information current for all stakeholders. Work plans linked to Objective 1 will be reviewed with suggestions made by scientific staff of governmental agencies, universities, and consulting firms. There are additional monitoring and study efforts identified in the Management Action Tables (MATs) that merit further consideration (Appendix C).

The strategy for achieving Objective 1 has the following four components:

1) Establish water quality "triggers"
2) Perform core routine monitoring: lake and rivers
3) Develop technical tools to support lake management
4) Conduct special studies

Each strategic component is described below.

Strategy: Establish Water Quality Triggers

There are several key water quality variables that need to be tracked in order to measure the long term health of the lake. These include, but are not limited to: levels of zinc, lead, cadmium, phosphorus, phytoplankton, and dissolved oxygen. The 2009 LMP establishes triggers for each of these variables and others, to gauge lake health. An annual comprehensive monitoring program produces trend data that provides an "early warning system" for deteriorating conditions. Ideally, this will allow corrective steps to be taken before conditions deteriorate to the point they would be very difficult and expensive to reverse, i.e., exceeding a trigger. See Section 5.1 for tables of water quality triggers.

In the event that monitoring data reveals trends that approach a trigger level for one or more constituents, this will prompt a comprehensive review to identify the causes of the trend and guide development of a corrective management response. Modeling will also be used as a tool to estimate additional nutrient reductions needed to restore water quality to below trigger levels. The MATs will be reviewed to verify implementation status and identify "next steps" for reducing nutrient inputs. Additional management actions will be prioritized, and may include: increasing the implementation of projects, targeting critical sources for reduction, reviewing Best Management Practices (BMP) effectiveness, and reviewing regulatory effectiveness (adequacy of enforcement and of rules). This adaptive management approach using water quality trends and triggers to signal the need for additional actions, followed with ongoing monitoring to determine the lakes response to these actions; will provide for a proactive and measured strategy for protecting water quality.

Strategy: Perform Core Routine Monitoring

The core routine monitoring program has two parts: the lake and rivers. Key activities for each part are discussed below. The locations of monitoring sites for the lake are shown in Figure B1 and for the rivers in Figure B2 (Appendix B).

Lake

A long-term core monitoring program is a critical element of an effective LMP for these reasons:

- Provides a record of key water quality variables captured during important periodic, flood-flow events
- Provides a long-term annual trend record that captures the considerable year-to-year variability of water quality data
- Provides a consistent, long-term record of dissolved oxygen profiles, the underlying key variable for a nutrient-based LMP to manage metals in bottom sediments
- Allows evaluation of total phosphorus, chlorophyll *a*, and phytoplankton composition trends and the observed declining trend of zinc concentration in upper waters

- Allows evaluation to determine if the significant higher phosphorus and chlorophyll *a* concentrations in southern waters contribute to the observed increases in northern waters as water flows from south to north
- Provides validation information for future use of the ELCOM-CAEDYM computer model as a tool to further understanding of lake conditions (see Computer Modeling below)
- Allows a data-driven adaptive management approach to the 2009 LMP based on yearly water quality information

In 2007 the Tribe and DEQ began a routine monitoring program, previously conducted by the USGS. This was initiated by development of a Quality Assurance Project Plan (QAPP). The lake monitoring program uses an EPA laboratory for sample analysis of metal concentrations; therefore EPA reviewed and approved the QAPP. If EPA continues to provide laboratory support to the monitoring program, it will review and approve the QAPP annually. The core routine monitoring program for the 2009 LMP is presented in Appendix B. Additional monitoring program details are found within the QAPP. An electronic version of the QAPP is on the DEQ website *www.deq.idaho.gov* (use the “Find it Fast” menu and click Coeur d’Alene Lake Management).

Rivers

Rivers are significant sources of nutrient input to the lake. The core monitoring program requires sampling stations in key river locations. The sampling stations include existing Basin Environmental Monitoring Plan (BEMP) sites, and additional new stations on the Coeur d’Alene and St. Joe rivers to fill data gaps. Appendix B describes the monitoring program in detail.

Strategy: Develop Technical Tools to Support Lake Management Efforts

Computer Modeling

In addition to reacting to past events, effective lake management requires the ability to predict the effects of future activity and plan actions to prevent or reduce water quality impacts. The Tribe and DEQ are working collaboratively to add critical predictive capability through the use of computer modeling. Development of a model customized for Coeur d’Alene Lake (ELCOM-CAEDYM) was supported and funded through the Coeur d’Alene Basin Environmental Improvement Project Commission (BEIPC) from an EPA CWA grant.

In general, the model simulates important processes within the lake system such as: 1) inflow loading of metals and nutrients, and river plume flow through the lake, 2) sediment-water interactions, 3) primary production, and 4) organic matter cycling within the water column. In addition, the model can be used to predict dissolved oxygen profiles which can be validated with actual data. Use of the ELCOM-CAEDYM model will greatly enhance understanding of the complex dynamics within the lake system, and has the potential to produce predictive results based on future land use changes within the basin (Appendix B).

Strategy: Conduct Special Studies to Answer Key Questions

In addition to core monitoring described earlier, special studies to answer key questions that relate directly to the 2009 LMP objectives are needed. These studies will improve knowledge and understanding of internal nutrient cycling, metals release from sediments, foodweb toxicity, subsurface sewage systems impacts, and other factors (Appendix B). This strategy is consistent with the recommendations from the National Research Council of the National Academy of Sciences (NRC/NAS, 2005).

3.2 Objective 2 – Establish and Strengthen Partnerships to Maximize Benefits of Actions under Existing Regulatory Frameworks

Rationale

The 2009 LMP relies on LMP partners to use existing regulatory tools and management actions to address nutrient and sediment inputs to Coeur d'Alene Lake. The Management Action Tables, or MATs, are a critical feature of this approach (Appendix C). The MATs document the diverse jurisdictions of local, State, Tribal, and Federal agencies, as well as existing programs, BMPs, codes, and regulations that influence water quality. In 2006, the Tribe and DEQ developed a protocol for conducting routine performance audits and conducted an initial audit of the MATs to:

- Determine the extent to which the management actions identified in the 1996 LMP are being implemented
- Evaluate the effectiveness of implemented management actions
- Identify BMPs that are not being implemented correctly or fully
- Evaluate funding and resources needed to accomplish the management actions
- Assess the commitment to continue the management actions and if needed, recommend/develop new BMPs, management strategies, and/or regulations and standards

The strategy for achieving Objective 2 has the following five components:

1) Use the inventory of existing authorities found in the MATs to coordinate partnerships to implement the 2009 LMP
2) Improve understanding of existing authorities, programs, and activities and their potential to support the 2009 LMP goal and objectives
3) Engage with local, State, Federal and Tribal land managers to influence yearly workplans and support activities that will further the LMP goal
4) Collaboratively implement projects when appropriate
5) Repeat the audit at 5-year intervals to evaluate progress

Each strategic component is described below.

Strategy: Use the LMP MATs to Coordinate Partnerships

A set of tables identifying management entities and actions affecting lake water quality in the Coeur d'Alene basin was created as part of the 1996 LMP effort. These MATs (Appendix C) were updated and revised through an audit process conducted during 2007 by the Tribe and DEQ using EPA CWA grant funding, available through the BEIPC. The detail provided in the MATs is the primary source of information that will be used to develop and strengthen partnerships to support lake management efforts.

Strategy: Improve Understanding of Authorities

Through the MAT audit process described above, DEQ and the Tribe will improve understanding of the most current authorities of other agencies related to accomplishing the overall LMP goal (Appendix E). This includes, but is not limited to: applied BMPs, water quality improvement or remediation projects, policy changes within government agencies, revisions of existing rules and regulations, and introduction of new rules and regulations by management agencies. This ongoing process includes, but is not limited to: field audits, phone contacts, meetings, workshops, and coordination with various water quality groups and commissions.

Strategy: Engage with Land Managers to Identify Opportunities in Annual Workplans

The Tribe and DEQ will consult with LMP partners during their respective annual workplan development processes to identify opportunities to influence work priorities that will support the lake management goal and objectives. The MATs will provide a shared point of reference about authorities and programs. This information will be used for discussing and including activities by these partners in their annual workplans. Other priorities and implementation activities may be incorporated in the DEQ/Tribe yearly LMP workplan.

Strategy: Collaborative Projects

In situations where a collaborative effort is appropriate, the Tribe and DEQ will support LMP partner-projects that are consistent with the 2009 LMP goal. As an example, the recent Mica Creek nutrient reduction project involved numerous partners, including active participation by the landowner. Funding was provided by a CWA grant, settlement monies, and in-kind services to implement the project.

Strategy: 5-year Audit and Update of MATs

The audit process described previously will be conducted every five years. The Tribe and DEQ will also evaluate implementation of actions specified in the MATs in conjunction with the annual workplan development process.

3.3 Objective 3 – Develop and Implement a Nutrient Reduction Action Plan

Rationale

The magnitudes and locations of nutrient sources in the Coeur d' Alene Lake Basin need to be more specifically identified. Once identified, priorities for addressing these sources will be developed.

The strategy for achieving Objective 3 has the following four components.

1) Design and conduct a basin-wide nutrient source inventory to determine relative contributions
2) Use the basin-wide nutrient source inventory and ongoing monitoring to prioritize site specific projects for implementation in coordination with the management agencies identified in the MATs
3) Incorporate the Total Maximum Daily Load (TMDL) process under the CWA into the nutrient reduction plan
4) Incorporate appropriate mitigation measures required by FERC for relicensing of the Avista hydroelectric project into the nutrient reduction plan

Each strategic component is described below.

Strategy: Basin-wide Nutrient Source Inventory

Development of a basin-wide nutrient source inventory is an essential first step to identifying and prioritizing management action for nutrient reduction. This inventory will focus on nutrient and sediment loading at key hydrologic locations across the basin. Samples will be collected during various times of the year to develop an understanding of loadings throughout the basin. There will also be compilation of existing information from other sampling programs, wastewater treatment plants, land-use mapping, and other sources. The product will be a Geographic Information System (GIS) environmental database layer that clearly depicts load distribution throughout the basin. This information will provide the Tribe, DEQ, and LMP partners with data to support future decisions about where to focus nutrient reduction work.

Strategy: Prioritize Projects Based on Inventory

The 2009 LMP recognizes the need to implement projects to reduce nutrient loading in the lake. Decisions on which projects will be implemented will depend on a number of factors, such as results of the nutrient inventory, routine monitoring, cost effectiveness, landowner participation, funding sources, and coordination with existing programs described in the MATs. Examples of ongoing programs and projects are: upgrading wastewater treatment facilities, stabilization of eroding river and stream banks, reduction of sediment loading from state and federal public lands, implementing agricultural BMPs, and enforcing land development ordinances.

Opportunities for upgrading wastewater treatment and disposal practices in the basin must be explored for communities discharging to the lake or its tributaries, such as the Silver Valley, Harrison, Plummer, and St. Maries communities. In addition, wastewater treatment upgrades may be needed in populated and/or developing bays on the lake or adjacent uplands. Costs for upgrading the wastewater treatment and disposal infrastructure in the basin for the purpose of reducing nutrient inputs to the lake will be large. As an example, in 1991, a sewer system that eliminated near-shore subsurface disposal sewage systems was installed in Kidd Island Bay for approximately 350 users, at a cost of approximately $2.6 million (in 2006 dollars).

Strategy: Incorporate TMDLs into the Nutrient Reduction Plan

A component of the nutrient reduction plan involves the Clean Water Act TMDL process for both DEQ and the Tribe. Under CWA section 303(d), DEQ and the Tribe are required to identify waters that are not meeting Water Quality Standards (WQS) or supporting beneficial uses. This process is ongoing. For these impaired waters, a TMDL is prepared for each pollutant. A TMDL is a calculation of the maximum quantity of a pollutant that can be added to a specific water body from all sources, human and natural background; without exceeding WQS. Idaho’s 303(d) list of impaired waters and TMDLs must be approved by EPA, and Idaho also must incorporate approved TMDLs into planning processes and water quality management plans. The EPA has developed a national list of impaired waters in Indian Country. Several of these streams are within the Coeur d’Alene Reservation. Figure 9 shows all waters within the Coeur d’Alene Lake Basin that are impaired by metals, sediments, nutrients, or bacteria (mostly sediment and metals), and a list of them is found in Appendix D. Implementation projects under the TMDL program will be incorporated into the LMP nutrient reduction plan.

Lake Metals TMDL

The portion of Coeur d’Alene Lake, north of Hidden Lake, within State of Idaho jurisdiction, is included in Idaho’s 303(d) list of impaired waters with metals as the pollutant of concern. The portion of Coeur d’Alene Lake, north of Hidden Lake, within Tribal jurisdiction, is currently not included in EPA’s Indian Country 303(d) list.

DEQ and EPA completed a metals TMDL for the Coeur d'Alene River subbasin, including Coeur d'Alene Lake, in 2000. The Idaho Supreme Court subsequently ruled that the required rule making procedures were not followed in setting the TMDL, making it null and void. State legislation in 2003 clarified that for all other waters in Idaho, rule making procedures are not required for TMDLs. The legislation, however, kept the rule making requirement identified by the Idaho Supreme Court in place for a metals TMDL for the Coeur d'Alene River subbasin. To date, there is no EPA approved metals TMDL for the lake, for either State or Tribal areas.

EPA has issued new point source discharge permits for the Coeur and Hecla mines that have significantly reduced the amount of metals they can discharge. The EPA is also implementing remedies identified in the OU2 and OU3 RODs, as described in Section 1.2, to reduce incoming metals to the lake. The 2002 ROD also includes reference to an LMP to address issues related to metals in the lake and lakebed sediments.

The Tribe and DEQ are not proposing a TMDL for metals as part of the 2009 LMP, at this time. The 2005 Idaho Legislation (House Bill 145) directs DEQ to revisit all TMDLs every five years

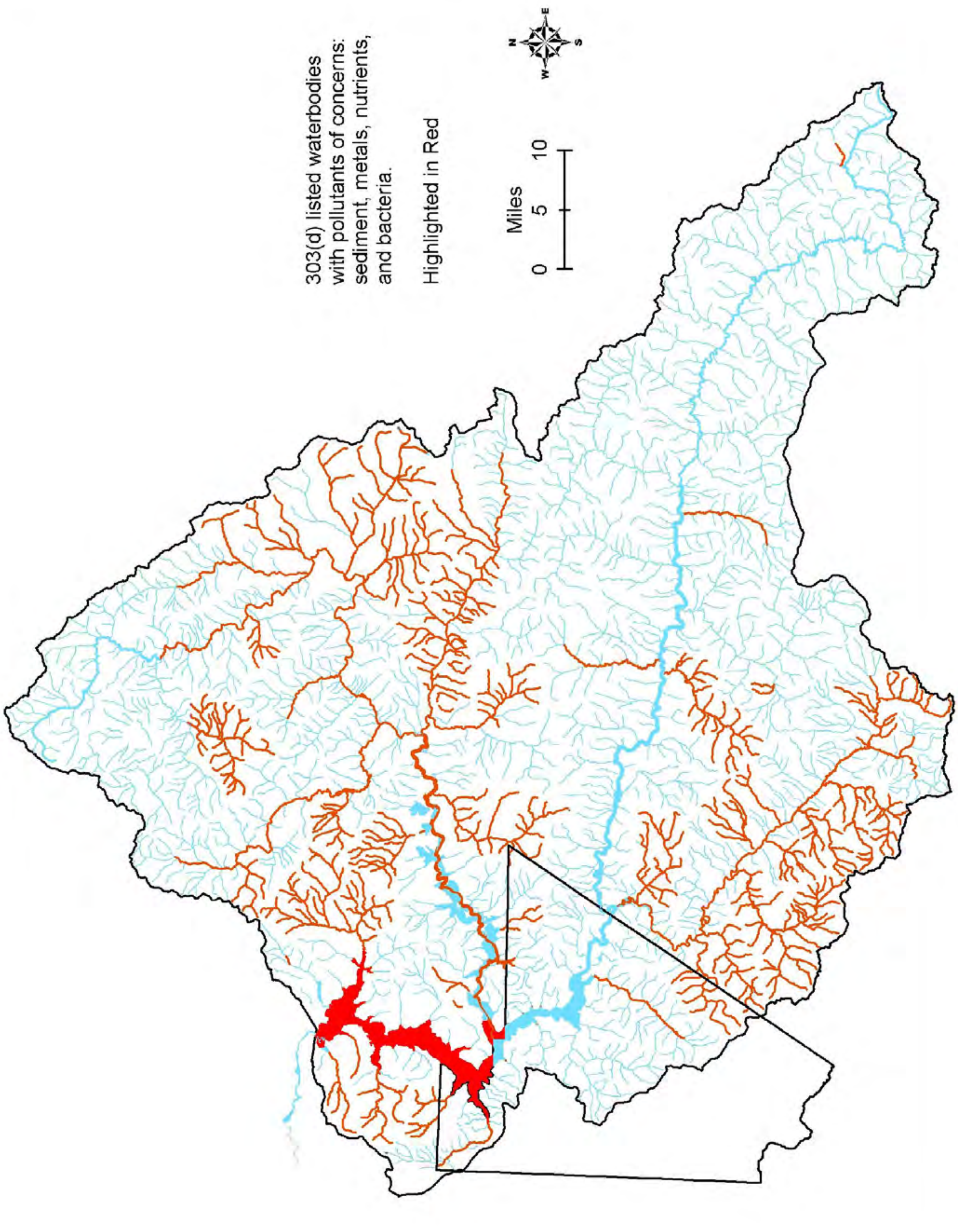

Figure 9. Map of DEQ and Tribe 303(d) Impaired Waterbodies (highlighted in red)

(Idaho Code §39-3611(07)). DEQ has established a long term 5-year review schedule. The voided metals TMDL, for both the South Fork Coeur d'Alene River subbasin and the Coeur d'Alene Lake subbasin, will be revisited beginning in 2009. Progress on implementation of the OU3 ROD for the basin, analysis of the BEMP data, and analysis of the lake water quality data collected by DEQ and the Tribe will be key references in completing this review. The Coeur d'Alene Tribe will coordinate with EPA and DEQ on this review. In essence, EPA's remedy for the basin functions as a metals implementation plan for the South Fork Coeur d'Alene River and the lake, without having a TMDL in place.

Lake Nutrient TMDL

The State of Idaho has a narrative standard for nutrients applicable to those surface waters of Coeur d'Alene Lake not within the present-day Reservation. The Tribe has a similar proposed narrative nutrient standard for approved Reservation waters (i.e., Coeur d'Alene Lake and the St. Joe River within the present Reservation, not including waters of Heyburn State Park). These narrative standards are not currently exceeded by surface water nutrient conditions in Coeur d'Alene Lake. The lake is currently not identified as an impaired water body under CWA Section 303(d) with respect to nutrients. A TMDL to address lake nutrient conditions is, therefore, not being developed at this time. The Tribe and DEQ view the LMP as a functional equivalent to a nutrient TMDL. This status could change because dissolved oxygen conditions in the southern lake do not meet the applicable proposed Tribal standards.

DEQ and the Tribe share common concerns regarding dissolved oxygen concentrations throughout the lake and mutual interests in developing agreed-upon actions in the LMP to address those concerns, as outlined in Section 5 of the LMP (performance actions and milestones).

Strategy: Avista/FERC Mitigation Program

For the last ten years the Coeur d'Alene Tribe and the State of Idaho have been parties to the Federal Energy Regulatory Commission's (FERC's) relicensing process for the Post Falls Hydro-Electric Dam (HED), owned by Avista Corporation. As part of this process, project operation impacts on natural resources were determined and mitigation measures were identified. These mitigation measures will become part of the new fifty (50) year license and will be required to be implemented during the duration of the license or until the mitigation projects are fully implemented.

Both the Tribe and the State of Idaho have reached separate agreements for mitigation, including work that will help manage nutrients entering the lake: 1) stream bank and lake shoreline bank stabilization, 2) riparian restoration or replacement, 3) invasive weed management, 4) water quality monitoring, and 5) cultural resource protection. The Tribe and DEQ envision that during the development of yearly LMP work plans, prioritization of mitigation projects will be evaluated and coordinated.

3.4 Objective 4 – Increase Public Awareness of Lake Conditions and Influences on Water Quality

Rationale

There is general public appreciation in the basin about the importance of maintaining good lake water quality. However, there is limited understanding of key components of water quality, and how lake water quality is affected by human activities such as construction, septic tank maintenance and drainfield performance, and the use of chemical fertilizers. The 2009 LMP must establish a shared public understanding of water quality and a commitment to its protection on a daily basis. This public understanding and commitment are essential to build support for funding to implement lake management activities. Individual's choices to protect water quality have significant impact. The importance of education in addressing environmental problems in freshwater ecosystems is recognized and promoted by the National Research Council (NRC, 1996).

Specific components of this overall strategy will include items 1 and 2, and based on a "needs assessment," may include other items as outlined in 3 through 5:

1) Conduct a public education and outreach needs assessment
2) Develop and implement an education and outreach services plan including Lake*A*Syst
3) Establish a lake stewardship center
4) Develop and maintain a science and resource library
5) Coordinate with schools and youth organizations

Strategy: Conduct a Public Education and Outreach Needs Assessment

Currently, there is a wide range of lake related information circulating in the community. For the most part, this information can be found with various governmental agencies, environmental groups, and private businesses. Although the information currently available addresses a myriad of lake issues, it is uncertain whether it is tailored to the wants and needs of the basin community. DEQ and the Tribe regularly receive requests from citizens and community organizations for services related to lake protection. These include: presentations, workshops, "how-to" materials and instructions, citizen monitoring, newsletters, organizing lake protection events, and developing project proposals.

These services, although important, may not constitute a complete education and outreach program. The Tribe and DEQ agree that public education and outreach is a critical component of the LMP. The initial step will be to conduct a needs assessment and use the results to design the education and outreach program.

Strategy: Education and Outreach Services Plan including a Lake*A*Syst Program

Staff will use the results of the needs assessment to develop an annual education and outreach plan that will outline the services desired by the community to increase awareness and understanding of lake water quality. This plan could include, among other things, a lake stewardship center, a science resource library, and school/youth programs. More details about these components follows.

A program that has already proven to be effective and successful in the surrounding lake communities of Priest, Pend Oreille, and Hauser, is the Lake*A*Syst Program. If desired by the community, the Tribe and DEQ could modify the existing materials and tailor the program for Coeur d'Alene Lake. This is a program targeted to individual landowners focusing on practices they can use to reduce water quality impacts from activities on their property. Information and use of "lake friendly" products, activity specific BMPs, and training programs for erosion and sediment control practices, are some examples of program components. The success of this program has been largely due to the delivery of the program by experts in water quality, conservation groups, educational or non-governmental organizations, and the commitment of individuals to apply stewardship practices.

Strategy: Lake Stewardship Center

If supported by the needs assessment above, a lake stewardship center would be established to create a focal point for community lake protection, and a resource base for increasing awareness and understanding of lake conditions and actions that can be taken to protect water quality. Since the lake is the "heart" of the community, locating a lake stewardship center in Coeur d'Alene would provide easy access to basin residents and visitors alike. It would be a symbol of the partnerships needed, and the community commitment of support to meet water quality protection goals. This center would be staffed with support from DEQ and the Tribe. A variety of science and resource materials would be housed and maintained for public use. Education and outreach services would be developed and offered in various media, targeting different audiences: general public, lake users, lakeshore property owners, civic groups, associations, government agencies, businesses, and schools.

There are many options for partnerships and locations for a lake stewardship center. Space donations, especially along the river educational corridor or downtown, will be pursued. North Idaho College, North Idaho Museum, Coeur d'Alene Chamber of Commerce, the Coeur d'Alene Library, or other strategically located and compatible area businesses, are all possibilities.

Strategy: Science and Resource Library

There is a considerable body of knowledge contained in published documents on the water quality of Coeur d'Alene Lake. A library of documents, including: project completion reports, technical guidance, monitoring reports, standard operating procedures, and quality assurance project plans, would be compiled and maintained at the lake stewardship center. Currently, large quantities of data and scientific documents exist with the Tribe, DEQ and EPA. There are also publicly accessible electronic databases (e.g., STORET) that would be made computer accessible at the lake stewardship center.

A wealth of resource materials already exist that can increase awareness of lake water quality and provide tools for protection. The center would compile and maintain resource documents for public use, including: agency rules and regulations, local ordinances, workshop opportunities, demonstration project information, field trip and tour schedules, and other relevant information. This library would be made available to the public in electronic and hard copy form, and housed in the lake stewardship center.

Strategy: Coordination with Schools and Youth Organizations

It is important for people of all ages to understand what they can do to become lake stewards. The school system is the logical "delivery system" to spread this message, throughout the community. Staff of the stewardship center will therefore work with primary, secondary, post secondary schools, and youth summer camps. The emphasis will be to heighten student observation skills to better understand that lake water quality affects their quality of life and that their actions can affect lake health.

3.5 Objective 5 – Establish Funding Mechanisms to Support the LMP Goal, Objectives, and Strategies

Rationale

The importance of this objective cannot be over-emphasized. The 2009 LMP goal of protecting lake water quality can only be achieved through reliable funding in amounts sufficient to carry out the specific strategies designed to achieve it. The basic approach of relying on existing legal authorities and programs described in the MATs to achieve the 2009 LMP goal requires financial support for these existing programs. A lack of reliable funding in the past for MAT implementation has been a significant obstacle to effective collaborative lake management. The 2009 LMP attempts to find a balance between funding needs and appreciation for the challenges associated with securing that funding. Section 6 of this document provides details for the 2009 LMP budget, schedule, and contingencies. The Tribe and DEQ consider LMP partners and the broader public essential to securing necessary funding from all sources, both public and private.

The four elements of the funding strategy are:

1) Identify core needs
2) Prioritize projects
3) Identify funding sources and secure commitments
4) Demonstrate fiscal accountability

These strategic components are described below.

Strategy: Identify Core Needs

The 2009 LMP recognizes the importance of setting priorities to accommodate the challenges posed by funding limits. The Tribe and DEQ have identified the following core needs for funding:

1) Conduct core routine water quality monitoring, Objective 1
2) Develop a basin-wide nutrient source inventory, Objective 3
3) Use MATs to coordinate and implement existing programs with LMP partners, Objective 2
4) Educate the community and increase awareness of lake conditions, Objective 4

Strategy: Prioritize Projects

Projects will be prioritized based on different criteria, such as cost effectiveness, community acceptance, willingness of landowner participation, availability of funding, partnerships, and applicable regulatory requirements. The cost to implement nutrient reduction projects based on the planned, basin-wide nutrient inventory (e.g., municipal sewer upgrades, bank stabilization, lakeshore/shallow bay sewer development, or TMDL implementation), will be significant. Obtaining project funding incorporates the vital relationship between community values and regional understanding of the importance of lake water quality. A collaborative approach will be used to develop yearly workplans and secure funding.

Strategy: Identify Funding Sources and Secure Commitments

The funding strategy consists of several mechanisms:

1) Annual budget requests and appropriations from Federal agencies, State, Tribal, and local governments
2) Annual congressional budget requests and appropriations
3) Local business community matching funds for cooperative projects
4) Other fundraising initiatives, like foundations, endowments, and special grant opportunities

Cultivating this funding pool will depend, in part, on the political acknowledgement of the importance and need for implementing the 2009 LMP. Advocacy of all basin partners will be necessary to garner political support. Commitment of partners to continue to prioritize and pursue funding for their respective LMP implementation activities, in coordination with the overall 2009 LMP implementation effort, is essential.

Strategy: Demonstrate Fiscal Accountability

The Tribe and DEQ are committed to a principle of accountability for the 2009 LMP spending. In practice, this will require attention to diverse sets of standards consistent with different funding sources, both public and private. The Tribe and DEQ intend to use generally accepted procurement and accounting protocols as established by State Statute or Tribal Code and will present accounting details in each year's annual LMP report. This information will be available to LMP partners and the general public.

Section 4: Administrative Structures for Lake Management

Achieving the objectives outlined in Section 3 through existing authorities and administrative structures, will require significant coordination and cooperation among the Tribe, DEQ, EPA, and other LMP partners. This section describes the primary existing administrative structures for lake management within DEQ, the Tribe, and EPA, along with a summary of legal authorities under the CWA, State, and Tribal laws. The approach for the 2009 LMP coordination involves creation of a collaborative implementation team, also described below. The overall coordination strategy for key LMP partners is summarized under External Coordination, with the understanding that detailed coordination plans for each LMP partner will be necessary. Appendix E presents a summary table of the jurisdictions and authorities of basin stakeholders to manage programs and activities related to water quality in the Coeur d'Alene Lake Basin. This LMP does not change authorities or regulations. It does, however, seek to more effectively coordinate these authorities and regulations, which will be the primary job responsibilities of the Tribe's and DEQ's LMP Coordinators.

4.1 DEQ Structure

DEQ is the designated Idaho agency for implementing parts of the Federal Clean Water Act, including adoption of the State WQS. Idaho Code §39-3601 *et seq.* assigns DEQ the responsibility to implement WQS to restore and maintain designated beneficial uses of streams, lakes and other surface waters. The legislative purpose of §39-3601 *et seq.* is to "enhance and preserve the quality and value of the surface water resources of the State of Idaho." Administrative Rules of the DEQ to fulfill the intent of this Idaho Code are Water Quality Standards, IDAPA 58.01.02.

The Coeur d'Alene Regional Office of DEQ, Water Quality Section, has the local responsibility (in the five county Panhandle area) for implementing the WQS. In the 2005 Idaho legislative session, a new full-time DEQ position was approved to serve as a Coeur d'Alene Lake water quality manager, assigned to the regional office. A primary duty of this position has been to work with the Tribe in developing the 2009 LMP. With finalization and approval of the 2009 LMP, duties of this DEQ position will shift to implementing the 2009 LMP. Initially, a major emphasis will be to seek funding and develop partnerships with other governmental agencies, and business and community groups, to actively implement high priority actions and concepts of the 2009 LMP.

The DEQ office performs other functions to support the implementation of the 2009 LMP. These include: 1) receive and respond to water quality complaints, 2) issue water quality certifications for Federal permits under Section 401 of the CWA, 3) review selected permits under the Idaho Joint Application for Permits (Idaho Department of Lands, Idaho Department of Water Resources, and Army Corps of Engineers), 4) review engineering plans and specifications for water and wastewater systems, 5) issue permits for wastewater reuse systems, 6) perform hydro-geological analysis of groundwater characteristics and potential contamination, and 7) administer rules for protecting groundwater quality.

In regard to TMDL processes for lands and activities outside of Tribal Reservation boundaries, DEQ is tasked with preparing subbasin assessments and TMDL determinations and facilitating the process of TMDL implementation planning. This is done in partnership with other State agencies, the land owners/land managers of a particular watershed, and a Watershed Advisory Group (WAG), as required by State law.

4.2 Coeur d'Alene Tribe Lake Management and Natural Resources Departments

The Coeur d' Alene Tribe, by Tribal Council Resolution, established a Lake Management Department to implement parts of the Federal Clean Water Act, including adoption of Tribal WQS, among other actions to protect and enhance water quality on the Reservation.

The Lake Management Department staff is located in Plummer and Coeur d' Alene Idaho. Programs within the Department that conduct LMP activities include: Lake Improvement, Recreation Management, Water Resources Management, and Hazardous Waste Management. In addition the Tribe also has a Natural Resources Department with various programs that conduct LMP activities. These programs include: Fisheries, Pesticides, Forestry, and Wildlife.

Currently, existing staff from these various programs have been tasked with developing the 2009 LMP. The Lake Management Department performs the following functions to support the implementation of the 2009 LMP. These include, but may not be limited to: 1) receive and respond to water quality complaints, 2) issue water quality certifications for Federal permits under Section 401 of the CWA, 3) review selected permits under the Idaho Joint Application for Permits (Idaho Department of Lands, Idaho Department of Water Resources, and Army Corps of Engineers), 4) develop and enforce encroachment standards, 5) regulate dredge and fill activities, 6) perform hydro-geological analysis of groundwater characteristics and potential contamination, and 7) implement wellhead protection activities.

In regard to TMDL processes for waters within the Tribal Reservation boundaries, the Tribe is tasked with preparing subbasin assessments and TMDL determinations and facilitating the process of TMDL implementation planning. This is done in partnership with State agencies, the land owners/land managers of a particular watershed, and watershed advisory groups.

4.3 EPA Water Quality Programs

Passage of the Federal Water Pollution Control Act in 1971 (commonly known as the Clean Water Act) nationally codified the authority of states and tribes to establish WQS. The Act and implementing regulations also standardize the approach to WQS development. Under the act, the authority to establish WQS is retained by states and approved tribes; EPA must review and approve the WQS. If EPA disapproves a WQS and a state or tribe does not revise it, EPA promulgates a standard. States and authorized tribes must review their WQS every three years and submit them to EPA for review. Idaho has approved WQS. The Coeur d'Alene Tribe's WQS are undergoing final revisions and will soon be submitted to EPA for approval. Sections 208 and 303 of the Federal CWA provide the authority to states for development of Water Quality Management (WQM) plans. Regulations for implementing these provisions are found in the Code of Federal Regulations (CFR) 40 Part 130.6. CWA Section 319 provides grant opportunities to states and tribes to implement actions to address nonpoint source pollution.

The EPA Region 10 office is located in Seattle, Washington. This office houses many administrative, technical, and policy staff that in part, work on Coeur d'Alene basin issues, primarily in implementing remedial actions under CERCLA, and overseeing water quality actions under the CWA. EPA public outreach staff develop the quarterly Basin Bulletin newsletter and other educational information. As a means to provide more local support for basin-wide issues, the EPA established a field office in Coeur d'Alene.

Neither the State of Idaho nor the Tribe are authorized to administer the National Pollutant Discharge Elimination System (NPDES) program within the State or Reservation, therefore, EPA is the NPDES permit authority for facilities throughout State and Tribal waters. EPA administers the permit issuance and compliance program for municipal and industrial wastewater discharges, including stormwater permits, biosolids, and the pretreatment program in the basin. A listing of EPA NPDES permits for discharges containing nutrients within the Coeur d'Alene Lake Basin is presented in Table 2 below:

Table 2. – Coeur d'Alene Lake Basin EPA NPDES Permits

NPDES	LOCATION (Idaho)	NAME 1	NAME 2	RECEIVING WATERS
ID0021300	Smelterville	South Fork Coeur d'Alene RSD	Wastewater Treatment Plant	South Fork CdA River
ID0020117	Smelterville	Smelterville, City of	Wastewater Treatment Plant	South Fork CdA River
ID0021296	Mullan	South Fork Coeur d'Alene RSD	Wastewater Treatment Plant	South Fork CdA River
ID0021997	Harrison	Harrison, City of	Wastewater Treatment Plant	Anderson Slough
ID0025071	Clarkia	Clarkia Water and Sewer District	Wastewater Treatment Plant	St. Maries River (Middle Fork)
ID0022799	St. Maries	St. Maries, City of	Wastewater Treatment Plant	St. Joe River
ID0022781	Plummer	Plummer, City of	Wastewater Treatment Plant	Plummer Creek
ID0022845	Fernwood	Santa Fernwood Sewer District	Wastewater Treatment Plant	St. Maries River
ID0025852	Post Falls	Post Falls, City of	Wastewater Treatment Plant	Spokane River
ID0022853	Coeur d'Alene	Coeur d'Alene, City of	Wastewater Treatment Plant	Spokane River
ID0026590	Hayden	Hayden Area Regional Sewer Board	Wastewater Treatment Plant	Spokane River (RM 108.7)

Table 2. – Coeur d'Alene Lake Basin EPA NPDES Permits cont.

NPDES	LOCATION (Idaho)	NAME 1	NAME 2	RECEIVING WATERS
IDS028193	Post Falls	Post Falls Highway District	Municipal Separate Storm Sewer System	Spokane River
IDS028207	Hayden Lake	Lakes Highway District	Municipal Separate Storm Sewer System	Hayden Lake
IDS028215	Coeur d'Alene	City of Coeur d'Alene	Municipal Separate Storm Sewer System	Spokane River, Lake Coeur d'Alene
IDS028223	Fernan	Idaho Transportation Department Dist. #3	Municipal Separate Storm Sewer System	Fernan Creek, French Gulch
IDS028231	Post Falls	City of Post Falls	Municipal Separate Storm Sewer System	Spokane River

4.4 Implementation Team

The Tribe and DEQ plan to use their respective staff and internal support to form a team to implement the core LMP program. Budget estimates to staff the implementation team are identified in Section 6, Table 8. This team would include:

- LMP Coordinators. These positions will be supervisory and responsible for managing implementation of the 2009 LMP, with an emphasis on development of yearly work plans and funding proposals, and coordination with partners to implement management actions in the MATs.
- Outreach Specialists. These positions will initially complete a needs assessment, then design and implement the education and outreach program.
- Limnologists. These positions will design and implement monitoring plans, conduct lake modeling, analyze/synthesize data and develop reports, and conduct the nutrient basin-wide inventory.
- Water Quality Technicians. These positions will support limnological work described above.
- Office Administrative Assistants. These positions will provide general administrative support for LMP activities.

4.5 External Coordination

The implementation team will be responsible for coordinating their activities with those of many other agencies, cities, municipalities, and public and private stakeholders that currently conduct activities affecting water quality in the Coeur d'Alene basin. Through close coordination of basin-wide activities with all parties, the implementation team can better understand program objectives, identify funding commitments, and abilities to share costs or leverage additional funds. This coordination will reduce duplication of effort and increase education of the public and other stakeholders. DEQ and Tribal staff will routinely communicate and coordinate (by telephone, email, and personal meetings) to establish effective and efficient project implementation plans, provide updates on information collected during BMP audits, establish priorities, analyze and interpret data, and conduct public education and outreach.

The Tribe and DEQ will utilize the coordination efforts listed above to encourage implementation. As coordination, funding, and education increase; it is expected that the level of commitment to conduct these activities will increase, resulting in improvements in water quality. Adaptive management will be employed over the life of the 2009 LMP as a means to be flexible, given the many issues to address and many possible solutions. A list of key forums and LMP partners for coordination includes the following:

4.5.1 Basin Environmental Improvement Project Commission (BEIPC)

The BEIPC was established under Idaho law. Its primary purpose as described in the Memorandum of Agreement (MOA) among DEQ, the Tribe, Washington State Department of Ecology, Benewah, Kootenai, Shoshone counties, and the Federal government (currently represented by EPA) was to implement the 2002 ROD for OU3. The BEIPC may also undertake other activities to improve water quality. The Basin Commission Board (the Board), the Technical Leadership Group (TLG), and the Citizens Coordinating Council (CCC), collectively the BEIPC, represent a wide range of regulatory, land management and public stakeholders. The Tribe and DEQ believe the BEIPC can provide beneficial resources and forums to facilitate the implementation of the 2009 LMP. Examples of coordination activities DEQ and the Tribe envision for implementation of the LMP, include, but are not limited to the following:

a) Provide routine updates on implementation activities at each BEIPC board meeting with the intention to coordinate with agencies/governments represented on the Commission

b) Engage nutrient management partners on the TLG to review Management Action Table (MAT) activities and work to better understand how to develop partnerships and joint plans for nutrient reduction projects

c) Present draft yearly monitoring plans for TLG review and comment, and present yearly monitoring results

d) Present draft annual work plans to the TLG for review and comment

e) Provide an annual overview of LMP implementation activities to the Commission's Citizens Coordinating Council and solicit their input

This level of coordination with BEIPC forums will maximize opportunities for information exchange and advice, while recognizing that DEQ and the Tribe retain their respective decision making authorities under CERCLA and the Clean Water Act (CWA).

4.5.2 Washington State

Washington State has a vital interest in all activities that affect water quality in the Spokane - Coeur d'Alene River Basin. Currently, Washington is developing a dissolved oxygen TMDL for the Spokane River. In addition, Washington State WQS for metals are violated at the border of Idaho and Washington. Given these concerns and the connection between our state's waters, sustained communication and coordination with the State of Washington – primarily the Washington Department of Ecology (WDOE), is critical. This coordination will be accomplished directly with the WDOE, and may also occur within the forums of the BEIPC. DEQ and the Tribe also will continue to participate in the Washington dissolved oxygen TMDL process, and the ongoing operations of the Post Falls Dam, and all other forums intended to resolve interstate water quality issues.

4.5.3 Local governments

The local governments of Shoshone, Kootenai, Benewah, and Latah counties, and their respective cities, have enacted ordinances to manage upland development and other land use activities in the Coeur d'Alene Lake Basin (Appendix E). These local governments play a crucial role in regulating activities on private lands that directly relate to sediment and nutrient inputs to tributaries and the lake. DEQ and the Tribe will encourage and support the counties and cities efforts to enforce all their regulations aimed at managing pollution in the basin.

Kootenai, Shoshone and Benewah counties are particularly interested in building and maintaining a closer working relationship with DEQ and the Tribe in coordinating implementation of the LMP, where their authorities are concerned.

The Tribe, DEQ and the counties have, therefore, agreed to:

1. Quarterly Meetings – The meeting location will rotate between county, DEQ and Tribal offices; agendas will be drafted two weeks in advance by the hosting office for review and input by all parties. Final agendas will be distributed to all parties one week in advance of the meetings.
2. Meeting Participants – Meetings will include no more than one (1) decision maker from each entity. Such meetings may also include agency staff, as determined necessary by the parties, based on agenda topics.
3. Meeting Outcomes – The hosting office will be responsible for drafting a short summary of meeting outcomes for review and comment by all parties. The final summary of meeting outcomes will be distributed to all parties within 30 days after each meeting.
4. Additional Meetings – Additional meetings may be agreed upon by the parties as reasonably necessary.
5. Staff Meetings – The counties, DEQ and the Tribe recognize there will be ongoing meetings at the staff level to coordinate and accomplish work on a spontaneous and routine basis. These staff meetings do not substitute for the decision maker level meetings described above.

4.5.4 Other state and federal agencies

Other state and federal agencies have a role in management of public lands and activities that affect water quality (see Appendix E). Direct, agency-specific coordination will occur in order to share and understand program goals and objectives, yearly work plans, funding strategies, monitoring/study plans, and specific projects being conducted to implement actions that affect basin-wide water quality. These agencies also participate in various BEIPC forums that provide an opportunity for collaborative coordination.

4.5.5 Other tribes

Downstream tribes have aboriginal rights to natural resources affected by the water quality flowing out of Coeur d'Alene Lake. Because the outlet of the lake creates the Spokane River that ultimately drains into the Columbia River, all tribes that rely on these waters and the natural resources that pertain to the waters have a stake in the effectiveness of the 2009 LMP. The Tribe and DEQ will work with other tribes in the region (Colville, Spokane, Kalispel, Kootenai, and Yakama) to foster awareness of upstream issues and seek downstream support for the LMP goal and objectives. The Coeur d'Alene Tribe is a member of the Upper Columbia United Tribes and will use this forum to provide information to other tribes and seek support for upstream issues.

4.5.6 Business community and civic organizations

Coeur d'Alene Lake is the engine that drives the local and regional economy. The business community has a vital interest in the implementation of a successful LMP that protects and enhances water quality throughout the basin. The Tribe and DEQ envision the business community as a key partner in lake management. The business community has provided valuable feedback during development of the 2009 LMP, and will have a key role in future public outreach to promote lake protection and water quality awareness. The Tribe and DEQ appreciate the importance of building understanding with the business community about lake management activities, and also in ensuring that key interests of the business community are addressed as part of an adaptive management approach. Coordination is planned through business organizations, such as the chambers of commerce, associations, and individual businesses.

4.5.7 Environmental and conservation organizations

Non-governmental organizations are uniquely positioned to voice environmental and conservation interests and to assist in broad public education. The Kootenai Environmental Alliance, the Lands Council, the Center for Justice, the Nature Conservancy, Ducks Unlimited, the Sierra Club, Idaho Conservation League, and others, have been vocal proponents of environmental protection for many years. The Tribe and DEQ are committed to fostering partnerships with these groups to achieve the shared goal of lake protection.

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Section 5: Methods, Performance Actions, and Milestones

Method: Adaptive Management Strategy

The goal of the LMP is to protect and improve lake water quality by limiting basin-wide nutrient inputs that impair lake water quality conditions, which in turn influence the solubility of mining-related metals contamination contained in lake sediments.

The overall strategy embodied in the 2009 LMP to accomplish this goal is adaptive management. At its core, this approach relies on monitoring to establish lake conditions and track changes over time, modeling to predict possible future scenarios if key factors change, implementation of actions to reduce nutrients, and finally, more monitoring to determine lake response relative to the overall goal. Monitoring will guide decisions about the need for additional implementation actions on a repeating annual cycle. This process is consistent with what the National Academy of Sciences (NRC/NAS, 2005) outlined, as follows:

> *"Adaptive management is a six-step process for defining and implementing management policies for environmental resources under conditions of high uncertainty concerning the outcome of management actions. A well-structured adaptive management plan contains the following interactive steps:*
>
> 1. *Assessing the problem*
> 2. *Designing a management plan*
> 3. *Implementing the plan*
> 4. *Monitoring*
> 5. *Evaluating results obtained from monitoring*
> 6. *Adjusting the management plan in response to the monitoring results."*

DEQ and the Tribe plan a comprehensive 5-year review of LMP implementation (in 2015). Water quality trends, success of MAT implementation actions, and nutrient reduction projects will be examined.

There are several different scenarios that could result from the adaptive management process described above. If current regulations are being followed and enforced, and MAT recommendations are being implemented and demonstrated effective (as determined by improvements in lake water quality), then there would be no need to change regulations.

If the current regulations are being followed and enforced, and MAT recommendations are being implemented – yet water quality deteriorates, other actions will need to be taken. New and/or strengthened regulations within DEQ, Tribal, and MAT partner authorities may need to be established. If water quality deteriorates and current regulations are not being followed or enforced adequately, and/or if BMPs are determined to be ineffective; then DEQ and the Tribe will work with the responsible authorities to ensure corrective steps are taken.

Performance Actions and Milestones

Performance actions lead to milestones that gauge success for each of the 2009 LMP strategies implemented. Performance actions are what the LMP partners set-out to accomplish, and the milestones are the outcome of these actions that determine success. The actions and milestones described below correspond with the Management Objectives and Strategies described more fully in Section 3.

5.1 Objective 1 – Improve Scientific Understanding of Lake Conditions through Monitoring, Modeling, and Special Studies

These *four strategic components* identified in Section 3.1 support this objective:

1) Establish water quality triggers (Tables 3 through 7)
2) Perform core routine monitoring of lake and rivers
3) Develop technical tools to support lake management
4) Conduct special studies

Performance actions for this strategy are:

- Manage lake water quality with respect to trends and action trigger levels for all monitored water quality variables
- Conduct core routine monitoring to build the data record for tracking water quality conditions and trends, and for use in verifying and improving model performance
- Carry out additional monitoring and special studies in response to specific needs
- Use the ELCOM-CAEDYM model as an analytical and predictive tool
- Summarize monitoring data and analysis through annual reports, and presentations to technical and other forums

Milestones for this strategy include:

- Management activities based on water quality trends and triggers are adjusted as necessary. Trend data is the measure of the success or failure of management actions and provides an “early warning system” for water quality deterioration. Therefore, management actions need to be adjusted in order to reverse negative trends that approach or exceed a water quality trigger. A trigger is an endpoint, while trend data is a continuum that needs to be evaluated on a yearly basis. Progress will be gauged on a yearly basis, and will be determined by whether there are significant differences in water quality variables from the previous year’s data.

The Tribe and DEQ are aware that certain triggers are already exceeded (in addition to the exceedances of metals WQS), in particular the triggers for total phosphorus, chlorophyll *a*, and dissolved oxygen in southern waters. Therefore, nutrient reduction actions are immediately needed. Examples of current projects to address these exceedances of water quality triggers include: the Plummer Creek watershed nutrient load assessment, sediment reduction projects in the Benewah Creek watershed, and an invasive aquatic weed control program. Completion of the nutrient inventory will identify additional nutrient reduction projects.

- Annual core routine monitoring program completed. Sampling will begin in the winter-early spring (December through March) and end in late November or early December.
- Annual "state of lake water quality" updates described in Section 2 (including modeling results) are published. Evaluation of data will occur (December through February) after the last field data for the year is collected (late November or early December). Yearly "state of the lake" water quality reports will be written and finalized by the spring of the new field season.
- Use special study results to guide management actions. Key questions will need to be framed and special studies designed to answer them. The studies will need to be planned and prioritized for implementation, utilizing existing staff or with additional funding.

5.2 Objective 2 – Establish and Strengthen Partnerships to Maximize Benefits of Actions under Existing Regulatory Frameworks

These *five strategic components* identified in Section 3.2 support this objective:

1) Use MATs to coordinate partnerships to implement the 2009 LMP
2) Improve understanding of authorities
3) Engage with land managers to identify opportunities in annual workplans
4) Collaborate to implement projects when appropriate
5) Evaluate MAT actions routinely and repeat the audit at 5-year intervals

Performance actions for this strategy are:

- Review and update MATs during annual workplan coordination with partners
- Meet with basin partners to promote understanding of authorities and consult on annual work plan development. This activity will commence immediately and be ongoing throughout the life of the LMP.
- Coordinate and implement MATs activities with basin partners, including an initial focus on Table C7 regarding river bank erosion and stabilization
- Integrate the 2009 LMP goal, objectives, and strategies in annual work plans of LMP partners

Milestones for this strategy are:

- LMP partner activities funded and implemented
- Meetings conducted with LMP partners to track MATs activities and effectiveness
- Projects funded and implemented
- Quarterly reports delivered to partners and the public
- Annual update of MATs completed
- 5-year audit of MATs completed

5.3 Objective 3 – Develop and Implement a Nutrient Reduction Action Plan

These *four strategic components* identified in Section 3.3 support this objective:

1) Design and conduct a basin-wide nutrient source inventory
2) Prioritize projects based on inventory
3) Incorporate TMDLs into the nutrient reduction plan
4) Incorporate Avista mitigation program into nutrient reduction plan

Performance Actions for this strategy are:

- Conduct a basin-wide inventory
- Identify, prioritize, and implement additional nutrient reduction projects including Avista mitigation measures that will help manage nutrient inputs into the lake
- Complete and implement TMDLs

Milestones for this strategy are:

- A basin-wide nutrient inventory funded, designed and conducted during 2010-2012
- Data analyzed and environmental database with GIS maps of nutrient loading developed
- Additional projects for nutrient reduction, including: wastewater treatment upgrades, subsurface sewage system upgrades, agricultural land restoration, riparian restoration, streambank stabilization, invasive aquatic weed control, and improvement/maintenance of road systems, are identified and scheduled
- Results of inventory shared with LMP partners and broader public
- WAGs established for TMDL development and implementation of sediment and nutrient reduction

Table 3. Water Quality Triggers for Station C1: SE of Tubbs Hill – Northern Pool, North End at 40 meters (see Appendix A, Figure A1 for map of stations)

Variables	CY91-92 Condition[a]	WY04-06 Condition[a]	Idaho WQ Standards Criteria (IDAPA 58.01.02)	Desired Condition	Trigger Condition
Total phosphorus 1 m – 30 m depth[b]	2.7 µg/L geomean[c]	5.0 µg/L geomean	nutrient narrative (200.06)	no greater than WY04-06 condition	8.0 µg/L annual geomean[d]
Dissolved oxygen in hypolimnion	minimum >6.0 mg/L	minimum >6.0 mg/L	hypolimnion exempt (250.02.a.iii)	minimum >6.0 mg/L	minimum <6.0 mg/L
Chlorophyll *a* in photic zone	0.46 µg/L (0.92 µg/L)[e] geomean 1.3 µg/L max (1.7 µg/L max)[e]	1.57 µg/L geomean 3.3 µg/L max	nutrient narrative(200.06)	no greater than WY04-06 condition	3.0 µg/L annual geomean[f] 5.0 µg/L max
Blue-green algae (cyanobacteria) blooms	blue-greens minor component	not measured	nutrient narrative (200.06)	blue-greens minor component	blue-greens are dominant algal group with seasonal blooms
Water clarity Secchi depth July – October	8.3 m geomean	9.4 m geomean	none	no less than CY91-92 condition	clarity trigger may reflect chlorophyll *a* trigger
Dissolved zinc 1 m ≈ 39 m[g] (1 m off bottom)	only total zinc measured	62 µg/L geomean 33-91 range	36 µg/L CCC[h] (210.02 & 210.03)	meet Idaho WQS	already consistently exceeds WQS
Dissolved lead 1 m ≈ 39 m (1 m off bottom)	only total lead measured	0.12 µg/L geomean 0.05-0.88 rng	0.54 µg/L CCC (210.02 & 210.03)	meet Idaho WQS	when WQS are exceeded
Diss. cadmium 1 m ≈ 39 m (1 m off bottom)	only total cadmium measured	0.23 µg/L geomean 0.15-0.52 rng	0.25 µg/L CCC (210.02 & 210.03)	meet Idaho WQS	already occasionally exceeds WQS

a = CY91-92 - USGS baseline study, annual sampling from January 1991 – December 1992.
WY04-06 - USGS study, annual sampling from October 2003 – August 2006.

b = Data combined for composite photic zone samples and discrete samples at 20 m and 30 m.

c = Geometric mean - used by USGS to summarize data in the CY91-92 studies. A geometric mean dampens the effect of a few very high or very low sample results as compared to an arithmetic mean.

d = A consistent annual trend of 8 µg/L geometric mean for total phosphorus would be a statistically significant upward departure from the CY91-92 data set.

e = Chlorophyll *a* analysis methods changed from CY91-92 to WY04-06. Thus, the USGS did a paired study of chlorophyll *a* samples using the two analytical methods and derived a statistical relationship that adjusts the original chlorophyll *a* values for CY91-92 (first listed value) to values comparable to the WY04-06 data (values in parenthesis).

Footnotes for Table 3, cont.

f = Based on a transitioning between the current oligotrophic condition and a meso-oligotrophic condition. An annual geometric mean of 3 µg/L chlorophyll *a* would be a doubling of the mean from the WY04-06 data set.

g = Data combined for composite photic zone samples and discrete samples at 20 m, 30 m, and 1 m off bottom.

h = CCC is Criterion Continuous Concentration – 4 day average concentration that ensures adequate protection of sensitive species of aquatic organisms from chronic toxicity. The CCC is not to be exceeded more than once every 3 years. The CCC was calculated with a total hardness of 25 mg/L as $CaCO_3$ (Idaho WQS uses a lower hardness cap of 25 mg/L to calculate CCC for dissolved metals).

Table 4. Water Quality Triggers for Station C4: NE of University Point – Northern Pool, South End at 40 meters

Variables	CY91-92 Condition[a]	WY04-06 Condition[a]	Idaho WQ Standards Criteria (IDAPA 58.01.02)	Desired Condition	Trigger Condition
Total phosphorus 1 m – 30 m depth[b]	3.8 µg/L geomean[c]	6.2 µg/L geomean	nutrient narrative (200.06)	no greater than WY04-06 condition	8.0 µg/L annual geomean[d]
Dissolved oxygen in hypolimnion	minimum >6.0 mg/L	minimum >6.0 mg/L	hypolimnion exempt (250.02.a.iii)	minimum >6.0 mg/L	minimum <6.0 mg/L
Chlorophyll *a* in photic zone	0.48 µg/L (0.94 µg/L)[e] geomean 1.5 µg/L max (1.8 µg/L max)[e]	1.55 µg/L geomean 3.1 µg/L max	nutrient narrative (200.06)	no greater than WY04-06 condition	3.0 µg/L annual geomean[f] 5.0 µg/L max
Blue-green algae (cyanobacteria) blooms	blue-greens minor component	not measured	nutrient narrative (200.06)	blue-greens minor component	blue-greens are dominant algal group with seasonal blooms
Water clarity Secchi depth July – October	7.7 m geomean	8.6 m geomean	none	no less than CY91-92 condition	clarity trigger may reflect chlorophyll *a* trigger
Dissolved zinc 1 m ≈ 39 m[g] (1 m off bottom)	only total zinc measured	68 µg/L geomean 36-104 range	36 µg/L CCC[h] (210.02 & 210.03)	meet Idaho WQS	already consistently exceeds WQS
Dissolved lead 1 m ≈ 39 m (1 m off bottom)	only total lead measured	0.27 µg/L geomean 0.05-2.76 rng	0.54 µg/L CCC (210.02 & 210.03)	meet Idaho WQS	already occasionally exceeds WQS
Diss. cadmium 1 m ≈ 39 m (1 m off bottom)	only total cadmium measured	0.26 µg/L geomean 0.16-0.43 rng	0.25 µg/L CCC (210.02 & 210.03)	meet Idaho WQS	already frequently exceeds WQS

For footnotes a – h, see for Table 3 for Station C1.

Table 5. Water Quality Triggers for Shallow Bays of Northern Pool – Shoreline to ≈ 20 meters

Variables	Summer 91-92 and July – Oct 95-02[a]	WY04-06 Condition[b]	Idaho WQ Standards Criteria (IDAPA 58.01.02)	Desired Condition	Trigger Condition
Nearshore periphyton & aquatic plants[c]	periphyton production in bays - 1992	not measured	nutrient narrative (200.06)	to be determined by nearshore LMP studies	to be determined by nearshore LMP studies
Eurasian milfoil	not present	not present	none	not present	present
Total phosphorus water column	5.7 µg/L geomean 1991 - 2002	5.8 µg/L geomean	nutrient narrative (200.06)	no greater than current condition	9.0 µg/L annual geomean[d]
Dissolved oxygen to near bottom	minimum >6.0 mg/L 1991 - 2002	dissolved oxygen data not reported	min. >6.0 mg/L bottom 20% of depth exempt (250.02.a.iii)	minimum >6.0 mg/L	minimum <6.0 mg/L
Chlorophyll *a* in photic zone	0.40 µg/L (0.90 µg/L)[e] geomean 1.7 µg/L max (2.0 µg/L max)[e] 1991 - 1992	1.2 µg/L geomean 3.5 µg/L max	nutrient narrative (200.06)	no greater than current condition	3.0 µg/L annual geomean[f] 5.0 µg/L max
Water clarity Secchi depth 10 m and deeper July – Oct.	8.1 m geomean 1991 - 2002	not measured	none	no less than current condition	clarity trigger may reflect chlorophyll *a* trigger
Blue-green algae (cyanobacteria) blooms	not measured	not measured	nutrient narrative (200.06)	blue-greens - minor component	blue-greens are dominant algal group with season blooms
Coliform bacteria	not measured	not measured	126 *E. coli*/100 ml geomean of 5 samples/30 days (251.01.c[g])	meet Idaho WQS	when WQS are exceeded
Dissolved zinc water column	58 µg/L geomean 28-272 range 1995 - 2002	49 µg/L geomean 25-98 µg/L range	36 µg/L CCC (210.02 & 210.03)	meet Idaho WQS	already consistently exceeds WQS
Dissolved lead water column	samples <det. limit of 3 µg/L 1995 - 2002	0.17 µg/L geomean 0.05-1.24 range	0.54 µg/L CCC (210.02 & 210.03)	meet Idaho WQS	already occasionally exceeds WQS
Diss. cadmium water column	samples <det. limit 0.5 µg/L 1995 - 2002	0.19 µg/L geomean 0.10-0.35 range	0.25 µg/L CCC (210.02 & 210.03)	meet Idaho WQS	already occasionally exceeds WQS

Footnotes for Table 5

a = These data are from USGS sampling in summer months for 1991-92 baseline study, and DEQ sampling for July – Oct., 1995–2002.

b = WY04-06 – these data are from USGS study with periodic sampling within littoral bay areas from October 2003 – October 2005. Data was combined for littoral stations NS3 through NS12 (see Appendix A, Figure A1 for map of sampling stations).

c = Periphyton is attached algae growing on natural and artificial substrates.

d = Based on a numerical total phosphorus target established for the nutrient TMDL of near shore waters of Pend Oreille Lake, Idaho (Tetra Tech, 2002).

e = Chlorophyll *a* analysis methods changed from CY91-92 to WY04-06. Thus, the USGS did a paired study of chlorophyll *a* samples using the two analytical methods and derived a statistical relationship that adjusts the original chlorophyll *a* values for CY91-92 (first listed value) to values comparable to the WY04-06 data (values in parenthesis).

f = Based on a transitioning between the current oligotrophic condition to a meso-oligotrophic condition. An annual geometric mean of 3 μg/L chlorophyll *a* would be a doubling of the mean from the WY04-06 data set.

g = For areas that are specified as public swimming beaches, the criteria is 235 *E. coli*/100 ml for a single sample (251.01.a).

Table 6. Water Quality Triggers for Station C5: NE of Blue Point – Southern Pelagic Site South of Harrison.

Parameter	CY91-92 Condition[b]	WY04-06 Condition[b]	Coeur d'Alene Tribe WQ Standards Criteria[c]	Desired Condition	Trigger Condition
Total Phosphorus (euphotic zone)[d]	6.1 µg/L geomean[e]	11.2 µg/L geomean	Narrative[c]	no greater than CY91-92 condition	8.0 µg/L annual geomean
Total Phosphorus (1 m off bottom)	6.1 µg/L geomean	15.6 µg/L geomean	Narrative	no greater than CY91-92 condition	8.0 µg/L annual geomean
Dissolved Oxygen in hypolimnion	minimum 2.8 mg/L	minimum 2.5 mg/L	minimum >8.0 mg/L	minimum >8.0 mg/L	minimum <8.0 mg/L
Chlorophyll *a* in photic zone	0.68 µg/L (1.13 µg/L)[f] geomean 1.9 µg/L (2.21 µg/L d)[f] max	1.56 µg/L geomean 5.3 µg/L max	Narrative	no greater than CY91-92 adjusted condition[f]	3.0 µg/L annual geomean 5.0 µg/L max
Blue-green algae (cyanobacteria) blooms	blue-greens minor component	not measured	Narrative	blue-greens minor component	blue-greens are dominant algal group with seasonal blooms
Water Clarity Secchi depth July – October	5.2 m geomean	5.6 m geomean	Narrative	no less than WY04-06 condition	clarity trigger may reflect chlorophyll *a* trigger
Dissolved zinc (euphotic zone)	only total zinc measured	17.0 µg/L geomean 1.4-60.0 range	26-37 µg/L CCC[g]	meet CDA Tribe WQS	already exceeds WQS
Dissolved zinc (1 m off bottom)	only total zinc measured	40.0 µg/L geomean 4.2-83.0 range	27-37 µg/L CCC	meet CDA Tribe WQS	already exceeds WQS
Dissolved lead (euphotic zone)	only total lead measured	0.15 µg/L geomean 0.05-0.7 range	0.39-0.56 µg/L CCC	meet CDA Tribe WQS	already exceeds WQS
Dissolved lead (1 m off bottom)	only total lead measured	0.18 µg/L geomean 0.05-1.2 range	0.45-0.55 µg/L CCC	meet CDA Tribe WQS	already exceeds WQS
Diss. cadmium (euphotic zone)	only total cadmium measured	0.08 µg/L geomean 0.02-0.20 range	0.19-0.26 µg/L CCC	meet CDA Tribe WQS	already exceeds WQS
Diss. cadmium (1 m off bottom)	only total cadmium measured	0.15 µg/L geomean 0.04-0.40 range	0.20-0.26 µg/L CCC	meet CDA Tribe WQS	already exceeds WQS

For footnotes b – g, see Table 7 for Station C6. Footnote 'a' in Table 7 does not apply to Station C5

Table 7. Water quality triggers for Station C6: Chatcolet Lake – Southern Pelagic Site[a]

Variable	CY91-92 Condition[b]	WY04-06 Condition[b]	Coeur d'Alene Tribe WQ Standards Criteria[c]	Idaho WQ Standards Criteria (IDAPA 58.01.02)	Desired Condition	Trigger Condition
Total phosphorus (euphotic zone)[d]	9.0 µg/L geomean[e]	18.6 µg/L geomean	Narrative[c]	nutrient narrative (200.06)	no greater than CY91-92 condition	9.0 µg/L annual geomean
Total phosphorus (1 m off bottom)	15.8 µg/L geomean	32.4 µg/L geomean	Narrative	nutrient narrative (200.06)	no greater than CY91-92 condition	9.0 µg/L annual geomean
Dissolved oxygen in hypolimnion	minimum 0.0 mg/L	minimum 0.2 mg/L	minimum >8.0 mg/L	minimum >6.0 mg/L – bottom 20% of depth exempt (250.02.a.iii)	meet applicable WQS	when applicable WQS is exceeded
Chlorophyll *a* in photic zone	0.70 µg/L (1.22 µg/L)[f] geomean 2.9 µg/L (3.13 µg/L)[f] max	2.57 µg/L geomean (17.9 µg/L) max	Narrative	nutrient narrative (200.06)	no greater than CY91-92 adjusted condition[f]	3.0 µg/L annual geomean 5.0 µg/L max
Blue-green algae (cyanobacteria) blooms	blue-greens minor component	not measured	Narrative	nutrient narrative (200.06)	blue-greens minor component	blue-greens are dominant algal group with seasonal blooms
Eurasian milfoil	Unknown	present	None	none	not present	present
Water clarity Secchi depth July – October	3.1 m geomean	2.5 m geomean	Narrative	none	no less than CY91-92 condition	clarity trigger may reflect chlorophyll *a* trigger
Dissolved zinc (euphotic zone)	only total zinc measured	1.55 µg/L geomean 0.4-8.0 range	26-37 µg/L CCC[g]	36 µg/L CCC (210.02 & 210.03)	meet applicable WQS	when applicable WQS is exceeded
Dissolved zinc (1 m off bottom)	only total zinc measured	1.97 µg/L geomean 0.4-30.6 range	27-37 µg/L CCC	36 µg/L CCC (210.02 & 210.03)	meet applicable WQS	when applicable WQS is exceeded

Table 7. cont.

Variable	CY91-92 Condition[b]	WY04-06 Condition[b]	Coeur d'Alene Tribe WQ Standards Criteria[c]	Idaho WQ Standards Criteria (IDAPA 58.01.02)	Desired Condition	Trigger Condition
Dissolved lead (euphotic zone)	only total lead measured	0.08 µg/L geomean 0.04-0.23 range	0.39-0.56 µg/L CCC	0.54 µg/L CCC (210.02 & 210.03)	meet applicable WQS	when applicable WQS is exceeded
Dissolved lead (1 m off bottom)	only total lead measured	0.09 µg/L geomean 0.04-0.50 range	0.45-0.55 µg/L CCC	0.54 µg/L CCC (210.02 & 210.03)	meet applicable WQS	when applicable WQS is exceeded
Diss. cadmium (euphotic zone)	only total cadmium measured	0.04 µg/L geomean 0.04-0.15 range	0.19-0.27 µg/L CCC	0.25 µg/L CCC (210.02 & 210.03)	meet applicable WQS	when applicable WQS is exceeded
Diss. cadmium (1 m off bottom)	only total cadmium measured	0.04 µg/L geomean 0.04-0.06 range	0.20-0.27 µg/L CCC	0.25 µg/L CCC (210.02 & 210.03)	meet applicable WQS	when applicable WQS is exceeded

a = DEQ and the Tribe do not agree on the applicable WQS at this station. DEQ and the Tribe recognize that water quality conditions at this station are reasonably representative of water quality in the adjoining nearby TAS area. The listed "desired conditions" for this station therefore reflect the Tribe's WQS that are applicable to the TAS waters for which this station is representative. The "trigger conditions" for this station are the applicable WQS of both the Tribe and the State; the Tribe's WQS as applicable to the TAS area and, as to this station, the State and Tribe each apply their respective WQS.

b = CY91-92 - USGS baseline study, annual sampling from January 1991 – December 1992.
WY04-06 - USGS study, annual sampling from October 2003 – August 2006.

c = Coeur d'Alene Tribe, 2005. Water Quality Standards for Approved Surface Waters of the Coeur d'Alene Tribe. Prepared for the United States Environmental Protection Agency (Region 10).

d = Euphotic zone composite from surface to depth of 1% incident light (PAR).

e = Geometric mean - used by USGS to summarize data in the CY91-92 studies.

f = Chlorophyll *a* analysis methods changed from CY91-92 to WY04-06. Thus, the USGS did a paired study of chlorophyll *a* samples using the two analytical methods and derived a statistical relationship that adjusts the chlorophyll *a* value for the CY91-92 to make the values comparable to the WY04-06 data.

g = CCC is Criterion Continuous Concentration. Toxicity is dependent upon total hardness which ranged from 17.6-25.8 (mg/l) throughout the study periods (Tribal WQS utilizes actual hardness measured when below 25 mg/L to calculate CCC for dissolved metals).

5.4 Objective 4 – Increase Public Awareness of Lake Conditions and Influences on Water Quality

There are *five strategic components*, identified in Section 3.4 to support this objective:

1) Conduct a public education and outreach needs assessment
2) Develop and implement an education and outreach services plan including Lake*A*Syst
3) Establish a lake stewardship center
4) Develop and maintain a science and resource library
5) Coordinate with schools and youth organizations

Performance Actions for this strategy are:

- Develop a public education and outreach needs assessment survey instrument
- Conduct an assessment to understand community education and outreach service needs
- Evaluate results of needs assessment and determine the scope of public education and outreach plan
- Develop and implement a Lake*A*Syst program
- Establish a lake stewardship center
- Make a science and resource library available for public use
- Promote incorporation of LMP information into school curriculums and youth group organizations

Milestones for this strategy are:

- A needs assessment completed (year one)
- Education and outreach plan completed (year one)
- Lake*A*Syst program developed and implemented (year one)
- A lake stewardship center is established if needs assessment affirms priority
- Information materials developed to support public awareness and understanding
- A science and resource library is established
- Information has been incorporated into school curriculums and youth group organizations

5.5 Objective 5 – Establish Funding Mechanisms to Support the 2009 LMP Goals, Objectives, and Strategies

These *four strategic components* identified in Section 3.5 support this objective:

1) Identify core needs
2) Prioritize projects
3) Identify funding sources and secure commitments
4) Demonstrate fiscal accountability

Performance Actions for this strategy are:

- Seek firm funding commitments for Tier I Core program from State and Tribal governments and other available sources (Section 6, Table 8)
- Develop annual and 5-year LMP work plans
- Prioritize projects, based on established criteria (Section 3.5)
- Seek firm funding commitments for Tier II priority projects (Section 6, Table 9)
- Maintain fiscal accountability
- Create and maintain a tracking tool to document funding and project completion status

Milestones for this strategy are:

- Core program funding is obtained
- Project priorities are identified
- Funding requests for Tier II projects are completed
- Annual and 5-year implementation plans to support budget requests are completed
- Annual report on expenditures, as established by State Statute, Tribal Code, or grant conditions completed
- Annual report on project completion

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Section 6: Budget Estimates, Schedules, and Contingencies

The 2009 LMP, as an alternative to a Superfund remedy for the lake, will be a long-term and costly endeavor. The lack of funding commitments for previous LMP efforts has been the most significant obstacle to reaching agreement on a plan and to making progress with implementation. DEQ and the Tribe have, therefore, employed a different strategy in the 2009 LMP that focuses on adaptive management for implementation activities (Section 5) and a "tiered" approach to budget requests. Initial emphasis and funding (Tier I) will be placed on working with watershed partners using existing authorities to implement the Management Action Tables (Appendix C). Water quality monitoring will establish existing conditions, track changes over time and identify specific sources of nutrient inputs. As management actions are implemented, ongoing monitoring will determine their effectiveness and the need for additional actions and/or regulations. Monitoring will provide the justification for additional future funding requests (Tier II).

Budget estimates for implementing the 2009 LMP are broken down into two tiers. Tier I (Table 8) consists of the core LMP program elements DEQ and the Tribe believe are the minimum, essential, and ongoing components necessary for initial implementation of the plan. Funding for Tier I must come from the respective governments to be consistent, long-term, and effective. Tier II (Table 9) consists of other programs, projects, and special studies that are related to the LMP, and are either underway or may be warranted in the future, to achieve the LMP goal. Funding for Tier II can come from a variety of sources. One of the critical functions of the DEQ and Tribe LMP Coordinators will be to work with watershed partners to implement MAT recommendations and develop other funding proposals for additional nutrient reduction projects once the inventory is completed.

As co-managers of lake water quality, given their respective Clean Water Act authorities, the Tribe and DEQ have identified their staffing and budget needs to implement the LMP, beginning with the core program (Table 8). Work coordination will be critical, as DEQ and the Tribe focus implementation of the core program in their respective jurisdictions. Planning, reporting, prioritizing and coordination of LMP implementation with watershed partners will be tasks performed together.

The budget estimates for staff contained in Tables 8 and 9 are based on several factors: DEQ and the Tribe's past experience in accomplishing similar work, assumptions for standard indirect rates, standard overhead costs, and using salary levels for experienced staff with the associated benefits and operating costs. High-end estimates were applied to the above factors. Actual costs vary between the Tribe and DEQ, therefore the higher values were used for the sake of simplicity and to avoid underestimation.

The budget estimates for other operating costs in Table 8, and TMDL implementation projects, special studies, and wastewater treatment projects contained in Table 9, are based on additional factors. Previous costs for similar studies, services such as lab analysis, plant identification, modeling training, and septic tank inventory work were used. The annual estimate of 2 million dollars for TMDL and other nutrient reduction projects (Table 9), comes from actual costs of projects completed in Appendix D. The estimates for wastewater treatment improvements come from a combination of completed engineering feasibility studies and actual cost for completed projects. The cost estimates for Tier II of the LMP are given to provide a realistic frame of reference for future potential costs of additional nutrient reduction actions that may be needed. Completion of the comprehensive nutrient inventory and ongoing monitoring in Tier I will identify, prioritize, and justify the need for additional implementation projects and special studies to answer key water quality questions.

Since the LMP is functioning as an alternative to a Superfund remedy for the lake, it makes sense that the work be planned, conducted, reported, and reviewed on timelines that coincide with implementation of the OU3 ROD for the basin. Tables 8 and 9, therefore, include a 5-year planning horizon. The core LMP program is ongoing and must be funded annually. Monitoring will help determine priorities for many of the Tier II program components. Section 5 describes, more specifically, the timeframes and accountability mechanisms to track implementation progress and effectiveness, long-term.

DEQ and the Tribe have developed and submitted funding requests to their respective governments in order to implement the core LMP program in 2009. The State legislature and Tribal Council have the discretion to approve funding as requested, approve a different funding scenario or disapprove the requests.

Funding decisions cannot be predicted, therefore, contingencies must be identified. If staffing and funding to implement the complete core LMP program is not approved in 2009, the following are possible alternative scenarios for proceeding with a reduced level of LMP implementation:

1) Evaluate existing staff and resources and prioritize elements of the core program that can be implemented accordingly
2) In addition to #1, identify components of the core program that would be appropriate and timely for seeking EPA grants to implement
3) In addition to #1 and #2, identify components of the core program that would be appropriate and timely to seek funding contributions from other watershed partners to complete specific work through contracts
4) In addition to #1, #2 and #3, identify components of the core program that would be appropriate and timely to enter into agreements with other watershed partners to complete specific work

The Tribe and DEQ understand that if the LMP is not funded in the immediate future, including the scenarios above, an EPA directed and funded Superfund remedy for the lake remains an option.

Table 8. Budget Estimates & Proposed Schedule for Tier I – Core LMP Program Implementation

I. CORE 2009 LMP PROGRAM	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
1. LMP Coordination						**See footnote* – "fully loaded"** **See footnote** – "currently funded"**
DEQ						Personnel costs have been adjusted 5%/yr for inflation after Year 1.
a. DEQ LMP Coordinator - Analyst 4	*110,000*	*115,500*	*121,275*	*127,339*	*133,706*	1.0 FTE - existing DEQ position **
b. DEQ administrative support	16,500	17,325	18,191	19,101	20,056	0.25 FTE - new DEQ position
c. LMP materials (reports, CDs, mailing)	4,000	2,000	2,000	2,500	2,500	
d. Conduct Management Action Table audit	--	--	--	--	5,000	
DEQ subtotal:	130,500	134,825	141,466	148,940	161,262	
Tribe						
a. Tribe LMP Coordinator	110,000	115,500	121,275	127,339	133,706	1.0 FTE - new Tribe position
b. Tribe administrative support	16,500	17,325	18,191	19,101	20,056	0.25 FTE - new Tribe position
c. LMP materials (printing, CDs, mailing)	4,000	2,000	2,000	2,500	2,500	
d. Conduct Management Action Table audits	--	--	--	--	5,000	
Tribe subtotal:	130,500	134,825	141,466	148,940	161,262	
LMP Coordination Total:	**261,000**	**269,650**	**282,932**	**297,880**	**322,524**	
2. Routine Monitoring						
DEQ						
a. Limnology position - Analyst 4	110,000	115,500	121,275	127,339	133,706	1.0 FTE - new DEQ position
b. Technician position - Analyst 3	70,000	73,500	77,175	81,034	85,085	1.0 FTE - new DEQ position
c. Administrative staff	16,500	17,325	18,191	19,101	20,056	0.25 FTE - new DEQ position
d. Nutrient & phytoplankton samples - lab analysis	20,000	20,600	21,218	21,855	22,510	
e. Metals & chlorophyll samples - EPA lab analysis	*13,000*	*14,300*	*14,730*	*15,170*	*15,625*	EPA funded in Year One **
f. Monitoring supplies, equipment, operating	12,000	12,360	12,731	13,113	13,506	
g. Aquatic plant assessments	4,000	4,000	4,000	4,000	4,000	
h. Contractual for CWR modeling support	10,000	10,000	10,000	10,000	10,000	
DEQ subtotal:	255,500	267,585	279,320	291,612	304,488	

*Note: the term, "fully loaded" is referring to all costs associated with staff positions, including: salary, fringe benefits, travel, office space, equipment, indirect, and other associated expenses. **Note: costs in italics are currently funded.

Table 8. continued Budget Estimates & Proposed Schedule for Tier I – Core LMP Program Implementation

I. CORE 2009 LMP PROGRAM	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
2. Routine Monitoring cont.						
Cd'A Tribe						
a. Computer modeler, analysis, reporting	115,000	120,750	126,788	133,127	139,783	1.0 FTE - new Tribe position
b. Limnology position	110,000	115,500	121,275	127,339	133,706	1.0 FTE - new Tribe position
c. Technician position	70,000	73,500	77,175	81,034	85,085	1.0 FTE - new Tribe position
d. Administrative staff	16,500	17,325	18,191	19,101	20,056	0.25 FTE - new Tribe position
e. Nutrient & phytoplankton samples - lab analysis	20,000	20,600	21,218	21,855	22,510	
f. Metals & chlorophyll samples - EPA lab analysis	*13,000*	*14,300*	*14,730*	*15,170*	*15,625*	EPA funded in Year One **
g. Monitoring supplies, equipment, operating	12,000	12,360	12,731	13,113	13,506	
h. Aquatic plant assessment	20,000	20,000	20,000	20,000	20,000	Milfoil control began in 2005
i. Contractual for CWR modeling support	10,000	10,000	10,000	10,000	10,000	
Tribe subtotal:	386,500	404,335	422,108	440,739	460,271	
Routine Monitoring Total:	**642,000**	**671,920**	**701,428**	**732,351**	**764,759**	
3. Basin-wide Nutrient Inventory (3 years)		**Begin**		**End**		
Sampling, data mining, analysis, computer modeling, reporting						
DEQ						
a. Limnologist	--	0	0	0	--	Same staff as in I.2
b. Technician position	--	0	0	0	--	Same staff as in I.2
c. Administrative staff	16,500	17,325	18,191	19,101	20,056	0.25 FTE - new DEQ position
d. Nutrient samples - lab analysis	--	8,000	8,000	8,000	--	
e. Operating, supplies, equipment	--	4,000	4,000	4,000	--	
f. Contractual	--	10,000	10,000	10,000	--	(e.g., GIS, and data mining)
DEQ subtotal:	16,500	39,325	40,191	41,101	20,056	

Table 8. continued Budget Estimates & Proposed Schedule for Tier I – Core LMP Program Implementation

I. CORE 2009 LMP PROGRAM	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
3. Basin-wide Nutrient Inventory cont.		**Begin**		**End**		
Cd'A Tribe						
a. Computer modeler, analysis, reporting	--	0	0	0	--	Same staff as in I.2
b. Limnology position	--	0	0	0	--	Same staff as in I.2
c. Technician position	--	0	0	0	--	
d. Administrative staff	16,500	17,325	18,191	19,101	20,056	0.25 FTE - new Tribe position
e. Nutrient samples - lab analysis	--	8,000	8,000	8,000	--	
f. Operating, supplies, equipment	--	4,000	4,000	4,000	--	
g. Contractual	--	10,000	10,000	10,000	--	(e.g., GIS, and data mining)
Tribe subtotal:	16,500	39,325	40,191	41,101	20,056	
Nutrient Inventory Total:	**33,000**	**78,650**	**80,382**	**82,202**	**40,112**	
4. Education & Outreach Program						
DEQ						
a. DEQ outreach specialist - Analyst 3	102,000	107,100	112,455	118,078	123,982	1.0 FTE - new DEQ position
b. Administrative staff	33,000	34,650	36,383	38,202	40,112	0.5 FTE - new DEQ temp position
DEQ subtotal:	135,000	141,750	148,838	156,280	164,094	
Tribe						
a. Tribe outreach specialist	102,000	107,100	112,455	118,078	123,982	1.0 FTE - new Tribe position
b. Administrative staff	33,000	34,650	36,383	38,202	40,112	0.5 FTE - new Tribe position
Tribe subtotal:	135,000	141,750	148,838	156,280	164,094	
Shared Program						DEQ & Tribe share costs 50/50
a. Outreach materials and equipment (*e.g.*, reference library, printing, CDs, mailing, school displays)	5,000	25,000	20,000	10,000	10,000	Includes Lake*A*Syst materials
b. Stewardship Center facility cost (rental, utilities)	--	24,000	25,200	26,460	27,783	Pending needs assessment in Year 1
c. Stewardship Center services, equipment & supplies	--	50,000	10,000	10,000	10,000	Pending needs assessment in Year 1
Shared subtotal:	5000	99,000	55,200	46,460	47,783	
Education & Outreach Total:	**275,000**	**382,500**	**352,876**	**359,020**	**375,971**	
CORE Grand Total:	**1,211,000**	**1,402,720**	**1,417,618**	**1,471,453**	**1,503,366**	

Table 9. LMP Budget Estimates & Proposed Schedule for Tier II – Programs, Projects & Studies

II. 2ND TIER LMP PROGRAM	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
1. TMDL Program Coordination						**See footnote* – "fully loaded"** **See footnote** – "currently funded"**
DEQ						Personnel costs have been adjusted 5%/yr for inflation after Year 1.
a. TMDL Coordinator - Analyst 3	*102,000*	*107,100*	*112,455*	*118,078*	*123,982*	1.0 FTE – existing DEQ position
b. TMDL administrative support	16,500	17,325	18,191	19,101	20,056	0.25 FTE - new DEQ position.
c. TMDL materials (reports, CDs, mailing)	2,000	2,000	2,000	2,000	2,000	
DEQ subtotal:	120,500	126,425	132,646	139,179	146,038	
CdA Tribe						
a. TMDL Coordinator	102,000	107,100	112,455	118,078	123,982	1.0 FTE – new Tribe position
b. TMDL administrative support	16,500	17,325	18,191	19,101	20,056	0.25 FTE – new Tribe position
c. TMDL materials (reports, CDs, mailing)	2,000	2,000	2,000	2,000	2,000	
Tribe subtotal:	120,500	126,425	132,646	139,179	146,038	
TMDL Program Coordination Total:	**241,000**	**252,850**	**265,292**	**278,358**	**292,076**	
2. TMDL Implementation Projects						
Projects on TMDL & non-303(d) waterbodies	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	Estimates based on Appendix D project costs
TMDL Implementation Total:	**2,000,000**	**2,000,000**	**2,000,000**	**2,000,000**	**2,000,000**	
3. Eurasian Watermilfoil Control Treatments						Same staff as in I.2. Additional costs include: contracts, materials-supplies, and lab analysis.
Control treatments for Eurasian Watermilfoil	180,000	180,000	180,000	180,000	180,000	Estimate based on treatment application costs since 2006
EWM Treatment Total:	**180,000**	**180,000**	**180,000**	**180,000**	**180,000**	

*Note: the term, "fully loaded" is referring to all costs associated with staff positions, including: salary, fringe benefits, travel, office space, equipment, indirect, and other associated expenses. **Note: costs in italics are currently funded.

Table 9. continued LMP Budget Estimates & Proposed Schedule for Tier II – Programs, Projects & Studies

II. 2ND TIER LMP PROGRAM	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
4. Special Studies						Same staff as in I.2. Additional costs include: contracts, materials-supplies, and lab analysis.
a. Establish, and maintain two (2) in-lake meteorological stations	--	120,000	2,000	2,000	2,000	
b. Zooplankton sampling and analysis	1,000	1,000	1,000	1,000	1,000	
c. Benthic invertebrate sampling, and analysis	--	10,000	10,000	--	--	
d. Update fish consumption advisory: conduct fish tissue sampling - study food chain biomagnification of metals concentrations	--	--	--	10,000	10,000	
e. Lakebed surface sampling and sediment coring	200,000	--	--			
f. Continue sediment benthic flux of metals/nutrients (through USGS contract)	--	--	--	--	50,000	
g. DEQ land use change and runoff characteristics, existing proposed study (March 2006)	--	20,000	20,000	--	--	
h. Nearshore studies of suspected septic drainfield impacts (periphyton, aquatic plants, groundwater monitoring wells)	--	--	--	75,000	75,000	
i. Aquatic plant contributions to internal nutrient loading	--	10,000	10,000	10,000	--	
Special Studies Total:	**201,000**	**161,000**	**43,000**	**98,000**	**138,000**	

Table 9. continued LMP Budget Estimates & Proposed Schedule for Tier II – Programs, Projects & Studies

II. 2ND TIER PROGRAMS	Year 1	Year 2	Year 3	Year 4	Year 5	Comments
The estimated costs below for WWTPs were supplied by the Sewer Districts from various planning documents						
5. Upgrades to Wastewater Treatment Plants- Upstream						
a. South Fork Coeur d'Alene River Sewer District	--	14,000,000				
b. Smelterville	--					Total WWTP costs are shown in one year, but actual expenses occur over many years
c. Clarkia WWTP	--	30,000				
d. Santa/Fernwood WWTP	--	39,000				
e. St. Maries WWTP	--	59,000				
f. Harrison WWTP	--	150,000				
g. Plummer WWTP	--	8,000,000				
Upstream WWTP Upgrades Total:		**22,278,000**				
6. Embayment Sewage Systems Upgrades						
	--	--				To be determined
7. Upgrades to Wastewater Treatment Plants-Downstream						
a. City of Coeur d'Alene WWTP	--	15,000,000				
b. City of Post Falls WWTP	--	14,000,000				
c. Hayden Area Regional Sewer Board	--					
Downstream WWTP Upgrades Total:		**29,000,000**				
8. Additional Funding/Staffing for MATs Implementation						To be based on coordination with MAT partners
	--	--				To be determined

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Appendix A – State of Lake Water Quality

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Appendix A – State of Lake Water Quality

A.1 Introduction

A key finding through the Phase 1 LMP Assessment of the ADR process was that among the Coeur d'Alene Lake community, there was not a clear understanding of the current water quality conditions within the lake, and at times there were conflicting views and messages from different agency staff and technical experts on the lake condition (Harty, 2007). As part of the ADR process to prepare for drafting a collaborative LMP, a "State of the Lake - 2007" presentation with handout materials was prepared by the Tribe and DEQ containing an agreed upon summary of limnological conditions within the lake. The presentation and materials were given to community stakeholder groups during briefing and input sessions prior to writing the 2008 draft LMP. This Appendix is essentially an expanded version of the outline format and information contained within the "State of the Lake" presentation.

It is the intent of the Tribe and DEQ to frequently update and publish increased understanding of lake conditions gained through continued monitoring, studies, and analysis. When the 2008 draft LMP was completed and distributed (June 2008), the scientific report of USGS studies from 2003 – 2006 (see Section A.2) had not yet been published in final form. Preliminary data summaries of USGS lake monitoring were used in the draft LMP Appendix A (raw data for some sampling stations was available by download from the USGS web site). The final USGS report was published in September 2008 (Wood and Beckwith, 2008). The "State of the Lake" for this 2009 final LMP has been updated to provide a more comprehensive summary of the USGS 2003 – 2006 studies including annual load estimates of phosphorus and nitrogen into the lake, comparing the recent study with the initial 1991-92 baseline study.

Another example of future updated information will come from the recently completed development of an ELCOM-CAEDYM computer model specific to Coeur d'Alene Lake, by staff from the University of Western Australia – Centre for Water Research and the USGS (Dallimore *et al*., 2007 and Hipsey *et al*. 2007; see also Appendix B). In September 2007, the Centre provided training to staff of DEQ, the Tribe, and USGS on the science behind the computer model, including: hydrodynamics of river flow through the lake, biological interactions and metabolism, lake thermodynamics, water chemistry, and geochemistry of metal containing compounds. There was also introductory training on model setup, data parameters, data input, and conducting model runs. As DEQ and Tribal scientists learn to conduct computer runs, input newly obtained data, and use field data for computer run validation, it is anticipated that the level of understanding of lake conditions and responses to basin nutrient loads will increase.

A.2 Previous Monitoring and Research Efforts

Coeur d'Alene Lake has received considerable monitoring and research efforts. Previous lake studies include those listed in Table A1, beginning with EPA monitoring visits to the lake in 1975 under the National Eutrophication Survey. An important and comprehensive effort was the USGS baseline study conducted in calendar years 1991 and 1992 (CY91-92). Data from this effort was utilized in the development of the initial, 1996 LMP. A subsequent baseline study was conducted by the USGS, Tribe, and others, from October 2003 – August 2006 (WY04-06).

Table A1. Monitoring and research studies conducted in Coeur d'Alene Lake since 1975 (this is not a complete list). See References for full citations.

1975:
EPA National Eutrophication Survey – 3 sampling visits, April, July, & September
(U.S. EPA, 1977)

1987:
USGS sampling trips
(Woods, 1989)

1989:
USGS extensive sampling of metal concentrations in lakebed sediments
(Horowitz *et al*. 1993, 1995)

1991 and 1992:
USGS baseline study of limnological conditions
(Woods and Beckwith, 1997)

1994:
USGS bioassays of dissolved zinc inhibition of phytoplankton
(Woods and Beckwith, 1997)

1995 – 2002:
DEQ monitoring of northern pool open waters and bays: summer – fall only
(unpublished data)

1998 - 2001:
USGS study of benthic flux of metals and nutrients from sediments
(Kuwabara *et al*., 2000 and Kuwabara *et al*. 2003)

August 2001, June 2004, June 2005:
USGS – research of zinc effects on phytoplankton productivity
(Kuwabara, *et al*. 2006)

2002 – 2005:
Studies & reports produced for Avista FERC Relicensing - Spokane River Hydrologic Project
(website: www.avistautilities.com/resources/relicensing/spokane/workgroups.asp?ID=10033)

October 2003 – August 2006:
USGS & Coeur d'Alene Tribe – further baseline studies of limnological conditions
(Wood and Beckwith, 2008)

2004 – 2006:
USGS, University of Western Australia – Centre for Water Research, and Coeur d'Alene Tribe – development of ELCOM-CAEDYM computer model specific for Coeur d'Alene Lake
(Dallimore *et al*., 2007 and Hipsey *et al.* 2007)

March 2003 – ongoing:
EPA - Basin Environmental Monitoring Program including two inflow river stations and one lake outflow station
(U.S. EPA, 2004a)

A.3 Morphometric Characteristics

Table A2 presents some basic physical and hydrological data for Coeur d'Alene Lake. Of importance to observed conditions within the lake and Spokane River (lake outflow), is the fact that a very large watershed (2.4 million acres) drains into the lake with a combined annual inflow volume from two major rivers and numerous tributaries that average approximately twice the lake volume. On a theoretical basis, lake volume is replaced on the average of twice a year (flushing rate, or the inverse, hydraulic residence time). This is a very rapid flow-through, or replacement time, for a large lake.

Table A2. Morphometric data for Coeur d'Alene Lake at full-pool elevation of 2128 ft (Woods and Beckwith, 1997)

Surface area =	31,875 acres
Lake volume =	2.3 million ac-ft
Max depth =	64 m
Mean depth =	22 m
Mean hydraulic residence =	0.5 years
Watershed area =	2.4 million acres
Shoreline length =	150 miles

A.4 Multiple Lake Zones and Two Major Rivers

The Coeur d'Alene Lake system is complex and interconnected with two major rivers and numerous tributaries flowing in and mixing with lake waters, and then discharging to create the Spokane River. However, when evaluating trends of water quality data, and ecological conditions, the lake can be viewed as multiple lake zones influenced by two major rivers (see Figure A1).

Mid-center northern pool within deep waters. This zone extends from the lake outlet eastward toward Wolf Lodge Bay and southward to just north of the mouth of the Coeur d'Alene River, with water depths ranging from 20 – 60 m. This area is represented by USGS sampling sites #1 (SE of Tubbs Hill), #3 (W of Driftwood Point), and #4 (NE of University Point). These sites were monitored in USGS baseline studies of CY91-92 and WY04-06, and by DEQ in 1995 – 2002. Wolf Lodge Bay as represented by USGS site #2 was sampled in CY91-92, but not in WY04-06.

Numerous shallow bays from shoreline to 20 m depth. This zone includes multiple areas which typically have tributary streams flowing into them such as Carlin Creek into Carlin Bay and Fighting Creek into Rockford Bay. There have been sampling sites within many of the bays since 1991, but not of the sample size, consistency, and frequency of the referenced USGS sites listed above.

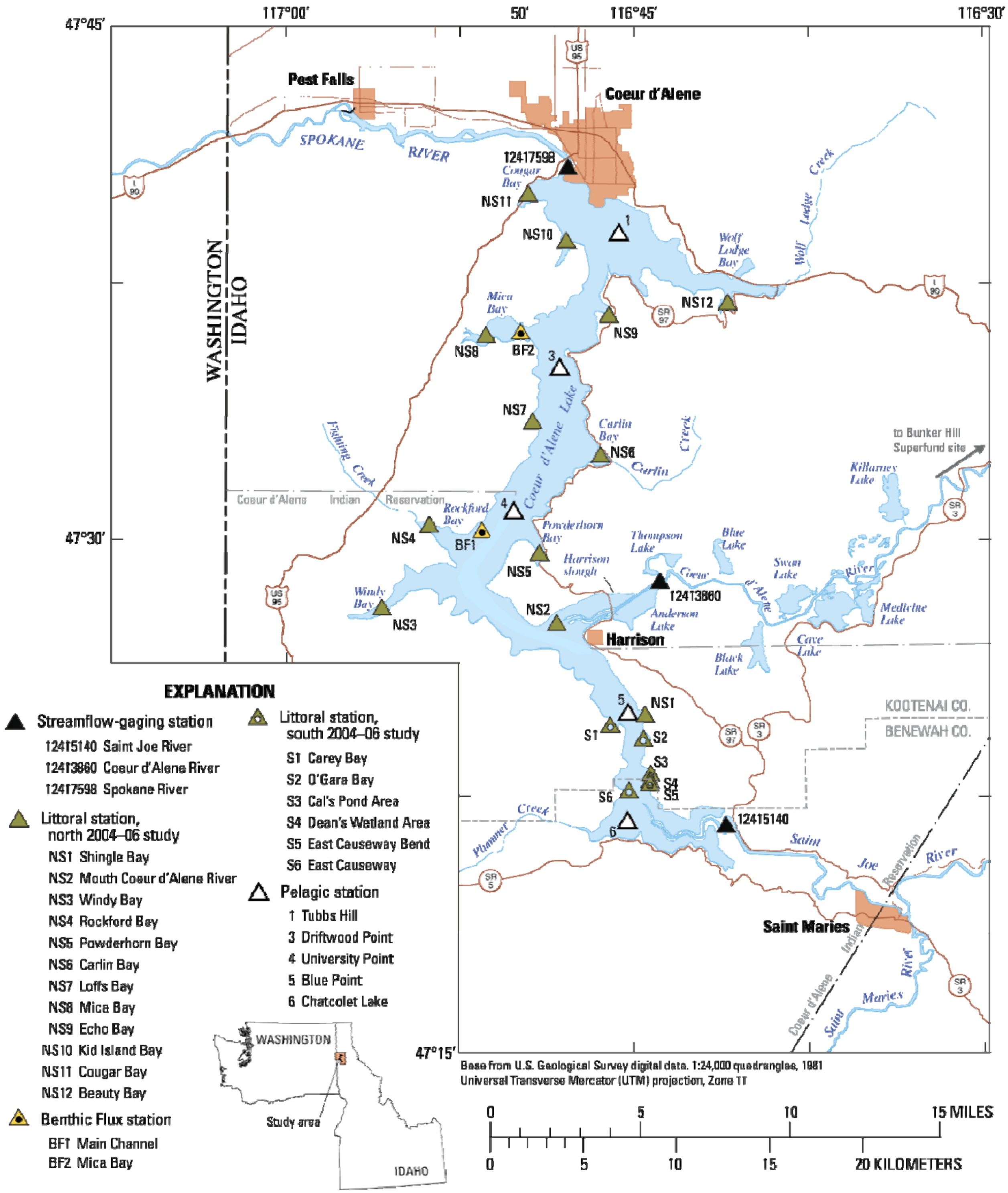


Figure A1. Map of USGS and Coeur d'Alene Tribe sampling sites in Coeur d'Alene Lake for the period of October 2003 – August 2006 (Wood and Beckwith, 2008).

Transitional zone between southern and northern pool waters. This zone includes the area between the mouth of the Coeur d'Alene River south to approximately Conkling Point where water depths range from 10 – 20 m. This zone is represented by USGS site #5, a site that was monitored in both baseline studies.

Southern shallow waters, 10 m and less. This zone extends southward from Conkling Point and includes the inflow channel and lateral lakes along the lower St. Joe River. This zone is represented by USGS site #6 (Chatcolet Lake), and was monitored in both baseline studies.

Major inflowing rivers, the Coeur d'Alene and St. Joe. Annual water volume into the lake is slightly greater for the St. Joe River than the Coeur d'Alene River. Annual combined inflow of these two rivers account for approximately 90% of the total inflow to the lake, (Woods and Beckwith, 1997). Water quality conditions of these two major rivers play a major role on observed lake conditions.

A.5 Hydrodynamics into and within Coeur d'Alene Lake

Flow and current patterns within the lake are created by: two major rivers and tributary streams, currents generated by wind events, and thermodynamics. Flow and current patterns are extremely variable and complex throughout a year and between years. It is anticipated that with future utilization of the hydrodynamic component of the ELCOM-CAEDYM model, an increased understanding of these hydrodynamics will emerge.

Monitoring during WY04-06 studies was under conditions where flows from the two rivers were below historic norms in WY04 and WY05, and above normal flow for WY06. In WY06, combined inflow of the two rivers was around 4.3 million acre-feet, while the estimated volume of the lake is around 2.3 million acre-feet, or about one-half of the total river inflow (Figure A2).

A.6 Riverine Flow of Metals, Suspended Sediment, and Nutrients

Annually, the Coeur d'Alene River continues to carry elevated concentrations of both dissolved and particulate forms of potentially toxic metals into the lake (Figure A3 for zinc). The St. Joe River carries low concentrations of trace metal compounds into the southern lake, but total phosphorus (TP) concentrations, on the average, are higher within the St. Joe River (Figure A4), and it delivers a greater annual phosphorus load than the Coeur d'Alene River.

USGS total phosphorus and nitrogen loading estimates into the lake (in kilograms/yr), along with annual inflow volumes from the St. Joe and Coeur d'Alene Rivers, are summarized for the 5 study years in Table A3 (CY91-92 & WY04-06, extracted from Wood and Beckwith, 2008). The estimated total nutrient loads include loads from the two major rivers, and other sources such as tributaries to the lake, subsurface wastewater around the lake shoreline, and precipitation on the lake's surface. For the CY91-92 study, load estimates from wastewater treatment plants were presented, but were not included for the WY04-06 study. For a complete description of sampling methods, sample site locations, laboratory method reporting limits (MRLs), computer modeling, extrapolation methods, and error considerations, the reader is referred to Wood and

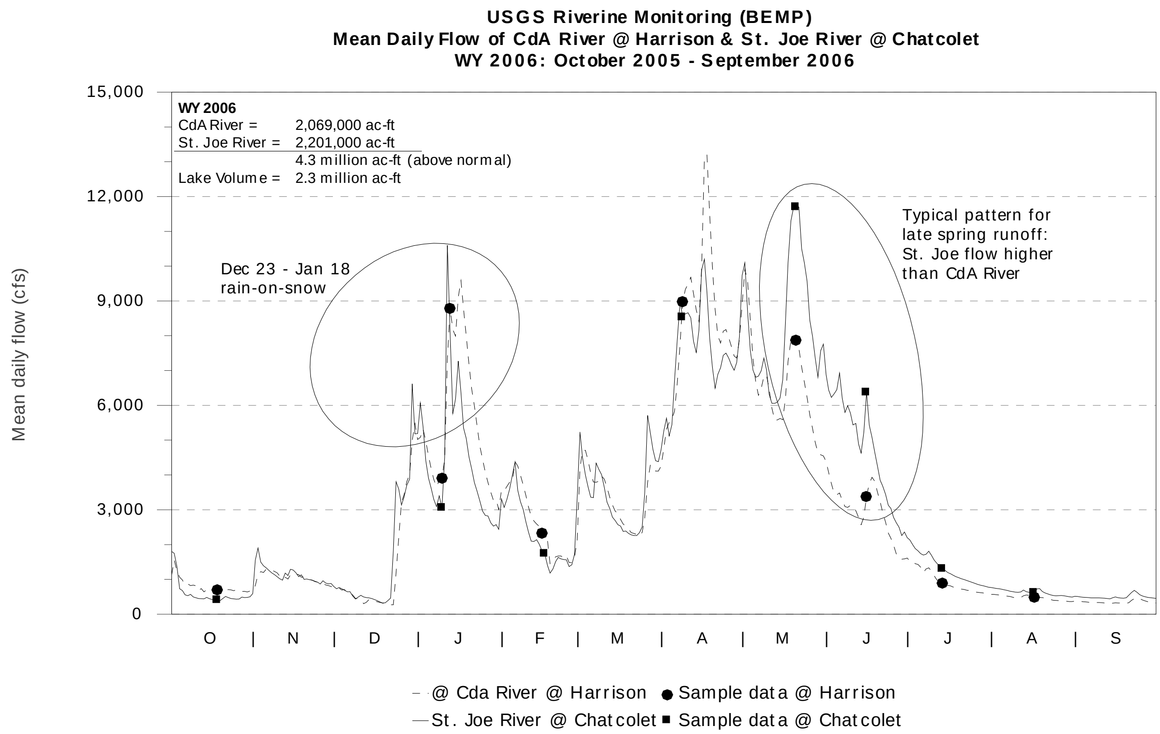


Figure A2. Hydrograph of Coeur d'Alene River and St. Joe River mean daily flows (cfs) for Water Year 2006 (Brennan *et al*. 2007)

Beckwith (2008). There were differences in these factors between the two study periods which need to be taken into consideration when evaluating the loading results and comparison of the two studies.

Total phosphorus (TP) loads from the two rivers combined ranged between 66 – 88% of the annual total load among the 5 study years. The St. Joe River had the higher percent contribution each study year. Because river flow is a key factor in the calculation of TP load, the different hydrologic conditions among the 5 study years were responsible for most differences in annual loads delivered into and discharged out of the lake. USGS concludes that when annual TP loads are normalized for river flow among the 5 years, loading was higher for the WY04-06 study period compared to CY91-92 because TP concentrations in gaged inflows were statistically higher in the latter study (Wood and Beckwith, 2008).

Total nitrogen (TN) annual loads into Coeur d'Alene Lake are more difficult to evaluate between the study periods than TP. In part this is because total nitrogen concentrations tend to be relatively low at the mouths of the two rivers, and the MRL for TN in CY91-92 was 0.20 mg/L compared to the MRL in WY04-06 of 0.06 mg/L (many more TN sample concentrations reported as <MRL during the earlier study). Estimated TN loads from the two rivers combined ranged between 37 – 88% of the annual total load among the 5 study years. Except for 1991, Coeur d'Alene River had the higher percent contribution.

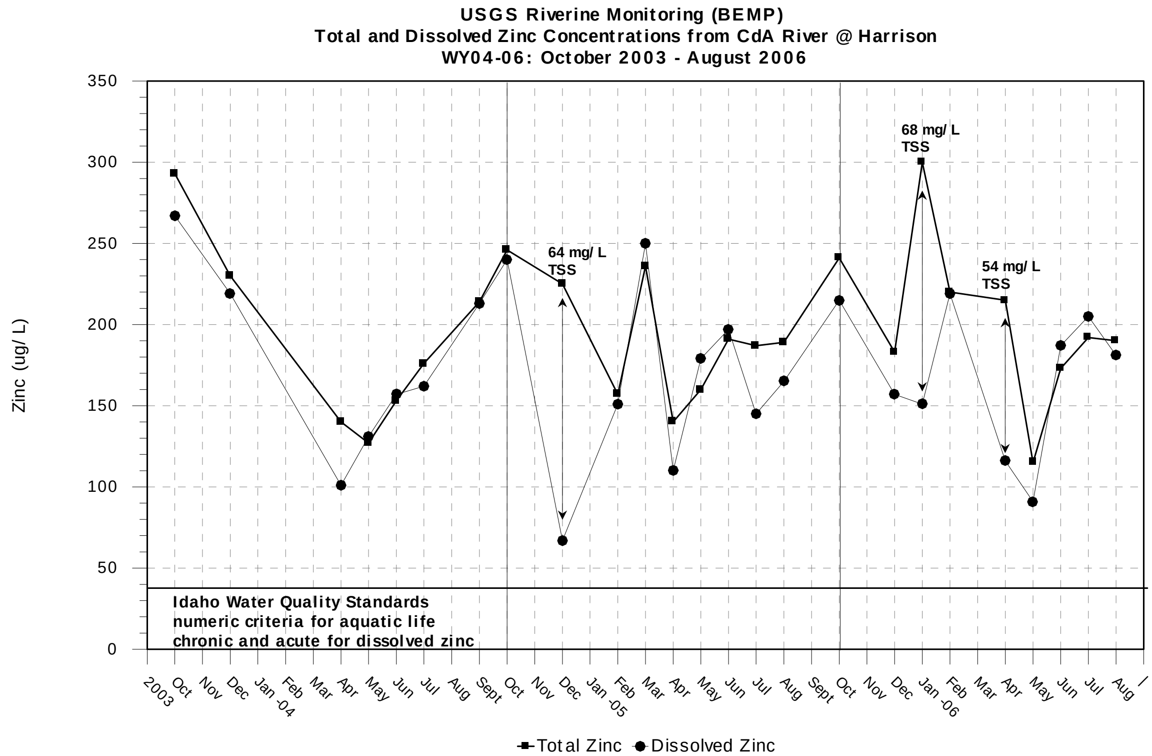


Figure A3. Total and dissolved zinc near the mouth of the Coeur d'Alene River for Water Years 2004 – 2006 as measured by USGS (Brennan *et al*., 2005; Brennan *et al*., 2006; Brennan *et al*. 2007).

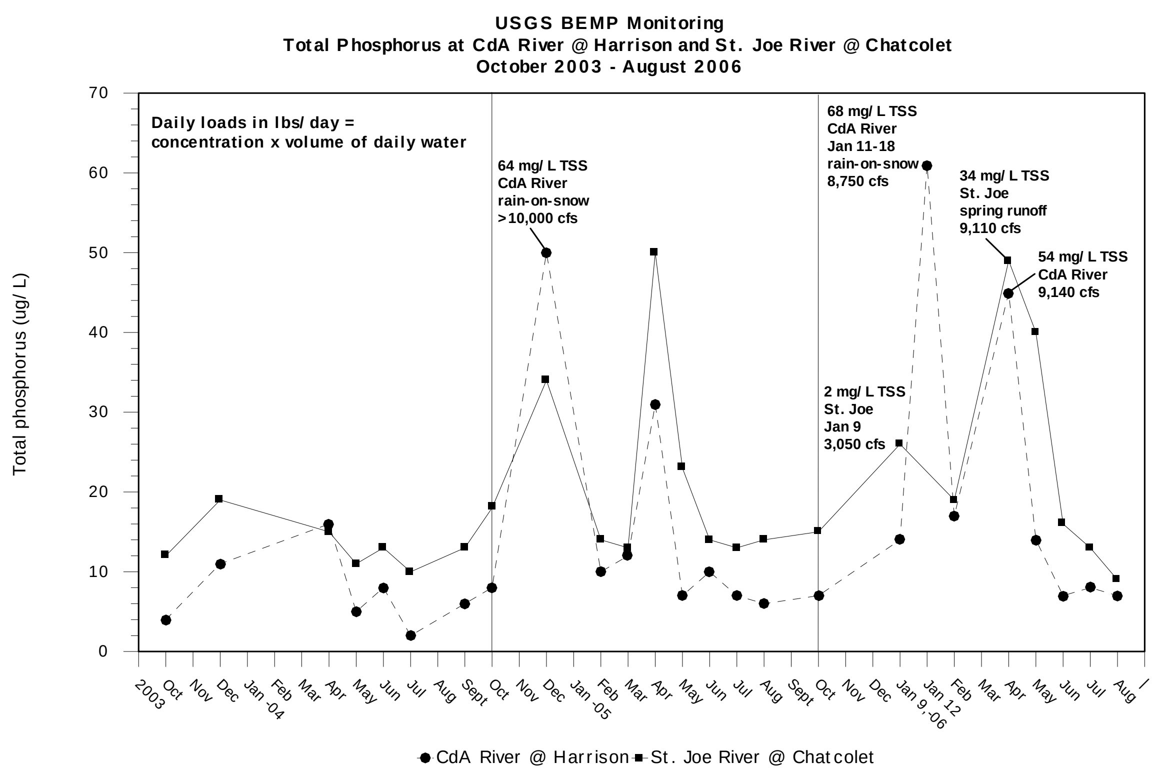


Figure A4. Total phosphorus near the mouths of the Coeur d'Alene River (dashed line) and St. Joe River (solid line) for Water Years 2004 – 2006 as measured by USGS with TP peaks associated with high flow and high TSS events (Brennan *et al*., 2005; Brennan *et al*., 2006; Brennan *et al*. 2007).

Table A3. Summary of nutrient loading budgets and annual river flow volume for Coeur d'Alene Lake as developed by the USGS for calendar years 1991 and 1992 and Water Years 2004 – 2006 (data taken from Table 4, Wood and Beckwith, 2008)

Budget component	CY1991	CY1992	WY2004	WY2005	WY2006
Total phosphorus load (kilograms/yr)					
Total inflow load	92,800	39,400	75,800	99,000	144,000
Percent St. Joe River	43%	38%	47%	46%	50%
Percent Cd'A River	36%	28%	34%	39%	38%
Total outflow load	47,800	25,400	33,400	32,900	55,300
Residual (outflow – inflow)	-45,000	-14,000	-42,000	-66,100	-88,700
Residual (percentage of inflow)	48	36	56	67	62
Overall error	15,000	5,400	7,350	10,000	16,200
Total nitrogen load (kilograms/yr)					
Total inflow load	2,110,000	953,000	408,000	399,000	466,000
Percent St. Joe River	47%	36%	15%	12%	18%
Percent Cd'A River	39%	42%	29%	27%	19%
Total outflow load	1,750,000	775,000	253,000	213,000	639,000
Residual (outflow – inflow)	-360,000	-178,000	-155,000	-186,000	173,000
Residual (percentage of inflow)	17	19	38	47	NA
Overall error	180,000	68,000	67,700	62,000	259,000
River flow volume (cubic hectometers/yr)					
St. Joe River	3,350	1,660	1,940	2,140	2,720
Coeur d'Alene River	2,610	1,280	1,700	1,910	2,550

USGS concludes that when annual TN loads are normalized for river flow among the 5 years, loading was higher for the CY91-92 study period compared to WY04-06. DEQ and the Tribe are reevaluating this reported conclusion based in part because of the numerous TN values <0.20 mg/L in CY91-92, and because the CY91 annual load estimate of 2,110,000 kilograms far exceeds other study years. One sampling event during a high flow period within the week of May 19, 1991, produced a TN concentration of 2.5 mg/L at the St. Joe River sampling station, and 1.4 mg/L at the mouth of the Coeur d'Alene River. These concentrations are far higher than any other reported values within the study periods, and highly influenced the annual TN load for 1991.

As river flows enter the lake, a portion of the annual particulate and dissolved metal load, as well as a portion of the phosphorus load, eventually ends up in lakebed sediments. A portion is carried north and exits out the Spokane River. Overall, the lake is a net sink for cadmium, lead, zinc, and phosphorus loads (more comes in than goes out).

Water quality conditions within Coeur d'Alene Lake change in response to high river and stream flows. There can be significant rain-on-snow events occurring any time from December through March, and high flows during spring peak runoff, which typically occurs from late March through mid-June (see Figure A2 for WY06). Suspended sediment (measured as Total

Suspended Sediment, TSS) from the rivers and streams can be high during these periods. Figure A4. shows an association of high flows, TSS spikes, and TP spikes within the two rivers. Spikes in TP concentrations can be recorded within the lake corresponding to the high flow input plumes (most of the high TP values in the box plots of Figure A9). During these periods water clarity typically declines throughout the lake.

Lake trends in total lead and zinc can be traced to inflow trends from the Coeur d'Alene River. For example, the high values of the total lead box plot (Figure A7) are associated with high flow periods. Trends in metal concentrations are complicated to track because of the influence of the St. Joe River moving northward, a river source with low metal concentrations.

A.7 Trace Elements in Lakebed Sediments

Within the northern pool, and south to about Conkling Point, lakebed sediments are highly contaminated in antimony, arsenic, cadmium, copper, lead, mercury, silver, and zinc (Table A4 for trace element concentrations; from Horowitz *et al*. 1995 as summarized in Woods and Beckwith, 1997). Sediments in southern waters are much lower in metal concentrations and are considered less influenced by metal inflows from the Coeur d'Alene River. Southern waters, however, are not completely isolated from metal-laden inflows from the Coeur d'Alene River, or from wind-driven circulation of contaminated bed sediments from more northern parts of the lake. Table A5 summarizes the estimated masses of trace elements associated with enriched sediments in Coeur d'Alene Lake based on research presented in Horowitz *et al*. (1993 and 1995).

High concentrations of trace metals within lakebed sediments can be toxic to benthic invertebrates. Studies are ongoing on food web effects from metals within sediments and the concern of human fish consumption and toxicity to migratory birds.

Studies have been conducted on metal-containing compounds within lakebed sediments and sediment pore waters, and on the release of dissolved metals from the sediments into adjacent lake waters (e.g., Harrington *et al*., 1998; Kuwabara *et al*., 2000; Kuwabara *et al*., 2003; Toevs *et al*., 2006; and Sengör *et al*. 2007). This process is termed benthic flux and includes precipitation of solid phase metal compounds back to the sediments.

Benthic flux mechanisms are very complex, variable among the specific metal elements, and not completely understood at this time. It appears that metal containing compounds within and on top of the sediments do release dissolved metals that migrate to the water column immediately above the sediments (Kuwabara *et al*., 2000 and Kuwabara *et al*. 2003). It is uncertain as to what degree high concentrations of both total and dissolved metals near the sediments migrate upward within hypolimnion waters during stratification, or become transferred to upper waters during fall lake turnover. The role of hypolimnetic dissolved oxygen levels during stratification in relation to particulate and dissolved metals in lakebed sediments is discussed in Section A.11.

Table A4. Statistical summary of selected trace elements in surficial and subsurface lakebed sediments in enriched and unenriched areas, Coeur d'Alene Lake (Horowitz *et al*. 1993, 1995 as summarized in Woods and Beckwith, 1997).

[mg/kg, milligrams per kilogram; S, surficial sample; C, subsurface core sample]

Trace Element	Sample Type	Concentration for enriched area (mg/kg)				Median for unenriched areas[1]
		Minimum	Maximum	Mean	Median	
Arsenic	S	2.4	660	151	120	4.7
	C	3.5	845	103	30	12
Cadmium	S	<0.5	157	62	56	2.8
	C	<0.1	137	25	26	0.3
Copper	S	9	215	72	70	25
	C	20	650	91	60	30
Lead	S	14	7,700	1,900	1,800	24
	C	12	27,500	3,200	1,250	33
Mercury	S	0.02	4.9	1.8	1.6	0.05
	C	<0.01	9.9	1.9	0.95	0.06
Zinc	S	63	9,100	3,600	3,500	110
	C	59	14,000	2,400	2,100	118

1Unenriched area median concentration for sample type S based on 17 samples from southern area of Coeur d'Alene Lake and lower reach of St. Joe River. Unenriched area median concentration type C based on 189 sample aliquots from cores beneath enriched area.

Table A5. Calculated estimates of masses of trace elements associated with enriched sediments in Coeur d'Alene Lake (table extracted from Horowitz *et al*. 1995).

Trace Element	Total mass in enriched Zone (metric tonnes)	Mass in enriched zone per km^2 (metric tonnes)	Mass if sediment contained background concentrations (metric tonnes)	Excess due to presence of enriched sediments (metric tonnes)
Arsenic	12,000	111	495	11,500
Cadmium	3,300	31	16	3,284
Copper	10,000	99	2,600	7,400
Lead	470,000	4,350	1,700	468,000
Mercury	265	2	5	260
Zinc	240,000	2,900	9,600	230,000

A.8 Graphical Presentation of Data

For discussions of lake water quality presented in the remainder of this Appendix, there is a series of box plots; they are often used to depict data comparisons between CY91-92 and WY04-06 studies. These box plots were developed from raw data down-loaded from the USGS web site, and checked with data graphs presented in the USGS final report (Wood and Beckwith, 2008). A diagram of box plots statistics used in this report as computed by SYSTAT software is shown as Figure A5. Box plot central tendency is shown as the median, and includes calculation of the geometric mean (average of the logarithmic values of a data set, converted back to a base 10 number). The geometric mean dampens the effect of very high or low values in small sample size data sets compared to calculation of the arithmetic mean. In the CY91-92 data set of limnological variables, USGS used geometric means to assign trophic state to Coeur d'Alene Lake sampling stations (Woods and Beckwith, 1997 as reproduced in Table A6). The measures and milestone tables of the 2009 LMP (see Section 5.1) also assigns geometric means to limnological variables for desired and trigger conditions.

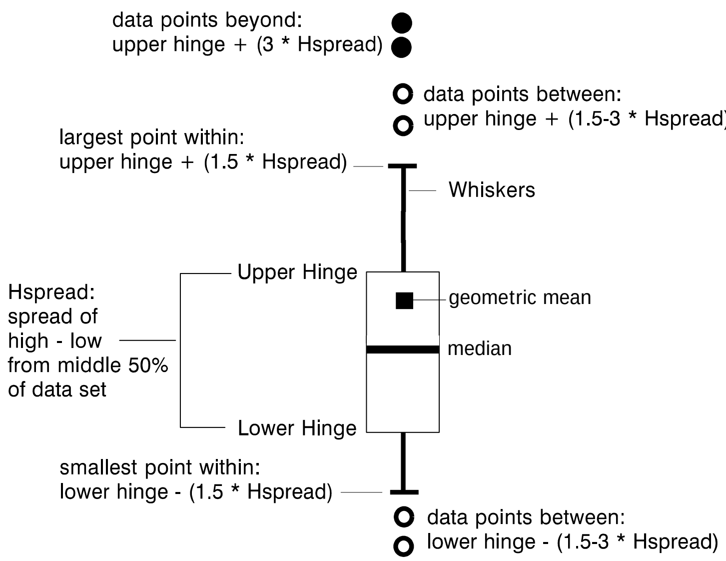


Figure A5. Definitions of box plot statistics used for data presentations within this report.

A.9 Trace Metals within the Lake Water Column

Based on the USGS - WY04-06 data set, concentrations of dissolved zinc within northern pool waters (sites #1, #3, and #4) consistently violate the Idaho Water Quality Standards (WQS) numeric criteria for aquatic life (IDAPA 58.01.02.210, Figure A6 for photic zone samples). Dissolved metals in the WQS are functionally free ions within water samples passed through a 0.45 micron filter. The WQS chronic criteria (CCC) and acute criteria (CMC) for dissolved zinc are both 36 µg/L based on an adjustment to 25 mg/L total hardness as $CaCO_3$. The zinc CCC criteria at site #5 (Tribal WQS, 26 – 37 µg/L) is frequently exceeded. For dissolved lead, the CCC criteria is occasionally exceeded within the northern pool and at site #5 (Figure A7).

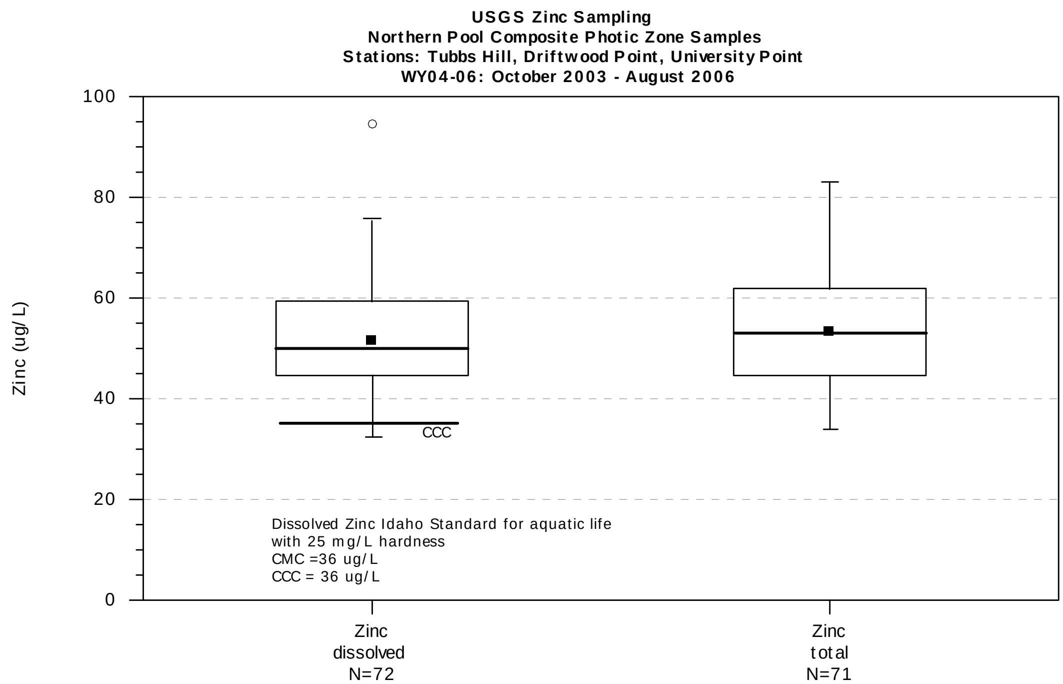


Figure A6. USGS photic zone samples for zinc, data for three northern pool stations combined, WY04-06 study.

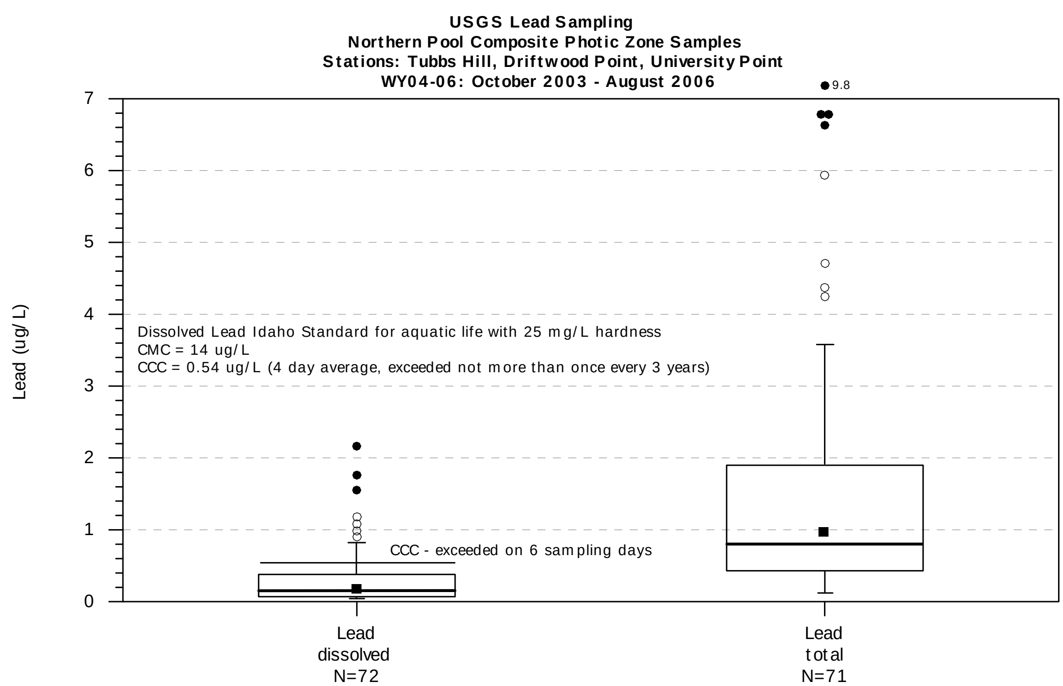


Figure A7. USGS photic zone samples for lead, data for three northern pool stations combined, WY04-06 study.

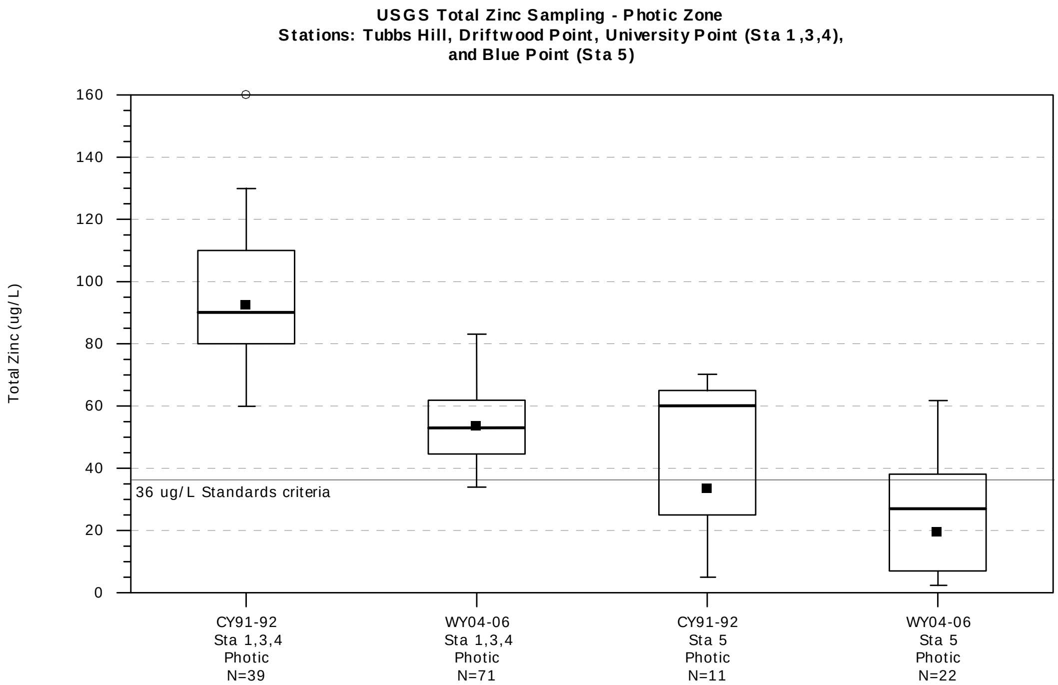


Figure A8. USGS photic zone samples for total zinc; data for three northern pool stations combined, and data for station Blue Point (Station #5). Data is compared between study periods CY91-92 and WY04-06.

Dissolved cadmium occasionally exceeds the State WQS CCC criteria (0.25 µg/L) at sites #1 and #3, and frequently exceeds the criteria at site #4. The Tribal WQS cadmium criteria (0.19 –0.26 µg/L) is frequently exceeded at site #5. Dissolved metals criteria are not exceeded at site #6.

Total zinc concentrations (dissolved plus particulate) within photic zone samples (composite samples from the lake surface down to the depth of 1% of incident surface light), when combined for northern pool USGS sampling sites #1, #3, and #4, show a significant decline from CY91-92 data compared to WY04-06 (Figure A8). Dissolved zinc was not measured in CY91-92, but total and dissolved zinc were nearly the same in concentration in WY04-06 data. Median total zinc in CY91-92 was 90 µg/L (n=39 samples) compared to a median of 53 µg/L in the latter study (n=71 samples).

The reasons for an apparent zinc decline within photic zone samples between the two baseline studies are subject to further analysis.

Zinc concentrations at USGS site #5 (NE of Conkling Point), fluctuate widely from low concentrations to a maximum of 70 µg/L (Figure A8). This fluctuation is due to a mixed influence of Coeur d'Alene River plumes flowing south, and a St. Joe River plume (with low metal concentrations) flowing north. Dissolved zinc at site #5 often violates WQS criteria (Tribal WQS). Dissolved zinc at site #6 (Chatcolet Lake) does not violate WQS criteria.

Zinc data in the lake is difficult to analyze because of fluctuating trends among seasons, and with depth. Zinc depth profiles were taken by USGS in 1999, and then routinely sampled in WY04-06. Samples were from: the photic zone (a composite sample), 20 m and 30 m (12 m at site #5), 1 m off the bottom, and occasionally a few centimeters off the bottom. Zinc concentrations vary significantly between depths during summer through fall stratification, as zinc exhibits a pronounced declining trend within photic zone samples from about May through October. This likely represents a sinking of particulate bound zinc from upper waters.

Dissolved zinc is of importance not only from exceedance of WQS, but also because zinc-ion activity can limit, or inhibit phytoplankton productivity within the lake. The mechanism of zinc inhibition to aquatic primary producers is reported as a disruption of phosphate assimilation and phosphate intracellular utilization (Kuwabara *et al*. 2006). Zinc-ion inhibition results in lower chlorophyll *a* concentrations than what might be expected or predicted within Coeur d'Alene Lake. It appears that diatoms, a major phytoplankton component of the lake, have a greater tolerance to zinc-ion activity than other phytoplankton forms (Kuwabara *et al*. 2006).

A.10 Nutrient Concentrations, Phytoplankton, and Water Clarity

Limnological investigations typically categorize a lake with a "trophic state" using in-lake indicator conditions of: total phosphorus, chlorophyll *a* (as a measure of phytoplankton biomass), water clarity, and at times nitrogen. An "oligotrophic" lake is generally: low in nutrient concentrations (phosphorus and nitrogen), low in phytoplankton productivity with minor blue-green algae populations, and high in water clarity during summer through fall months. A "eutrophic lake" is generally: high in nutrients, high in phytoplankton productivity, often includes blooms of nuisance blue-green algae, and is low in water clarity. Table A6 presents the trophic state classification used for CY91-92 Coeur d'Alene Lake studies (Woods and Beckwith, 1997). This table may be used to compare data presented for the lake.

Table A6. Trophic-state classification based on open-boundary values for four limnological variables (as published in Woods and Beckwith, 1997).

Limnological variable[a]		**Oligotrophic**	**Mesotrophic**	**Eutrophic**
Total phosphorus (µg/L)	geometric mean gm ± 1 SD	8.0 4.8 – 13.3	26.7 14.5-49.0	84.4 48.0 – 189.0
Total nitrogen (µg/L)	geometric mean gm ± 1 SD	661 371 – 1,180	753 485 – 1,170	1,875 861 – 4,081
Chlorophyll *a* (µg/L)	geometric mean gm ± 1 SD	1.7 0.8 – 3.4	4.7 3.0 – 7.4	14.3 6.7 – 31.0
Secchi-disc transparency (m)	geometric mean gm ± 1 SD	9.9 5.9 – 16.5	4.2 2.4 – 7.4	2.4 1.5 – 4.0

a = annual geometric mean values and standard deviations

A.10.1 Nutrients

Total phosphorus (TP) concentrations of photic zone samples for the three northern pool sites (#1, #3, #4) during CY91-92 had geometric means of 2.9, 3.0, and 4.2 respectively (Figure A9); a concentration depicting an oligotrophic condition. For WY04-06 sampling, TP was slightly higher with geometric means of 5.4, 6.0, and 6.3 µg/L respectively.

At site #5, geometric mean TP increased between the study periods from 6.1 µg/L in CY91-92 to 11.2 µg/L in WY04-06. At site #6 there is a substantial shift to higher TP concentrations between study periods with a TP geometric mean of 9.0 µg/L in CY91-92 versus 18.6 µg/L in WY04-06. Reasons for this increase are being explored.

USGS concludes in their final 2008 report that when applying total phosphorus data to non-parametric statistical analysis, the WY04-06 data is statistically, significantly higher than the CY91-92 data set at all 5 pelagic stations (Wood and Beckwith, 2008).

During major winter rain-on-snow events, or during the rising limb of spring run-off, total phosphorus concentrations within the lake can show significant increases. This is due to material brought in by high river and stream flows, and possibly by rising lake waters inundating shorelines that have been dry during winter months. TP in northern pool sites can measure between 15 – 25 µg/L during these periods, and at sites #5 and #6, TP can reach 30 – 45 µg/L.

USGS did not conduct a comparison of total nitrogen concentrations between the two study periods because of the change in method reporting limit (MRL) previously discussed in Section A.6. TN concentrations within the lake are seldom greater than 500 µg/L with most data values less than 300 µg/L. These TN values are considered as a low, oligotrophic condition (refer to Table A6). For dissolved inorganic nitrogen (DIN, ammonia+nitrite+nitrate), MRL also differed between the two USGS study periods, but some comparisons could still be made. DIN has low concentrations in Coeur d'Alene Lake, mostly less than 100 µg/L within the photic zone, and commonly dropping below the MRL (<26 µg/L) in summer months within the photic zone because of phytoplankton assimilation. DIN concentrations are overall greater in lake bottom waters, but seldom greater than 200 µg/L. USGS statistical analysis did not show any significant differences in DIN between the CY91-91 and WY04-06 study periods.

Nitrogen compounds play important roles within the lake. This can include: 1) a subsurface source of dissolved inorganic nitrogen from drainfield wastewater (containing ammonia and nitrate), where flow into nearshore areas can fuel growth of rooted aquatic plants, and 2) the nutrient role for phytoplankton growth and assemblage composition, as algae respond within a seasonal range of the bioavailable Nitrogen (DIN):Phosphorus (dissolved orthophosphate) ratios. The existing N:P ratio can dictate whether it is phosphorus or nitrogen that is the nutrient limiting phytoplankton growth.

A.10.2 Phytoplankton

Phytoplankton biomass is commonly assessed by measuring chlorophyll *a* concentrations within algae retained on a water filter. Analytical methods by the USGS national laboratory to determine chlorophyll *a* were different between study periods CY91-92 (high-performance liquid chromatography, HPLC), and WY04-06 (chromatographic-fluorometric, C-F). This change in

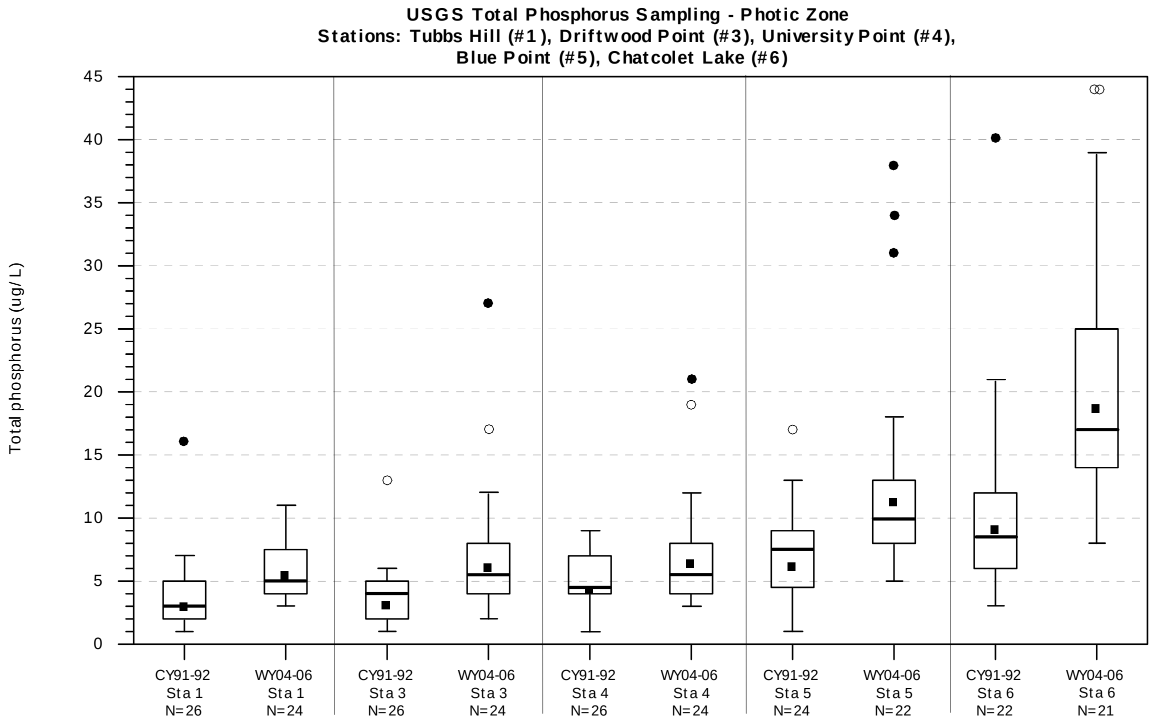


Figure A9. USGS photic zone data for total phosphorus at five pelagic sampling stations in Coeur d'Alene Lake. Data is compared between study periods CY91-92 and WY04-06.

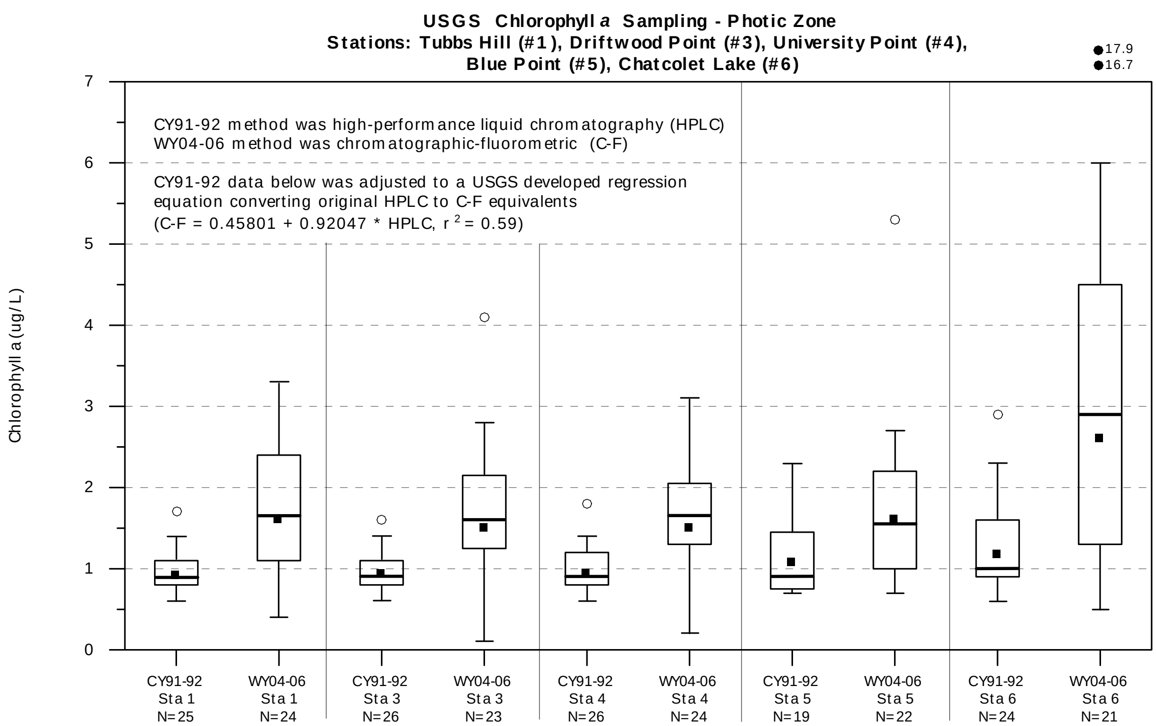


Figure A10. USGS photic zone data for chlorophyll *a* at five pelagic sampling stations in Coeur d'Alene Lake. Data is compared between study periods CY91-92 and WY04-06.

analytical methods presents some difficulties for comparisons between the two study periods. USGS paired-sampling, with samples analyzed by the two methods, resulted in a regression equation converting CY91-92 HPLC values to C-F values (C-F = 0.45801 + 0.92047 * HPLC, $r^2 = 0.59$). Adjustment to C-F values averaged around 0.4 µg/L higher than the HPLC data set. The data analysis in following paragraphs and Figure A10 utilizes the C-F conversion of CY91-92 data for comparison with the WY04-06 data set.

In CY91-92, chlorophyll *a* values at all lake sites within the photic zone were very low. At northern pool sites the range of values (adjusted) was narrow with the median and geometric mean around 0.9 µg/L (Figure A10). At sites #5 and #6 the data had slightly higher values, with medians and geometric means ranging from 0.9 – 1.2 µg/L.

In WY04-06, chlorophyll *a* concentrations throughout the lake were greater. At northern pool sites and site #5, the geometric means were around 1.5 µg/L (about 50% higher than the CY91-92 concentrations). At site #6 there was a wide spread of reported chlorophyll *a* values, with a median of 2.9 µg/L and geometric mean of 2.6 µg/L (more than 2 times greater than CY91-92). Spikes in chlorophyll *a* at site #6 have been from late summer through fall compared to spring peaks at northern pool sites.

USGS concludes in their final 2008 report that when applying chlorophyll *a* data to non-parametric statistical analysis, the WY04-06 data is statistically, significantly higher than the adjusted CY91-92 data set at all 5 pelagic stations (Wood and Beckwith, 2008). Reasons associated for the increase in chlorophyll *a* between study periods are not clear, and will be the subject of further analysis.

There can be a significant subsurface peak of chlorophyll *a* during summer months, commonly found within the cooler waters of the thermocline (metalimnion). This peak is called chlorophyll metalimnetic maxima, a common occurrence in lakes.

Samples for phytoplankton identification and enumeration were taken during the USGS study period of CY91-92. Diatoms were the predominant algal group throughout the seasons at all sites. The Cyanophyta (blue-green algae, now called cyanobacteria) were incidental or absent at sites #1 – #5. At site #6, blue-green species constituted at least 10% of the phytoplankton density (expressed as cells/ml or colonies/ml) during summer months of 1991 and 1992. The blue-green alga of dominance was *Anabaena flos-aquae*, a common blue-green species in smaller, mesotrophic lakes of northern Idaho.

Samples for phytoplankton identification and enumeration were not part of the routine monitoring during WY04-06. The USGS research project of dissolved zinc effects on phytoplankton (Kuwabara *et al*. 2006) included samples for phytoplankton composition taken in June 2004. Two sites were sampled, one at the outlet of Chatcolet Lake, the other at USGS site #5. Comparing this one set of samples with those taken in CY91-92 showed a couple of contrasts of note, although caution is taken because of different taxonomists. Within these southern waters, the green algae *Chorella minutissima* was a dominant alga in 2004 but was not reported in CY91-92 samples. Five of seven blue-green species identified in 2004 were not recorded in CY91-92.

A.10.3 Water Clarity

Water clarity as measured by the qualitative method of Secchi disc transparency has been measured continuously since 1991 (including July to October, 1995 – 2002, by DEQ). In both USGS baseline study periods, photosynthetically active radiation (light transmission and attenuation) through upper waters was also measured by solar radiation sensor equipment. This method determines the depth underwater at which there is 1% of the light incident on the waters surface, or the theoretical primary producer photic zone.

Water clarity follows a seasonal pattern of being low during significant rain-on-snow events and spring peak flow, and then clearing to reach clarity peaks from July through October. At northern pool sites, minimum clarity ranges around 1 – 4 m Secchi depth (Figure A11), with 1% photic zone depths ranging 2 – 10 m. From mid summer through fall, Secchi depths can range from 9 – 12 m, with 1% photic zone depths ranging 15 – 21 m.

At sites #5 and #6, periods of lowest clarity range from 1 – 2 m, and during periods of improved lake clarity, the southern two sites do not reach the transparency observed in northern sites.

Combining all seasonal data for WY04-06, the geometric mean Secchi disc depth for the 3 northern pool sites combined was 5.6 m (median = 6.2 m), while at site #5 the geometric mean was 3.4 m, and at site #6, 2.7 m. Seasonally combined data do not show a statistical difference between the WY04-06 and CY91-92 study periods at any of the sampling sites (Wood and Beckwith, 2008).

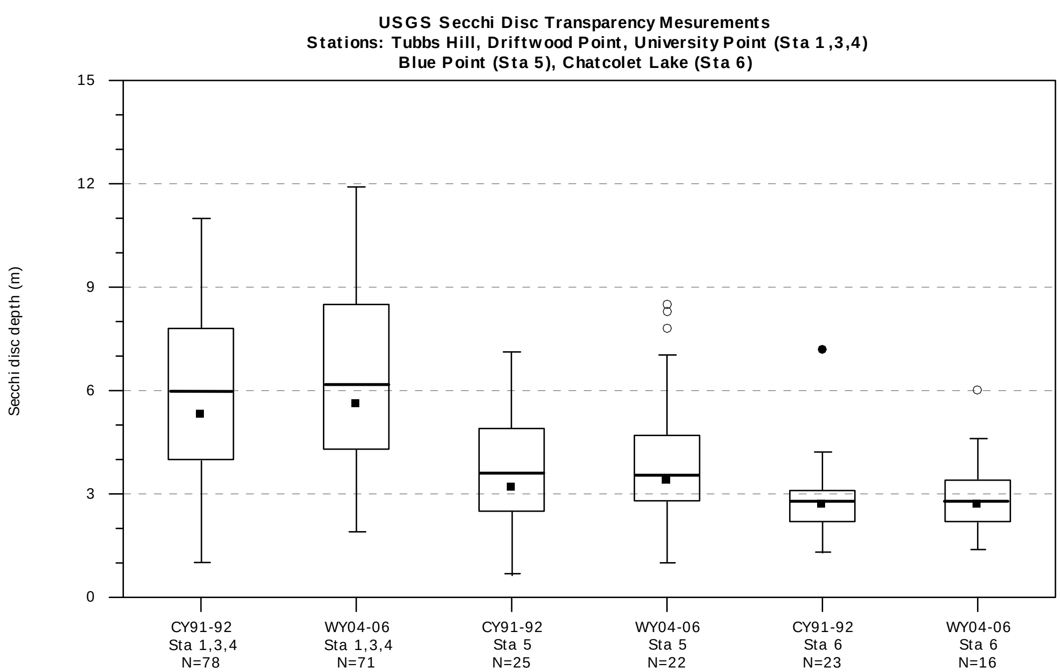


Figure A11. USGS measurements of Secchi disc transparency: data for three northern pool stations combined, and also data for stations Blue Point and Chatcolet Lake. Data is compared between study periods CY91-92 and WY04-06.

A.11 Dissolved Oxygen

Dissolved oxygen (DO) profiles at northern pool stations, during early summer through late fall stratification, show a hypolimnetic condition of consumed oxygen by bacterial decomposition of organic material and chemical oxidation (Figure A12a with 70% DO saturation in bottom-most waters). During stratification there is minimal DO replenishment from the atmosphere until fall turnover. By October, with the lowest hypolimnetic DO concentrations of the stratified season, percent DO saturation can decline to around 60% (Figure A12b). However, numerous October profiles show that DO concentrations remain above 6 mg/L within the hypolimnion down to near the bottom sediments. Deep water areas of Coeur d'Alene Lake experience fall turnover, or complete mixing of water layers, in November.

DO profiles at site #5 (15-17 m station depth), exhibit concentrations below 6 mg/L within the hypolimnion. Some profiles taken in late summer have ranged from 6 - 2.5 mg/L DO within the bottom 3 meters of water (Figure A12c). By late October, temperatures and DO are fairly uniform as fall turnover has occurred in shallower lake areas.

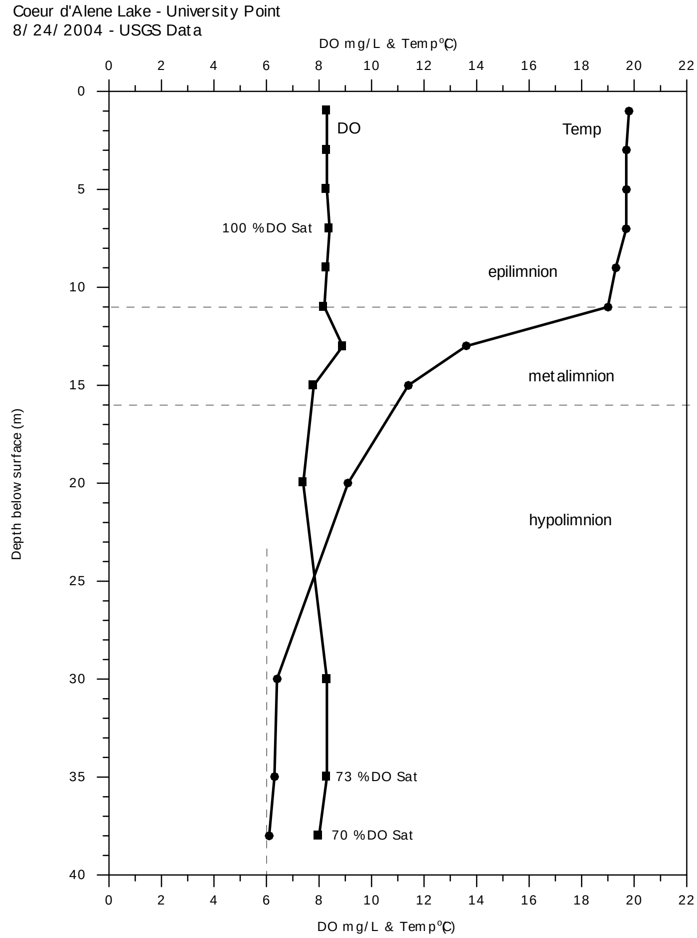
During warm, calm periods, profiles at site #6 (10-11 m station depth) show the development of a thermocline and low DO within the bottom few meters. Several summer profiles have shown DO <1.0 mg/L within the bottom 3 meters (Figure A12d). Samples of phosphorus and nitrogen compounds taken 1 m off the bottom under these anoxic conditions can be quite high, establishing the potential for internal nutrient loading during a wind driven turnover event.

Comparing DO data between CY91-92 and WY04-06, there were no significant differences at any of the sampling sites between study periods.

Current knowledge considers that oxic conditions within the hypolimnion serve to minimize the mobilization of dissolved metals coming from the lakebed sediments. With hypolimnetic anoxic conditions (i.e., DO <1.0 mg/L), changes in redox potential, microbial metabolism, and chemical reactions within lakebed sediments could result in an increase of solubility's for some particulate metal compounds (e.g., ferric oxide complexes) and therefore an increased release rate of dissolved metals (Kuwabara *et al*. 2000, Kuwabara *et al*. 2003, Toevs *et al*. 2006, La Force *et al*. 1999). In lakes without a history of mining related metals input, hypolimnetic anoxia results in significant sediment release of ferrous (Fe^{+2}) and manganous (Mn^{+2}) ions, along with orthophosphate (PO_4^{-3}).

The USGS profile and water sampling on August 22, 2006 at station #6 demonstrates the increase of dissolved constituents within the hypolimnion of Chatcolet Lake (Figure A12d). Comparing the integrated photic zone sample data (from 0.5 to 8 m) to the single-point grab sample at 9 m (within the anoxic hypolimnion, about 2 m above the lake bottom) shows very high increases in bottom water concentrations for dissolved orthophosphate, ammonia, iron, and manganese. Although the bottom sediments in Chatcolet Lake are considered to only contain background levels of trace elements (see Tables A4 and A5), note that dissolved zinc and lead in the photic zone sample were 8 and <0.08 µg/L respectively, while the hypolimnion sample increased to 31 and 0.50 µg/L.

Figure A12a. Dissolved oxygen and water temperature profiles at University Point sampling station (#4) on August 24, 2004.



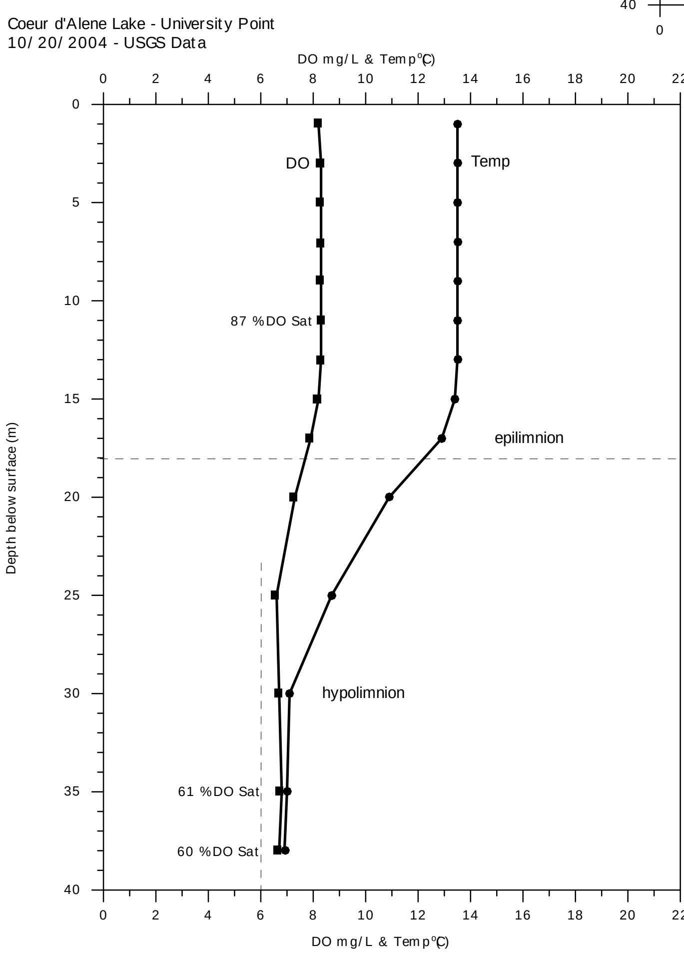
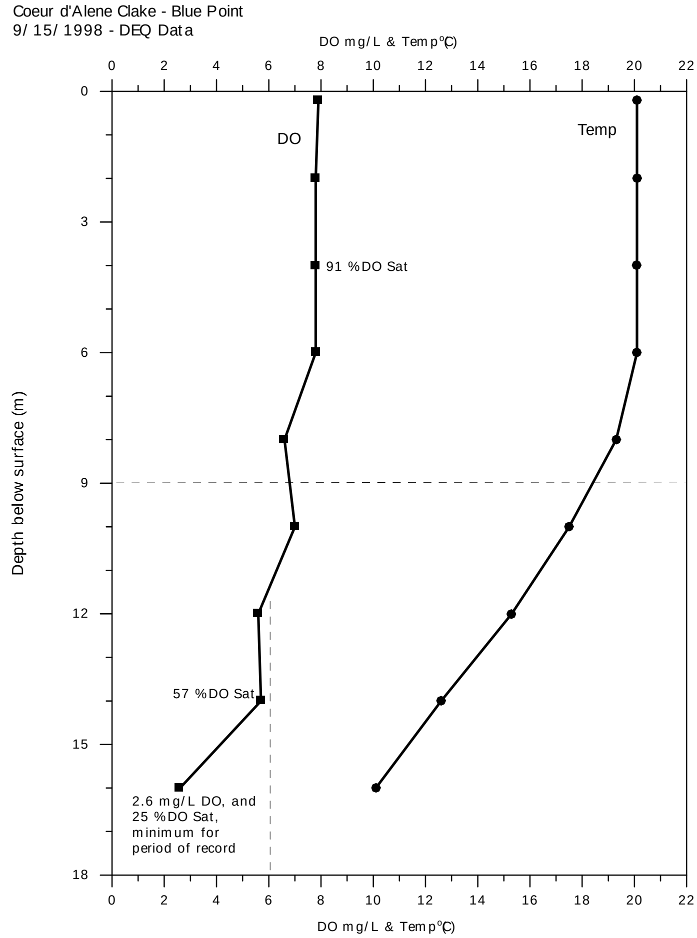


Figure A12b. Dissolved oxygen and water temperature profiles at University Point sampling station (#4) on October 20, 2004.

Figure A12c. Dissolved oxygen and water temperature profiles at Blue Point sampling station (#5) on September 15, 1998 (DEQ data).



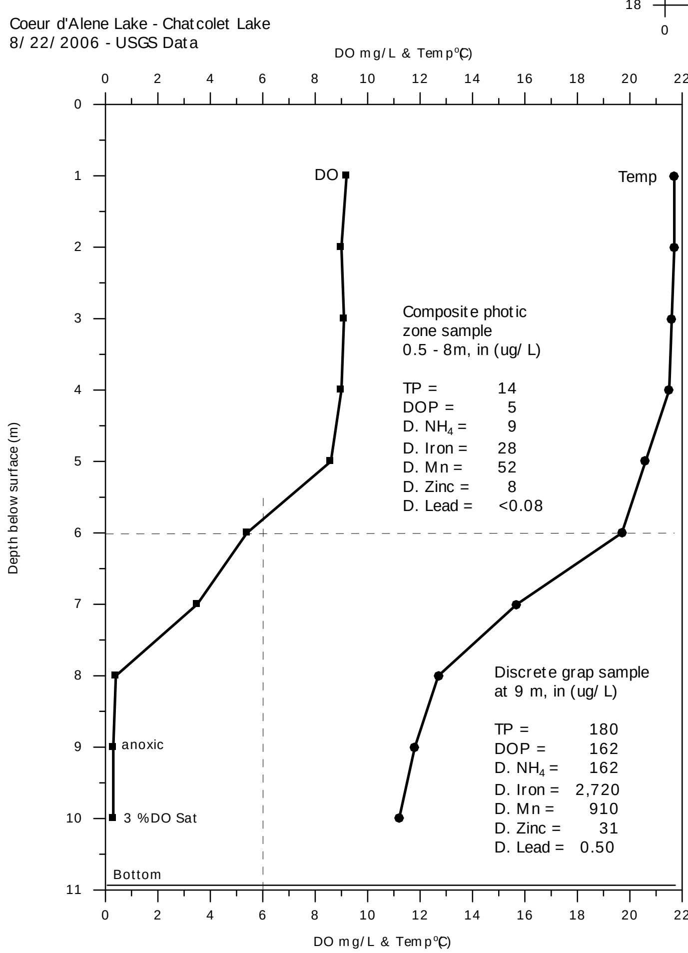


Figure A12d. Dissolved oxygen and water temperature profiles at Chatcolet Lake sampling station (#6) on August 22, 2006.

Excess phosphorus and nitrogen loading into a lake from upland watershed land use activities can fuel aquatic plant growth. In spring through fall, as phytoplankton cells die and sink to the bottom, bacteria decompose this organic material utilizing dissolved oxygen which is not replenished during lake stratification (i.e., hypolimnetic oxygen demand). Also, organic material brought into the lake, both as dissolved organics and particulate organics as a component of suspended sediment, settles to the lake bottom and adds to the dissolved oxygen demand. The goal of the 2009 LMP is aimed at keeping metals in bottom sediments insoluble by maintaining an oxic condition in the hypolimnion, by minimizing both the fueling effect of incoming nutrients on lake plant growth, and minimizing external organic loads.

Another importance of maintaining or improving the currently observed DO profile under stratification is for fisheries management because 6 mg/L DO is about the lower limit of salmonid tolerance. Preventing anoxic lower waters also caps lakebed particulate-bound phosphorus from dissolving and entering lower lake waters (i.e., internal phosphorus loading).

A.12 Eurasian Watermilfoil

Within the southern lake shallows, Eurasian milfoil (*Myriophyllum spicatum*), and/or a hybrid of Eurasian milfoil and a native milfoil species, has become established and can be found in dense beds within some areas. Scientists from the Coeur d'Alene Tribe have performed extensive aquatic plant identification, mapping, and biomass measurements. In 2006 and 2007, initial control treatments were conducted in the densest Eurasian milfoil stands, including: herbicide applications, diver suction removal, diver hand removal, and bottom barriers.

Establishment of dense Eurasian milfoil stands can have significant ecological effects within the lake. These include: crowding out native aquatic rooted plants, and increasing internal nutrient loading by assimilating sediment nutrients (phosphates and nitrogen) through the root system and then releasing these into the water upon senescence (die-back) in the fall.

A.13 EPA Lake Data from 1975

While 1975 data is only three sampling events (at eight lake stations), the resulting data indicate a considerable difference compared to CY91-92 and WY04-06 USGS studies, with 1975 exhibiting a more eutrophic lake condition. EPA classified Coeur d'Alene Lake as mesotrophic based on their sampling, where in CY91-92 USGS classified the lake as oligotrophic.

Total phosphorus measured by laboratory methods has long been a fairly consistent and reliable constituent for analysis. TP data in 1975, within the photic zone and combined over the sampling events for five northern pool stations (n=14 samples), results in a geometric mean of 14 μg/L. This is about triple the average TP concentrations in the CY91-92 and WY04-06 study periods. Data combined for 2 southern stations in 1975 gave a geometric mean of 24 μg/L TP, again higher than observed in later years by USGS.

Chlorophyll *a* analysis in 1975, by EPA, would have had different laboratory methodology and equipment available compared to samples analyzed by the USGS laboratory. Thus, caution is needed for comparisons. Still, the differences are dramatic. With 1975 data combined for five northern pool stations, chlorophyll *a* geometric mean was 8.0 μg/L, and April samples ranged from 18 – 32 μg/L. Again, this compares to a range of geometric means of 0.9 – 1.5 μg/L in USGS studies. Levels of 1975 chlorophyll *a* may have been under a condition of higher dissolved zinc than measured in USGS studies (zinc was not analyzed by EPA).

Secchi disc measurements taken in July and September of 1975 may corroborate a northern pool condition of greater phytoplankton biomass than observed in later studies. Secchi disc measurements at northern pool stations ranged from 2.5 to 5.8 m maximum, at least one-half the average clarity from 1991 on.

As cited in the USGS report from CY91-92 studies (Woods and Beckwith, 1997), examination of phytoplankton data from both a 1971 study and the 1975 EPA sampling, indicated that the presence of Cyanophyta within the lake had declined substantially in the latter years.

Examination of the northern pool dissolved oxygen profiles taken on September 9, 1975, show the minimum hypolimnetic DO level at 7.0 mg/L.

A.14 Conclusions on Current Trophic State

Given conventional limnological parameters of total phosphorus, total nitrogen, chlorophyll *a*, water clarity, and dissolved oxygen profiles, the northern pool remains as an oligotrophic water body: low in nutrient concentrations and phytoplankton biomass, good summer water clarity, and oxygen levels above 6 mg/L in bottom waters during stratification. However, zinc concentrations within the water column are still high, and there are times when dissolved lead and cadmium exceeds WQS criteria for aquatic life. WY04-06 data for southern lake waters shows significantly higher values for total phosphorus and chlorophyll *a* compared to CY91-92 data. WY04-06 data trends toward a mesotrophic classification, or moderately productive.

Further water quality investigations may be warranted within shallow bays. The USGS final report of WY04-06 presents water column data from sampling of selected bays, and overall, there are no statistically significant differences between bay sampling data compared to the nearest open water, deep sampling sites. This is not an uncommon result when attempting to assess bay conditions with water column sampling (for example in Priest Lake, Rothrock and Mosier, 1997).

Any localized impacts in bay environments could be related to subsurface wastewater treatment systems, runoff from increasing land disturbance through development on the shorelines, or water quality of inflowing tributaries affected by watershed land uses (such as agriculture). Bay studies to assess impacted conditions may have to focus on examining near-shore sedimentation rates, growth patterns of rooted aquatic plants, and growth of attached algae (periphyton) on natural substrates and artificial structures such as pilings. However, these can be difficult and expensive scientific endeavors, in particular, assessment of groundwater percolation into localized near-shore areas that may be impacted by subsurface wastewater. USGS did some periphyton measurements and statistical correlations from selected bays in the CY91-92 studies, and this work could be expanded upon in future investigations.

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Appendix B – Core Routine Monitoring, Technical Tools, and Special Studies for the Coeur d'Alene LMP

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Appendix B – Core Routine Monitoring, Technical Tools, and Special Studies for the Coeur d'Alene LMP

Coeur d'Alene Lake

In June 2007, DEQ and the Tribe began a routine monitoring program within Coeur d'Alene Lake. This program is a continuation of baseline monitoring and studies conducted by the USGS and Tribe from October 2003 through August 2006 (Wood and Beckwith, 2008), and an earlier baseline study conducted from January 1991 through December 1992 (Woods and Beckwith, 1997). The 2003 – 2006 studies (Water Years 04–06) were funded by an EPA Clean Water Act grant whose funding ended in 2008. DEQ and the Tribe, as part of the ongoing effort to develop and implement the Coeur d'Alene LMP, agreed to continue monitoring at key USGS sites with the goal of providing a long-term, annual trend record of key water quality parameters in support of the LMP goal and objectives. Tribal staff samples stations in Tribal jurisdiction waters of the southern lake and lower St. Joe River, and DEQ staff samples northern pool waters within State jurisdiction.

Regional staff of the EPA has participated in this continued monitoring effort. The EPA staff secured agreements and made arrangements for the EPA Manchester Laboratory (in Port Orchard, WA) to receive and analyze samples for concentrations of trace metals, certain minerals, and chlorophyll *a*. DEQ and the Tribe secured laboratory facilities and have funded the analysis of samples for nutrient concentrations and phytoplankton identification/enumeration. The Tribe selected Spokane Tribal Laboratory for their nutrient analysis, DEQ selected SVL Analytical (Kellogg, ID), and both selected TG EcoLogic (an LLC arm of TerraGraphics) for phytoplankton samples.

DEQ and the Tribe jointly prepared a Quality Assurance Project Plan (QAPP) according to EPA guidelines, and submitted the QAPP to EPA for approval. The document was approved in June, 2007 (DEQ and CdA Tribe, 2007). The QAPP was designed to not only address quality assurance/quality control (QA/QC) issues, but to serve as the initial work plan for the 2007 monitoring season. The approved QAPP can be viewed at the DEQ web site, *www.deq.idaho.gov*. In preparation for the 2008 monitoring season, EPA required an amended QAPP, and this document was approved in January 2008.

<u>Sampling Locations and Frequency</u>

DEQ selected two of the USGS reference sites in the deep waters of the northern pool for continued monitoring. These were sampling site 1, located southeast of Tubbs Hill, and site 4, located northeast of University Point (see Figure B1 and Table B1). The Tribe retained USGS site 5, located mid-lake between Browns Point and Shingle Bay (labeled NE of Blue Point by USGS), and site 6 in Chatcolet Lake. The Tribe also added a new site, designated SJ1, on the lower St. Joe River.

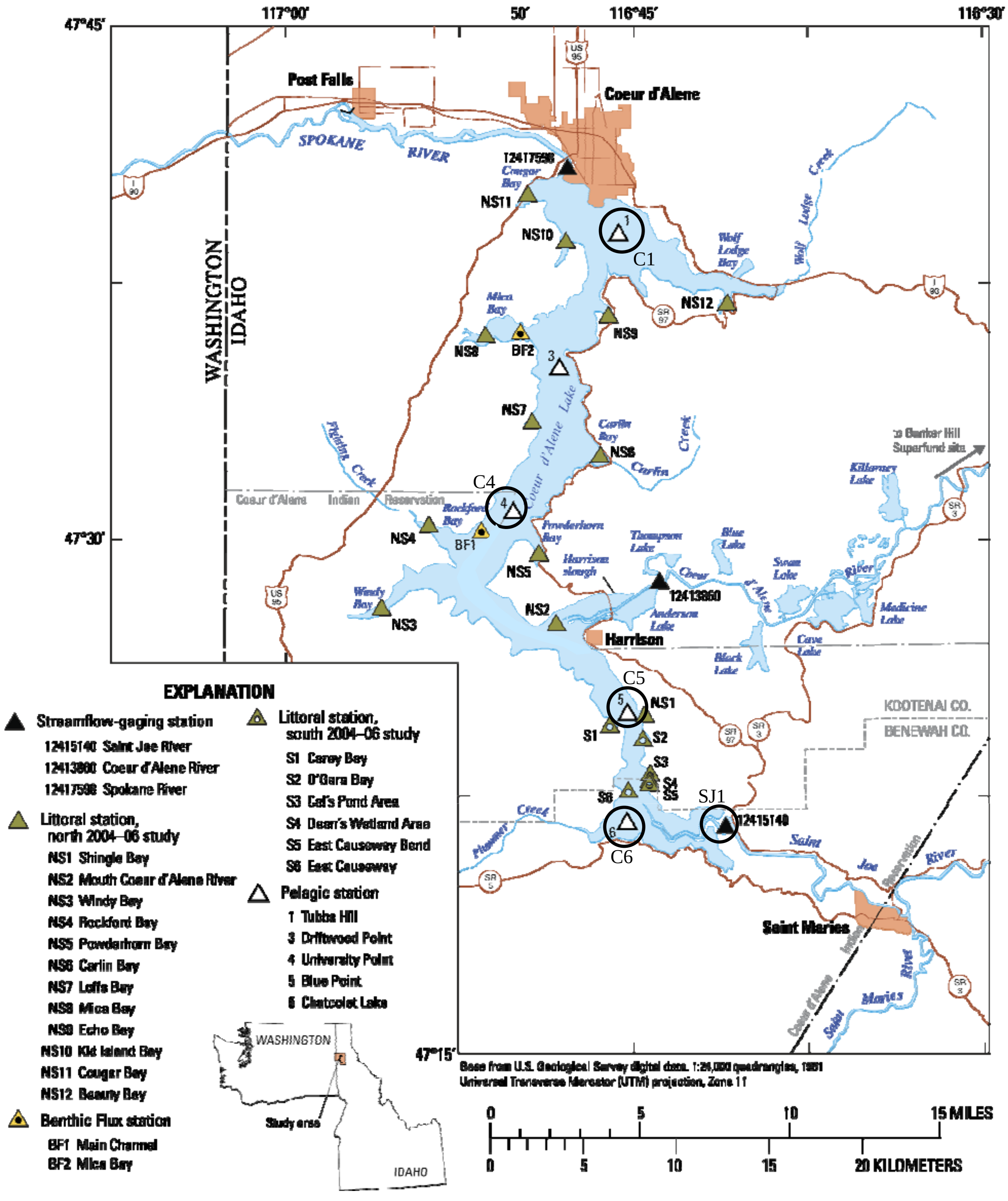

Figure B1. Map showing sampling sites for the 2007 and beyond Coeur d'Alene Lake Monitoring Program (circled); map provided by USGS for WY04-06 sampling program (Wood and Beckwith, 2008).

Table B1. Sampling locations of the 2007 and beyond Coeur d'Alene Lake Monitoring Program

USGS Site #	USGS site number, location, and approximate depth	Latitude	Longitude
C1	473900116453000 Coeur d'Alene Lake – 1.3 miles southeast of Tubbs Hill near Coeur d'Alene, ID Depth: 40 meters*	47° 39' 00"	116° 45' 30"
C4	473054116500600 Coeur d'Alene Lake – 1.7 miles northeast of University Point near Harrison, ID Depth: 40 meters*	47° 30' 54"	116° 50' 06"
C5	472500116450000 Coeur d'Alene Lake – mid lake between Browns Point and north end of Shingle Bay near Harrison, ID (NE of Blue Point by USGS). Depth: 17 meters*	47° 25' 00"	116° 45' 00"
C6	472120116451000 Chatcolet Lake - 0.4 miles northwest of Rocky Point near Plummer, ID Depth: 11 meters*	47° 21' 20"	116° 45' 10"
SJ1**	Lower St. Joe River - ~100 m upstream of USGS gage 12415140 near Chatcolet, ID Depth: 18 meters*	47° 21' 27"	116° 41' 10"

*At full summer pool, lake surface elevation 2128 feet
**New Tribal sampling site within lower St. Joe River

The schedule of sampling events was established at eight (8) sampling visits per calendar year (Table B2). The timing of sampling visits coincides with specific river flow and lake conditions of interest throughout the year. DEQ and the Tribe coordinate their respective field sampling events so that they both are conducted during the same week. The lake sampling schedule matches fairly closely the USGS sampling scheme at the mouths of the Coeur d'Alene and St. Joe Rivers under the EPA Coeur d'Alene Basin Environmental Monitoring Plan (BEMP, EPA, 2004a). The BEMP began in October 2003 to evaluate the long-term effects of cleanup actions as part of the Bunker Hill Superfund site remediation process.

<u>Field Measurements Taken</u>

At each site, field measurements taken include Secchi disc transparency depth and the 1% light compensation depth of Photosynthetically Active Radiation (PAR, as measured by radiation sensor equipment to identify the theoretical photic zone depth). Field measurements also include depth profiles of water temperature, dissolved oxygen (DO), percent DO saturation, pH, specific conductance, and chlorophyll *a* fluorescence, as measured by Hydrolab® DS5X instrumentation.

Table B2. Annual sampling visits for the Coeur d'Alene Lake Monitoring Program (selection of 8 sampling events below)

Sampling visits	Season	General Schedule	Lake condition
1	winter - early spring	December - March	unstratified; prior to spring peak runoff; potential opportunity to sample during major rain-on-snow lake inflow event.
2	winter - early spring	January - March	unstratified; prior to spring peak runoff; second opportunity to sample during major rain-on-snow lake inflow event, or early spring peak runoff.
3	spring	late March – early June	during spring peak runoff, opportunity to sample strong riverine influences on the lake; spring pulse of diatom growth develops.
4	late spring	mid to late June	onset of stratification, spring pulse of diatom growth; before the onset of strong thermal stratification.
5	summer	mid to late July	strong thermal stratification is established; sample the development of a metalimnetic chlorophyll *a* maxima; for some years, the peak of epilimnetic temperatures and thermocline thickness.
6	summer	mid to late August	for some years, the peak of epilimnetic temperatures and thermocline thickness; declines in dissolved oxygen near bottom may become evident; phytoplankton peaks might start to develop at stations C5 and C6.
7	late summer	mid to late September	phytoplankton growth waning in northern pool, and still-strong thermal stratification in northern pool; DO deficit at C5 may be at maximum for season.
8	fall	mid to late October	within northern pool, thermocline is deep but stratification still persists; DO deficits near bottom are still evident and often exhibit the peak of DO deficit for the season; waters of C5 and C6 have undergone fall turnover, and phytoplankton growth may still be at its peak.
9	early winter	late-November or early December	unstratified (lake has undergone fall turnover); water quality data fairly uniform from top to bottom, and not yet affected by a rain-on-snow event (usually).

Water Samples for Chemical Constituents

Water quality constituents that are sampled and analyzed for are shown in Table B3. Not all constituents are analyzed within every sampling depth zone. Table B3 shows laboratory method and target reporting limits from the three laboratories for the constituent list.

DEQ and the Tribe sponsored a joint meeting between key laboratory personnel of SVL Analytical and the Spokane Tribal Lab. Methods, procedures, instrumentation, and quality control were discussed for the nutrient compounds that are measured by different methods between the labs, i.e., total phosphorus, nitrate, ammonia, and total nitrogen. Methods used by both labs are nationally recognized and certified. Agreements between lab personnel were made which include running duplicate analysis of known standard solutions between the two labs, and using lower concentration, standard solutions, for equipment calibration curves. DEQ and the Tribe have conducted duplicate sample splits submitted to each lab to compare analysis results, and we will routinely continue to do this split sampling and analysis. DEQ and the Tribe are committed to continue a dialogue between the two labs to ensure that nutrient analysis and results are as comparable as possible.

Sampling for water quality constituents will entail using a 2.2 Liter, non-metallic Kemmerer-style sampler. Sample depths and constituents analyzed will be similar to those used for the WY04-06 USGS study. The four anticipated sampled depth zones are:

1. **Photic Zone Composite:** five equally spaced samples from 1.0 m below the surface to the depth where underwater PAR is 1% of the light incident on the surface, composited into a churn splitter.

2. **Zone of Maximum Chlorophyll *a*:** a discrete sample collected at the depth of maximum chlorophyll *a* fluorescence if so determined by the Hydrolab® profile. During stratification, on about four of the yearly sampling visits, there has been observed in both the USGS WY04-06 program, and the first year of the Tribe/DEQ program (2007), a pronounced peak of chlorophyll *a* fluorescence within the metalimnion.

3. **Discrete sampling at 20 m and 30 m for northern pool stations**: USGS sampled at these depths, and a trend of interest was that zinc concentrations vary considerably from upper waters to bottom waters from about April – October.

4. **1 meter above lake bottom:** a discrete sample with sampling depth determined from the Hydrolab® profile.

Coeur d'Alene and St. Joe Rivers

EPA funds the USGS to monitor flow, sediment, mining-associated contaminants, and nutrient transport within the Coeur d'Alene and St. Joe Rivers, and at the lake's outlet to the Spokane River, under the BEMP (EPA, 2004a). The BEMP monitoring network on the Coeur d'Alene River includes four sentinel sites (monitored 7-8 times each year) from Elizabeth Park on the

Table B3. Analytical methods and data quality for analytes of the Coeur d'Alene Lake Monitoring Program (NOTE: target reporting limits are the values used by the EPA Manchester Lab, Spokane Tribal Lab, and SVL Analytical for the 2007-08 monitoring years)

Analyte	**Analytical Method**	**Target reporting limit**	**Precision & Accuracy/ completeness**
Nutrients	***Spokane Lab / SVL Analytical***	***Spokane / SVL***	
ammonia, dissolved[(a)]	EPA 350.3 / EPA 350.1	10 µg/L	+/- 25% 95%
nitrite+nitrate, dissolved[(a)]	EPA 353.2	10 / 15 µg/L	
total nitrogen	SVL = SM[b] D-5176	50 µg/L	
total Kjeldahl nitrogen	Spokane = EPA 351.2	50 µg/L	
total phosphorus	EPA 365.3 / SM 4500-P-E	5 / 2 µg/L	
total dissolved phosphorus[(a)]	EPA 365.3 / SM 4500-P-E	5 / 2 µg/L	
orthophosphate, dissolved[(a)]	EPA 365.5 / SM 4500-P-E	2 µg/L	
Total recoverable metals, unfiltered, digested		***EPA Manchester Lab***	
cadmium	EPA 200.8 – ICP-MS	0.13 µg/L	+/- 25% 95%
lead	EPA 200.8 – ICP-MS	0.13 µg/L	
zinc	EPA 200.7 – ICP-SAS	5.0 µg/L	
arsenic	EPA 200.8 – ICP-MS	0.63 µg/L	
iron	EPA 200.7 – ICP-SAS	5.0 µg/L	
manganese	EPA 200.8 – ICP-MS	0.13 µg/L	
Dissolved metals, filterable, undigested[(a)]		***EPA Manchester Lab***	
cadmium	EPA 200.8 – ICP-MS	0.10 µg/L	+/- 25% 95%
lead	EPA 200.8 – ICP-MS	0.10 µg/L	
zinc	EPA 200.7 – ICP-SAS	5.0 µg/L	
arsenic	EPA 200.8 – ICP-MS	0.20 µg/L	
iron	EPA 200.7 – ICP-SAS	5.0 µg/L	
manganese	EPA 200.8 – ICP-MS	0.10 µg/L	
Minerals		***EPA Manchester Lab***	
total hardness (as $CaCO_3$)	SM 2340B	0.30 mg/L	
calcium, dissolved	EPA 200.7 – ICP-AES - mod. scan	30 ug/L	+/- 25% 95%
magnesium, dissolved	EPA 200.7 – ICP-AES - mod. scan	50 ug/L	
Biological		***EPA Manchester Lab***	
chlorophyll *a*	SM 1002G – fluorometric	1.0 µg/L	+/- 25% 95%
Biological	***TG Eco-Logic***		
phytoplankton	SM 1002 C-F – identification /enumeration with sedimentation and 1500 magnification	n/a	n/a

a = Samples will be field filtered through a 0.45 µm pore size capsule filter for dissolved analysis
b = Standard Methods for the Examination of Water and Wastewater

South Fork Coeur d'Alene River to the mouth of Coeur d'Alene River near Harrison (Figure B2). BEMP "sentinel" sites are sampled to provide data on potential short-term trends or "trend discontinuities" in identified longer-term trends. There is also one sentinel site on the North Fork Coeur d'Alene River, a sentinel site on the St. Joe River near the mouth, and a sentinel station at the lake's outlet. Several of the sentinel sites have continuous flow gauging stations, and some have real-time transmission of data. There are also several benchmark stations on selected tributaries to the S. F. Coeur d'Alene River, and one at Cataldo on the Coeur d'Alene River (Figure B2). BEMP "benchmark" stations are sampled extensively every 5 years to evaluate long-term progress toward the benchmarks established within the ROD Selected Remedy (EPA, 2004a).

DEQ and the Tribe obtain annual BEMP data as an important source of water quality information for concentrations of constituents coming into the lake, and as a comparison to concentrations measured within the lake. Annual phosphorus and nutrient loads (calculated in pounds per day) can be estimated from site data near the mouths of the two rivers. Flow and water quality data from BEMP will continue to be integrated into ELCOM-CAEDYM modeling efforts.

DEQ and the Tribe believe that additional riverine monitoring stations are needed within the LMP core monitoring program, or to the BEMP, or to the existing USGS network of sampling sites (Figure B2). Additional riverine sites are needed to better evaluate nutrient source loading, and to conduct the basin-wide nutrient inventory (see Section 3.3). One prevailing example is where the existing monitoring network suggests a general area of moderate to high nutrient loading, but the network is not adequate enough to further pinpoint an area of contribution. This appears to be the case for the southern end of the lake where phosphorus concentrations at lake station C6 (Chatcolet Lake) were significantly higher in WY04-06 studies compared to CY91-92 data. The St. Joe River as measured near its' mouth, can have fairly high nutrient loading. Although the Tribe has added station SJ1 (Table B1), there are still insufficient monitoring stations upstream to partition the nutrient load.

Historically, USGS has maintained flow gauging stations on the St. Joe River system at Red Ives Ranger Station (river mile 103), Calder (mile 43, upstream of the St. Maries River confluence), the St. Maries River at Santa (mile 24.6 on St. Maries), and the reestablished lower St. Joe site (for the BEMP) near Chatcolet (mile 5.4). For the DEQ/Tribe monitoring program, the Tribe added a sampling station near the lower St. Joe USGS gage site. Previous monitoring at this 18 m site, and other deep river sites upstream, has shown summer stratification and periodic dissolved oxygen deficits in lower waters (approaching anoxia). This degree of dissolved oxygen deficit is uncommon for other large rivers in northern Idaho.

In recent years water quality samples at the USGS Calder and St. Maries River sites have not been taken. It might benefit the understanding of nutrient loading sources into the southern lake if at least on a short-term basis, the water sampling program could be reinstituted at Calder, and that a new gauging and sampling site be established near the mouth of the St. Maries River. The St. Maries River watershed includes considerable land in agriculture and grazing use relative to other portions of the St. Joe drainage. Also, it would be beneficial for nutrient load analysis if the St. Maries Wastewater Treatment Plant (WWTP) obtained monthly samples for phosphorus and all nitrogen constituents (ammonia, nitrate, TKN) during periods of discharge to the St. Joe River (see discussion below for the Page WWTP).

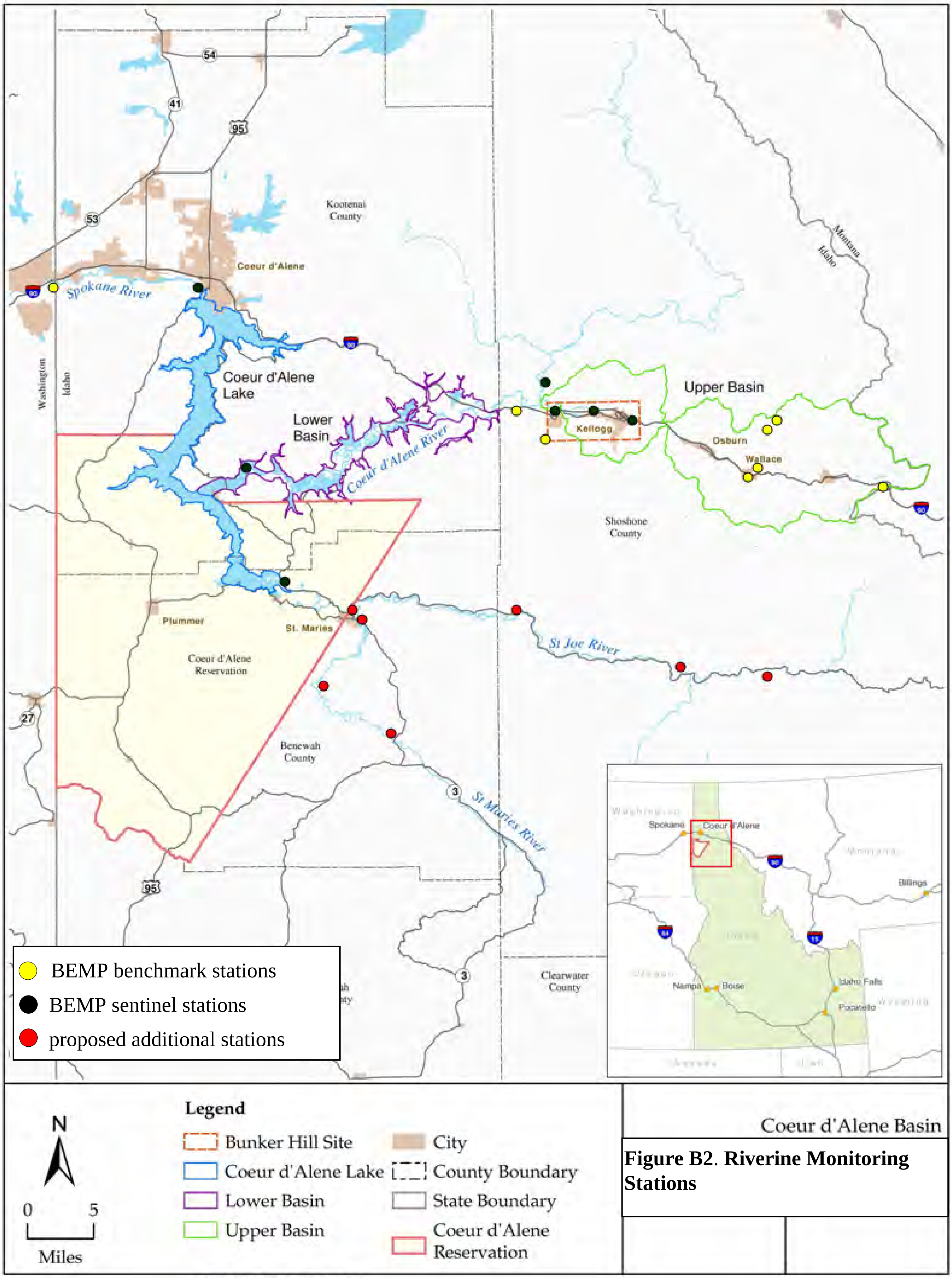

Figure B2. Riverine Monitoring Stations

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In the CY91-92 USGS studies, a considerable phosphorus and nitrogen load to the Coeur d'Alene River was assigned to the Page WWTP which discharges to the South Fork below Smelterville (Woods and Beckwith, 1997). An improved estimation of WWTP nutrient loading to the Coeur d'Alene River can now be made with the combination of the BEMP network, and recent NPDES permit requirements for the Page and Smelterville treatment plants to sample phosphorus and nitrogen constituents monthly. DEQ has begun preliminary load estimations down the Coeur d'Alene River beginning at the Elizabeth Park sampling site based on WY04-06 data. Nutrient load estimates down the river corridor do however incorporate high uncertainty due to the lack of water quality samples from Pine Creek (below Amy Gulch), and Coeur d'Alene River at Cataldo. These two are BEMP benchmark sites, and they are scheduled to be sampled every 5 years (8 times the year of sampling).

One point of interest in evaluating the BEMP data is an apparent phosphorus spike contribution between the Elizabeth Park and Smelterville sampling stations (upstream of the Page and Smelterville WWTPs). Some local residents have suspected (and even sampled) a phosphorus contribution coming from what's called the "Smelterville seeps". This nutrient source will be investigated as part of the LMP nutrient inventory (Section 3.3).

Tributaries

Sampling of selected tributaries, streams flowing directly into the lake or into the two rivers, will be part of the basin-wide nutrient inventory (Section 3.3). Based on inventory results, and also from previously collected data, some tributaries may become part of the long-term core monitoring program.

With the apparent increase of phosphorus concentrations at Chatcolet Lake station C6 between study years CY91-91 and WY04-06, an estimate of nutrient loading from tributaries flowing into the southern lake, and an assessment of the impact of this loading, needs to be developed. The Tribe has conducted sampling on Plummer, Fighting, Benewah, and Lake Creeks. Plummer and Fighting Creeks were monitored in the CY91-92 studies.

Very little sampling data exists for tributaries to northern pool waters. Wolf Lodge and Carlin Creeks were part of the monitoring effort in the CY91-92 studies. From visual observations, many tributaries to the lake exhibit turbid water conditions during rain-on-snow and spring peak flow events. Nutrient and suspended sediment sampling is warranted for northern pool tributaries that are on the §303(d) list of impaired waters and have EPA approved TMDLs (DEQ, 1999). These are Wolf Lodge, Cougar, Kid, and Mica Creeks.

B.2 Technical Tools to Support Lake Management Efforts

Computer Modeling

Researchers from USGS and the Centre for Water Research – University of Western Australia, applied a 3-dimensional hydrodynamic model, Estuary and Lake COmputer Model (ELCOM) to reproduce the hydrological regime in Coeur d'Alene Lake. ELCOM was coupled to the Computational Aquatic Ecosystem Dynamics Model (CAEDYM) to simulate lake processes, such as benthic flux of metal contaminants to/from lakebed sediments, and the interactive effects of dissolved zinc on algal productivity. Final reports of this research have been completed and submitted to EPA and the BEIPC (Dallimore *et al*., 2007 and Hipsey *et al*. 2007).

In general, the ELCOM-CAEDYM model simulates important processes within the lake system such as: 1) inflow loading of metals/nutrients and river plume flow through the lake, 2) sediment-water interactions, 3) primary production, and 4) organic matter cycling within the water column. In addition the model can be used to predict dissolved oxygen profiles which can be validated with actual data. Utilization of the model will greatly enhance understanding of the complex dynamics within the lake system, and has the potential for predictive results based on future land use changes within the lake basin.

Utilization of ELCOM-CAEDYM could result in monitoring efficiencies. If continued validation shows that predicted dissolved oxygen profiles are accurate, this may lessen staff hours needed for field profiling. If metal and nutrient concentrations within the lake can be satisfactorily predicted, this may free staff time from routine sample collection to specific short-term studies for answering unknown, key questions (e.g., pinpointing high nutrient input sources).

Meteorological Stations and In-lake Water Quality Sensors

The ELCOM-CAEDYM model utilizes meteorological information in its calculations. To date, meteorological stations have not been established on the lake (previous data used was from the Coeur d'Alene airport weather station, which does not adequately describe conditions on the lake). The quality of weather data specific to the lake would be greatly enhanced by having meteorological stations installed at the southern and northern end of the lake.

One example of newer technology is the Lake Diagnostic System (LDS), a meteorological station installed on the lake surface by a buoyed platform. The LDS can provide real-time weather data (i.e., continuous collected data transmitted to office receivers). In Idaho, an LDS has been installed in Brownlee Reservoir operated by the U.S. Bureau of Reclamation.

The LDS can also include an array of underwater sensors that measure water temperature and dissolved oxygen at multiple depths. A sampling array of sensors would provide an enhanced data set for the computer model, and could free up staff resource time now used to profile these parameters in the field.

B.3 Special Studies to Answer Key Questions

In addition to the core routine monitoring described in Section B.1, there is value in pursuing special studies to answer key questions that relate directly to the LMP objectives. While nutrient management is the primary LMP focus, this does not preclude an LMP effort to consider and be involved in issues of "whole lake health." This would include the effect of metals concentrations within the lake column that can affect aquatic life. The special studies listed below will improve knowledge and understanding of nutrient cycling, metals release from sediments, food web toxicity, and septic drainfield impacts. This is consistent with the recommendations from the

National Research Council (NRC/NAS, 2005). Many of the special studies below have been included in the 2nd Tier LMP budget table (Table 9), with cost estimates made.

Synoptic Sampling to Validate/Refine the ELCOM-CAEDYM Model

Validation and refinement of the ELCOM-CAEDYM model will improve the model's predictive ability, making the model a more powerful management tool. Data from the core routine monitoring program may not be sufficient to validate and refine the ELCOM-CAEDYM model to predict lake conditions at temporal and spatial scales needed to assist in making management decisions. Synoptic sampling that is not covered in the core routine monitoring program will provide "snapshots" of conditions from randomly selected sites in Coeur d'Alene Lake following meteorological events (e.g., rain-on-snow, wind storms). This will provide the data to validate the model's ability to predict variables (e.g., temperature, dissolved oxygen, chlorophyll *a*) at spatial and temporal scales outside the core routine monitoring program.

Southern Lake Shallows – Rooted Aquatic Plants

Tribal scientists have been surveying and mapping rooted aquatic plant communities within southern waters, including collection of data on biomass and nutrient content of submersed plant species. In this effort they have discovered infestations of the invasive species Eurasian watermilfoil and also a hybrid of Eurasian milfoil with the native northern milfoil. Beginning in 2006, the Tribe applied integrated milfoil control treatments in selected areas of southern waters. It is important that aquatic plant surveying and noxious weed control programs continue.

Northern Bays – Rooted Aquatic Plants

With the discovery of Eurasian milfoil in southern waters, it is important to establish a program of surveillance and mapping of rooted plant communities within bays of the northern pool. There are many areas of northern pool bays that would be susceptible to the establishment of Eurasian milfoil. Some mapping efforts have been performed by the Kootenai County Noxious Weed Department.

Nutrient Cycling by Rooted Aquatic Plants

Studies are needed to investigate the role of rooted aquatic plants in the shallows of the southern lake as nutrient contributors. Internal nutrient cycling and loading occur by rooted plants assimilating sediment nutrients (phosphates and nitrogen) through the root system, and then releasing these into the water upon senescence (die-back) in the fall.

Northern Bays – Water Quality Sampling and Nearshore Studies

In both the CY91-92 and WY04-06 studies, selected bays around Coeur d'Alene Lake were sampled on a rotational basis for water quality parameters. Bay sampling was also conducted by DEQ in the years of 1995 – 2002. Based on results presented in the USGS report from the WY04-06 studies (Wood and Beckwith, 2008), there were no statistically significant differences between bay water column data compared to the nearest open water, deep sampling sites. As discussed in Appendix A, this is not entirely an unexpected or uncommon result. At this point in time DEQ does not contemplate adding any bay, water column sampling sites to a routine monitoring program. Consideration will be given to periodic sample events within selected bays; a selection process based on evaluation of previously collected data.

Based on information that will be collected during the basin-wide nutrient inventory (Section 3.3), DEQ may conduct nearshore studies that could include: sampling of attached algae on natural and artificial substrates, sampling of nearshore lake sediment pore water, looking for areas of rooted aquatic plants that indicate enrichment by subsurface nitrate, and possibly establishing a few shallow monitoring wells near the shoreline.

Lakebed Sediments – Sediment Coring

Coeur d'Alene Lake is the ultimate sink for mining-contaminated sediments transported from the Silver Valley and lower Coeur d'Alene River. In 1989, USGS conducted extensive collection of surface sediment samples within the lake for determination of trace element concentrations (Horowitz *et al*. 1993). In 1990, 12 gravity cores were collected at selected lakebed locations for geochemical analysis and radiometric dating (Horowitz *et al*. 1995). Repeating such sampling on a periodic basis would permit a comparison with the 1989-90 trace element data. This comparison could be used to determine if any of the completed and/or ongoing Superfund remediation efforts have had a statistically significant effect on sedimentation rates, and sediment-associated metals concentrations.

Benthic Flux of Metals

More investigation, similar to the initial USGS studies on the benthic flux of metals from lakebed sediments (Kuwabara *et al*. 2000), is needed to improve our understanding. It is still uncertain as to what degree metals become dissolved within lakebed sediments, and then migrate to adjacent lake waters and become distributed through the water column. Also uncertain is the fate of the continuous metals load from the Coeur d'Alene River. What portion of the inflowing metals are incorporated in either particulate organic material (e.g., zinc absorbed by phytoplankton), or particulate inorganic materials (e.g., adsorbed onto ferric oxide compounds), and then eventually sink to the bottom?

Toxic Effects of Metals on Benthic Invertebrates

Some work has been done in this area, but it is uncertain to what degree metals in both dissolved and particulate states within sediments have altered the benthic community from the expected natural population assemblage.

Exposure and Bio-magnification of Metals

Studies to determine exposure and bio-magnification of metals within the aquatic food web of Coeur d'Alene Lake are needed. Analysis of fish tissue samples taken from the lake in 2002 detected lead, mercury, and arsenic at levels that may affect certain people's health. The Idaho Department of Health & Welfare and Coeur d'Alene Tribe issued a public fish consumption advisory in 2003 based on this sampling.

On-site Wastewater Disposal

An up-to-date inventory and mapping of subsurface sewage disposal systems around the lake perimeter has begun, and includes: individual septic tank drainfields, community drainfields, Large Soil Adsorption Systems, and wastewater lagoon systems. This project utilizes a Panhandle Health District (PHD) database of subsurface wastewater permits, and incorporates the data within GIS software format, including overlays of slope, soils, and underlying geology. The project is in part sponsored by EPA CWA grant funds approved through the BEIPC. DEQ has a contract with both PHD and the Tribal GIS department to produce this updated inventory and mapping in GIS format.

The survey and mapping of subsurface systems will be utilized by DEQ and Tribal staff to calculate an estimated nutrient loading to Coeur d'Alene Lake by subsurface wastewater. This evaluation may identify "hot spots" of suspected high nutrient loading areas and wastewater impacts to the lake. The subsurface evaluations may then lead DEQ and the Tribe to conduct water quality studies in suspected areas of impact.

Land Use/Land Cover Inventories

Periodic land use/land cover inventories and analysis using current technology (e.g., remote sensing and imagery) are needed. It is important to characterize and quantify nutrient sources as a function of land use/land cover for effective development and implementation of TMDLs at the stream reach, sub-watershed, and watershed levels.

Flooded Shallows and Wetlands

There are shallow areas of the southern lake such as Hepton Lake that were wetlands or historical farmlands, that are now flooded in summer and fall months. This flooding is because of Post Fall Dam operations that maintain a consistent summer pool of 2,128 feet elevation. There is a thought that these flooded areas might be nutrient contributors to the lake. The Tribe will be designing an investigation to explore this possibility in the Hepton Lake area. Also, there are completed and proposed projects that convert agriculture lands back to wetland habitat for waterfowl and other migratory birds. The question has arisen if these newly flooded lands are nutrient contributors. Again, this could be an area of water quality investigations.

Land Use Change and Runoff Characteristics

In 2006, DEQ staff in the Coeur d'Alene Regional Office developed a study proposal to assess surface and ground water impacts from large developments around the lake, and in particular golf course subdivision developments. The proposed study stemmed from numerous complaints of residents down slope of golf course developments who claimed to be experiencing water quality impacts to their drinking water supplies during (and after) construction activities. The DEQ study, with an estimated total cost of $40,000, has not been funded to date. Tribe and DEQ LMP staff believe that this study has merit because of current proposals for other large golf course subdivisions around the lake.

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Appendix C – Management Action Tables

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Appendix C – Management Action Tables

Background

The Management Action Tables (MATs) were first published in the 1996 Coeur d'Alene LMP (CLCC et al. 1996). These were developed by numerous individuals in the government, business, and private sectors; working within Technical Advisory Groups for broad land use categories such as: forest practices, wastewater, and agriculture. Management action items within the tables are a compilation of current rules, regulations, recommendations, BMPs, and other actions that play a role in water quality management of Coeur d'Alene Lake and its tributaries. A column titled "Lead Group" identified government agencies and other entities who would take the lead for implementing individual action items.

In 2002, there was an effort to update and revise the 1996 MATs by advisory workgroups. Revised tables were published in a draft *Coeur d'Alene Lake Management Plan Addendum.* The 2002 draft LMP was never published as a final document.

In 2006, staff from the Tribe and DEQ began a collaborative project to assess the level of implementation of action items in the tables. The revised 2002 tables were used to develop questionnaires and to conduct personal interviews with representatives of Lead Group entities, listed in the tables.

The final 2009 tables reflect recommended changes from the 1996 and 2002 versions, based largely on information collected through the interview process. Some action items were deleted because the actions had been fully implemented; others were deleted based on solid reasoning gained from the interviews or in some cases, redundancy across multiple tables. Some action items were reworded based on unclear language or other recommended rewording by those interviewed. Some action items were combined into a single item, again based on redundancy. At the end of each general land use table there are comments or a rationale for each recommended item, primarily based on information gained during the interviews.

Priority of Action Items and Lead Groups

The order of Action Items within the MATs do not indicate priority of implementation. Priority of Action Items will be established with partners during coordination sessions to develop workplans (see LMP section 3.2). These implementation priorities will be outlined in annual LMP workplans (see LMP section 5.2). In addition, the order of listed agencies or entities in the Lead Group and Other Participant columns does not signify order or priority of leadership among those identified.

By agreement with the three County governments (Kootenai, Shoshone, and Benewah) the Tribe and DEQ have committed that initial implementation of the LMP will include working with the jurisdictional agencies listed in Table C7 of the MATs. LMP staff will coordinate the development of a well thought out and ecologically responsible plan, including funding possibilities, for implementing the riverbank stabilization action items.

Estimated Costs and Funding Sources

The Estimated Costs and Funding Source columns within the final MATs have been left blank because DEQ and the Tribe feel that Action Item costs are best determined during coordination sessions with partners to develop workplans. The Lead Group agencies or entities are the best source for these costing figures and will be asked to provide this information. Estimated costs will be reported in annual LMP workplans.

Management of Contaminated Dredged/Excavated Sediments in the Lake and Spokane River

Numerous comments were received on the Draft 2008 LMP regarding management of contaminated dredged/excavated sediments. The Tribe and DEQ, therefore, recommend a new MAT be developed to outline the necessary actions to address this issue further. In an effort to expedite this work, the Tribe and DEQ will use the findings of the Contaminant Management Project Focus Team (formed by the BEIPC), outlined in a report entitled, *Issue Analysis: Contaminant Management for the Coeur d'Alene Lake and Spokane River upstream of the Post Falls Dam, July 2007*. MAT development will require close coordination with all agencies having authorities and basin stakeholders with an interest in this issue. The concepts in this report should be considered only a starting point for discussion and subsequent development of a MAT for management of contaminated dredged/excavated sediments (refer to the *Issue Analysis* paper at the end of Appendix C).

Acronyms and Abbreviations used in Management Action Tables

ACOE	U.S. Army Corps of Engineers
AVISTA	rename of Washington Water & Power
BEIPC	Coeur d'Alene Basin Environmental Improvement Project Commission (formed in 2002)
BSWCD	Benewah Soil & Water Conservation District
BC	Benewah County
BIA	U.S. Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management
BMP	Best Management Practices
CAC	Citizen's Advisory Committee for CBIG
CCC	Citizen's Coordinating Council for BEIPC
CBIG	Coeur d'Alene Basin Interagency Group (1990 - 1996)
CBRP	Coeur d'Alene Basin Restoration Project (1991 - 1996)
CIA	Central Impoundment Area
Cities	Collectively, cities within the Coeur d'Alene Lake Basin: Coeur d'Alene, Pinehurst, Kellogg, Osburn, Wallace, Mullan, Harrison, Plummer, St. Maries
CLCC	Clean Lakes Coordinating Council
Cons-Part	Agriculture Conservation Partnership comprised of the KSSWCD, BSWCD, NRCS, PLRCD and the ISCC
Counties	Collectively, counties that are within the Coeur d'Alene Lake Basin: Benewah, Kootenai, and Shoshone
CRBC	Coeur d'Alene River Basin Commission
CWA	Federal Clean Water Act
CWMA	Cooperative Weed Management Area
CWE	IDL's Cumulative Watershed Effects protocol
EPA	U.S. Environmental Protection Agency
Fire Dist.	Local Fire Districts
Forest Associations	Associated Logging Contractors, Intermountain Forest Association, etc.
Forest Industry	Contractors, and forest product industries
Forest Landowners-Private	Non-industrial private forest landowners and Industrial Timber companies (e.g., Potlatch, Stimson, Forest Capital, Inland Empire Paper)
FPA	Idaho Forest Practices Act
FSA	USDA Farm Service Agency
Hwy-Dists	Collectively, Highway Districts with jurisdictions within the Coeur d'Alene Lake Basin: Worley, East Side, Plummer-Gateway
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish & Game
IDL	Idaho Department of Lands
IDPR	Idaho Department of Parks & Recreation
IDWR	Idaho Department of Water Resources
ILB	Idaho Land Board

INFISH	Inland Native Fish Strategy
INLT	Inland Northwest Land Trust
IPNF	Idaho Panhandle National Forest
ISCC	Idaho Soil Conservation Commission
ITD	Idaho Transportation Department
KC	Kootenai County
KCPW	Kootenai County Parks & Waterways
KMPO	Kootenai Metropolitan Planning Organization
KSSWCD	Kootenai-Shoshone Soil & Water Conservation District
Legislature	Idaho State Legislature
LHTAC	Local Highway Technical Assistance Council
LSAS	Large Soil Absorption System
NAS	National Academy of Sciences
NIBCA	North Idaho Building Contractors Association
NPDES	National Pollutant Discharge Elimination System
NRCS	USDA Natural Resource Conservation Service
PAC	Panhandle Area Council
PHD	Panhandle Health District
PLRCD	Panhandle Lakes Resource Conservation and Development
SC	Shoshone County
SAWQP	State Agriculture Water Quality Program (now WQPA)
SPZ	Stream Protection Zone (in FPA)
State	State of Idaho
SWCD	Soil & Water Conservation Districts
TNC	The Nature Conservancy
TMDL	Total Maximum Daily Load
Tribe	Coeur d'Alene Tribe
T2 Center	Idaho Technology and Transfer Center
UI - CES	University of Idaho, Cooperative Extension Service
U of I	University of Idaho
USDA	United States Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish & Wildlife Service
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey
WPCA	Water Pollution Control Account
WQPA	Water Quality Program for Agriculture
WDOE	Washington Department of Ecology

Table C1. Public Outreach Information and Education (I & E)

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 1: Create a centralized public education and outreach program, including a Lake Stewardship Center. Functions of the education and outreach program include the following: a) Provide Federal, State, local, and Tribal regulatory information. b) Serve as a liaison and coordinate among government, tribal, businesses, and community entities for promoting water quality protection awareness and education. c) Provide a centralized location for information and education materials that are related to water quality protection. Existing and new materials will be housed in this location. d) Develop and implement a Coeur d'Alene Lake specific Lake*A*Syst (LAS) program and materials. e) Create and maintain a Coeur d'Alene Lake Management Plan (LMP) website. f) Conduct workshops, tours, & presentations for the community and area schools on water quality issues. g) Assist the conservation partnerships with their outreach efforts. h) Promote consumer awareness and use of "lake friendly" products. i) Promote training programs on erosion & sediment control Best Management Practices (BMPs). j) Provide landowners with information on proper maintenance of subsurface sewage systems.	IDEQ Tribe UI-CES	All other government, business, conser-vation partners, and community entities in the Cd'A Lake Basin		

Table C1. Public Outreach Information and Education (I & E)

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
k) Develop an educational pamphlet for distribution to boat registrants on reducing impacts caused by boat wakes to riverbanks and lakeshores. l) Fund and implement a Clean Marina program for marinas, boat operators, and the general public.				
m) Work with the public on the understanding of potential nutrient contributions from public lands.				

Comments and Rationale:

Action 1: The LMP audit found a lack of understanding of Coeur d'Alene Lake issues and the need to protect water quality. Though several entities throughout the basin each have some form of information and education efforts, there is a need for centralization and coordination.

Table C2. Forest Practices

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 1: Continue implementation of BMPs within the Forest Practices Act (FPA) and Cd'A Tribal Forest Management Plan (on Tribal Trust lands) as related to the stream protection zone (SPZ), and make recommendations as needed to FPA as related to SPZ.	IDL Tribe	USFS, BLM Forest Landowners-Priv., Forest Assoc.		
Action 2: Fully implement FPA rule 030.07.a (lakeside management rule) following the rule guidance. Implement Cd'A Tribal Forest Management Plan on Tribal Trust lands.	IDL Tribe	USFS, BLM Forest Landowners-Priv., Forest Assoc.		
Action 3: Continue to implement pre-operation inspections for proposed timber harvests and related road construction. Continue to conduct quadrennial audits of forest-practices operational areas, and conduct annual field audits where feasible.	IDL, IDEQ, Tribe USFS, BLM	Forest Landowners-Priv.		
Action 4: Continue to encourage alternatives to culverts where feasible within the Stream Channel Alteration permit process.	IDWR, IDL, ACOE USFS, BLM	Tribe, Forest Landowners-Priv.		
Action 5: Continue stream channel protection activities. Develop prescriptive stream-crossing and stream alteration BMPs that provide a high level of water quality protection from road sediments. Promote enforcement of the Stream Channel Protection Act within the basin for crossing and alteration proposals.	IDWR IDL ACOE	Tribe, USFS BLM, Forest Landowners-Priv., Forest Assoc.		
Action 6: Continue logger accreditation and other forestry I & E programs.	IDL, Tribe USFS, BLM Forest Assoc. UI-CES	Forest Landowners-Priv.		
Action 7: Identify, prioritize, and implement restoration projects using currently available technologies.	IDL, Tribe, USFS BLM, Forest Landowners-Priv.			

Table C2. Forest Practices

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 8: Minimize road construction impacts in basin by cooperating on joint access development to forest stands. Streamline process to allow access on previously developed roads.	IDL, Tribe, USFS BLM Forest Landowners-Private			
Action 9: Pursue all necessary funding to address road maintenance needs and management objectives which reduce sediment releases on forest roads.	IDL, Tribe, USFS BLM	Forest Landowners-Priv. Forest Assoc.		
Action 10: Monitor watershed restoration projects to determine effectiveness in minimizing sediment and nutrient loading into water bodies.	IDL, Tribe USFS, BLM, IDEQ	Forest Landowners-Priv. Forest Assoc.		

Comments and Rationale:

Action 1: Coeur d'Alene Reservation Forest Management Plan 2003-2017 adopted 12/12/02. There have been many significant changes to the 1996 FPA.

Action 2: Tribe and DEQ staff met with IDL regarding the rule guidance under FPA Rule 030.07.a. At this meeting IDL stated that the St. Joe Supervisory Area Guidelines for this rule were not applicable. IDL suggested that the LMP can recommend potential changes in either the rule or the guidance through the formal process of addressing the Idaho Forest Practices Act Advisory Committee (FPAAC).

Action 3: During the LMP MAT audit, IDL FPA Advisors stated that pre-operation inspections might be conducted on timber harvests in sensitive areas and for timber harvests conducted by contractors that have demonstrated non-compliance of the FPA in the past. Industrial Timber companies stated that pre-operation inspections, along with frequent FPA and company audits are conducted as a requirement of forest product certifications under either the Forest Stewardship Council or the Sustainable Forestry Initiative. A minimum of annual field audits is important and a requirement of forest product certifications. All entities stated that timber sale inspections are considered audits.

Action 4: IDL suggested the following – "Continue to encourage alternatives to culverts greater than 60 inches in diameter, on Class I streams, where feasible within the Stream Channel Alteration permit process." This practice of encouraging operators (or landowners) to seek a culvert alternative when pipes are greater than 60 inches is actually printed in IDL administrative rules (Culvert Sizing Table 1 listed under IDAPA 20.02.01.040.02.e in the Forest Practices Rules). Many times, it is more cost-efficient for landowners to install a bridge than to install a large culvert. A 2002 MOU between IDWR and IDL has streamlined the Stream Channel Alteration permit process. All entities agree that there is a need to consider alternatives to culverts.

Table C2. Forest Practices

Comments and Rationale cont.

Action 5: Road stabilization at stream crossings and stream channel protection activities are important FPA BMPs.

Action 6: The LEAP program has gained a successful reputation and most if not all lumber mills in North Idaho will only accept timber from certified LEAP participants.

Action 7: Restoration projects are still necessary however, inadequate funding restrains progress.

Action 8: Using the St. Joe watershed as an example, shared access and joint maintenance lessens the need for new roads.

Action 9: Insufficient funding and manpower cannot keep up with current forest road maintenance needs. Forest managers have reported to DEQ and the Tribe that they have insufficient funding for all road maintenance needs that could reduce sediment releases from forest roads.

Action 10: The LMP audit found overall agreement that monitoring of restoration project success and BMP effectiveness is an important component in forestry activities, however, funding is generally not available for monitoring.

Table C3. Roads

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 1: All entities with road responsibilities need to identify and prioritize road related water quality improvement needs, and develop long range plans for correcting existing problems (e.g., a five-year workplan).	ITD, Hwy-Dist. Counties, Cities IDL, USFS, BLM Tribe, KMPO Forest Landowners-Priv.	IDWR		
Action 2: Road jurisdiction entities need to improve on the control of erosion and sediment during construction and maintenance activities.	ITD, Hwy-Dist. Counties, Cities IDL, USFS, BLM Tribe Forest Landowners-Priv.	IDWR T2 Center		
Action 3: Develop and enforce regulations as needed to incorporate water quality protection strategies into existing road standards, policies, procedures, and decisions.	ITD, Hwy-Dist. Counties, Cities IDL, USFS BLM,Tribe	IDWR, Forest Landowners-Priv. Forest Assoc.		
Action 4: IDL, Counties, and Hwy Districts need to coordinate enforcement of road standards and specifications, and educate landowners when converting forest access roads to subdivision roads and driveways.	ITD, Hwy-Dist. Counties, Cities IDL, USFS, BLM Tribe, KMPO	Fire Districts IDWR, Forest Landowners-Priv. Forest Assoc.		
Action 5: Prevent sediment from entering road ditches from adjacent properties by adopting and enforcing erosion control and grading ordinances or regulations for all land disturbing activities.	ITD, Hwy-Dist. Counties, Cities IDL, USFS, BLM Tribe	EPA IDWR, Forest Landowners-Priv.		

Table C3. Roads

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 6: Promote training programs on maintenance and construction BMPs, and regulations which can be used to reduce road impacts to water quality. Provide private landowners with education and assistance materials to install road BMPs.	ITD, Hwy-Dist. Counties, Cities IDL, USFS, BLM Tribe LHTAC, DEQ	UI, IDWR, Forest Landowners-Priv. Forest Assoc.		
Action 7: Encourage ITD and other road jurisdictions to hold public meetings and/or make construcion plans available prior to and during project construction.	ITD, Hwy-Dist. Counties, Cities IDL, USFS, BLM Tribe			

Comments and Rationale:

Action 1: Problem roads that impair water quality remain, and need to have a long term plan of prioritization and funding in order to be maintained, repaired, or decommissioned.

Action 2: Lead group entities are only responsible for road related issues within their jurisdiction, and in the case of IDL, include enforcement of road BMPs on private lands during forest practices. DEQ and the Tribe believe that there is always room for improvement in BMP technologies and effectiveness. Observations show that there needs to be continued improvement in erosion and sediment control education and implementation. The Idaho Technology and Transfer Center (T2) through the U of I provides a framework for this improvement.

Action 3: Existing regulations are considered to be somewhat insufficient in the protection of water quality and improved enforcement is necessary.

Action 4: The LMP audit found this was a commonly stated problem. Forest access roads are constructed for low volume capacities, and when logging operations are complete these roads are "buttoned up" as per FPA standards with IDL. Some of these forest access roads, however, get converted to private access roads and driveways which do not meet Hwy District standards or specifications. This practice has been identified by FPA advisors as "logging with the intent to build". Currently there are efforts between IDL and the Counties to address this issue.

Action 5: Road Supervisors stated that there is a problem with adjacent land disturbances contributing sediment into County road ditches. Many road ditches can discharge directly into surface waters. The T2 Center and Stormwater and Erosion Education Program (SEEP) through PAC, provide education and certification. These education programs provide information regarding County and City ordinances as well as State and Federal regulations and identify the appropriate implementing entities.

Comments and Rationale cont.

Action 6: Promote and further support existing training and education programs such as T2, SEEP, and the Logger Education to Advance Professionalism (LEAP).

Action 7: During our audit it was stated that public meetings prior to and on occasion during road construction projects are important in order to gain public input. IDL posts FPA road construction schedules on their state-wide website.

Table C4. Development, Erosion, and Stormwater

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 1: In order to address stormwater run-off, provide information and technical assistance to contractors, utility companies, engineers, design professionals, businesses, recreationists, cities, agencies, property owners and the general public. Stormwater run-off information and education would be a function of the Cd'A Lake Stewardship Center (see Table C1).	IDEQ Tribe UI-CES EPA	All other stakeholders throughout the basin.		
Action 2: Utility companies need to incorporate and implement erosion and sediment control into the siting, installation, and maintenance of utilities.	Utilities			
Action 3: Improve enforcement of existing stormwater treatment and erosion control requirements; including maintenance, in the Cd'A Lake Basin to better prevent phosphorous and sediment loading from grading and development activities. Hire sufficient staff to inspect and enforce site disturbance and stormwater ordinances.	Counties Cities EPA			
Action 4: Protect, and ensure maintainance of existing riparian vegetative buffer around the entire perimeter of Coeur d'Alene Lake.	Counties, Cities IDPR, Tribe	Private property owners		
Action 5: Establish performance standards which will minimize the quantity of sediment leaving property boundaries. For example, prohibit increases in sediment export, or if sediment export is allowed, limit it to identified numeric standards. Require stabilization of soil disturbance	Counties Cities	EPA IDEQ Tribe		
Action 6: Establish requirements within site disturbance and stormwater ordinances that development projects will result in "no net increase" in phosphorus loading to surface waters. This will include treatment of stormwater, and pollution (e.g., phosphorus) trading where feasible.	Counties Cities	EPA IDEQ Tribe		

Table C4. Development, Erosion, and Stormwater

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 7: Investigate alternatives to Grassed Infiltration Areas (GIAs) for stormwater treatment within the City of Coeur d'Alene.	City of Coeur d'Alene	PHD, IDEQ, EPA		
Action 8: Site disturbance and stormwater ordinances shall not allow exemptions to erosion control requirements during the installation of subsurface sewage disposal systems on slopes greater than 10% and/or less than 500' from surface waters.	Counties Cities	PHD		
Action 9: Pursue funding for stormwater and erosion control programs, including stormwater utilities. Implement programs and ordinances throughout the Cd'A Basin.	Counties Cities	IDEQ, Tribe EPA		
Action 10: Conduct periodic audits and monitoring of BMP implementation and effectiveness.	Counties Cities	IDEQ, Tribe EPA		
Action 11: Prohibit burning of construction debris on lakeshores and adjacent to streams and drainageways. Provide information on the effects of burning any debris on the lakeshores and adjacent to streams.	IDEQ, Counties Cities, Fire Dist.	Tribe		
Action 12: Evaluate the level of treatment and stormwater retention needed for roads and highways in the basin; expand regulations and policies as needed to prevent contaminants from reaching the water.	All road jurisdictions in the basin			

Comments and Rationale:

Action 1: Public information and education on erosion control and stormwater run-off is needed and would be a major function of a Cd'A Lake Stewardship Center. Staff of the Center will promote SEEP or other related education programs.

Action 2: Erosion control techniques need to be in place during the installation of utilities. These might include: reseeding of disturbed areas, locating utilities away from streams and drainages, and timing utility projects.

Action 3: Throughout the Cd'A Lake Basin, there is insufficient funding and manpower for inspection and enforcement of current site disturbance and stormwater ordinances.

Comments and Rationale cont.

Action 4: In 2006, IDEQ and the Tribe conducted a shoreline survey for compliance with the Kootenai County Site Disturbance Ordinance 374. It was commonly observed that the 25' buffer zone was disturbed or eliminated in violation of the ordinance. There remains roughly 25% of undisturbed shoreline vegetation and this needs to be protected. The Tribe and DEQ LMP staff will work with the Counties and Cities on riparian buffer preservation under current ordinances, and the voluntary re-establishment of riparian buffers that have been damaged or removed.

Action 5: Numeric performance standards should be included and enforced in site disturbance and stormwater ordinances. For soil disturbance stabilization requirements, an EPA SWPPP, for example, requires stabilization within 7-14 days.

Action 6: Some ordinances already state that BMPs must be sufficient to prevent sediment from leaving a site. This is "no net increase" but is not often achieved. A pollution trading system is designed to offset new phosphorus loads by reducing existing loads. Mitigation actions might include: providing funds for upgrading the Page Wastewater Treatment Plant (to increase its phosphorus removal capabilities); replacing substandard septic systems; removing unpaved roads not in use; or surfacing poorly constructed dirt roads which are eroding into Cd'A Lake or its tributaries.

Action 7: As per City of Coeur d'Alene stormwater engineers and staff, GIAs are the only approved BMP over the Rathdrum Prairie-Spokane Valley Aquifer and have been difficult to design and maintain due to an increase in development and run-off. City staff recommend that alternatives need to be explored.

Action 8: As per PHD staff, site disturbance for septic tanks and drainage fields are deferred to County ordinances. PHD staff observe that installation of subsurface systems is often exempt from Kootenai County Site Disturbance Ordinance 374, per Section 5.A.7. They observe that when septic tanks are installed as close as 50 feet from the lake, and effluent is pumped to an up-gradient drainfield, erosion controls BMPs are exempt. PHD states that subsurface sewage disposal systems should be explicitly cited as needing a permit under the ordinance.

Action 9: Additional funding and staff are needed. As per Kootenai County staff, a stormwater utility is not a county concept, refer to city stormwater utilities.

Action 10: Audits and monitoring of BMP implenentation and effectiveness are lacking basin wide. This could be a significant cost for agencies.

Action 11: The burning of trade and construction waste is prohibited as per IDAPA 58.01.01.600-617. Burning of woody debris along streambanks, riverbanks, and lakeshores needs to be discouraged because burned residue can contribute to the phosphorus load. Burning of debris requires a local fire district permit.

Action 12: As an example, Lakes Hwy District has performed an evaluation of stormwater treatment and retention on some roads around Hayden Lake. As a result, the Hwy District obtained a 319 IDEQ grant for a pilot project to treat stormwater run-off before entering Hayden Lake.

Table C5. Agriculture

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 1: Continue to identify those tributaries which produce high levels of nutrients, sediment, pesticides, and bacteria from agricultural sources.	Cons-Part. IDEQ Tribe			
Action 2: Continue to provide direct technical assistance and provide new and existing cost-share programs to agricultural landowners, including livestock operators, for planning and implementation of BMPs. Encourage planning and implementation on a watershed scale.	Cons-Part.	Tribe		
Action 3: Improve outreach programs directed at agricultural landowners, including livestock operators. The program will utilize personal contact and mass communication tools with the intent of advertising available programs that encourage voluntary planning and implementation of BMPs.	Cons-Part.	IDEQ Tribe UI-CES		
Action 4: Education materials on the environmental benefits and available programs for agricultural BMPs will be a function of the Cd'A Lake Stewardship Center (see Table C1).	IDEQ Tribe UI-CES	Cons-Part.		
Action 5: Ensure the continued implementation of existing cropland management practices, including production of grass seed, through implementation of federal Farm Bill requirements.	NRCS	FSA USDA		
Action 6: Provide planning, implementation, and funding assistance to small acreage farms (e.g., ranchettes or hobby farms) for BMPs.	Cons-Part.	UI-CES Tribe		
Action 7: Continue to provide engineering surveys and designs for structural BMP implementation.	NRCS	Cons-Part.		
Action 8: Identify funding to conduct on-farm testing of potential new BMP technologies.	UI-CES Cons-Part.	UI EPA		
Action 9: Encourage funding for NRCS to conduct Rapid Watershed Assessments within the Cd'A Lake Basin.	NRCS	Cons-Part. Tribe		

Table C5. Agriculture

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 10: Continue to provide technical and financial assistance for stream and riverbank stabilization projects in agricultural areas.	NRCS, Cons-Part. Tribe	IDWR		
Action 11: Continue to provide and update databases and GIS coverage of land use activities, including BMP implementation through funded agricultural projects.	Cons-Part. Tribe	FSA		
Action 12: Fund and implement water quality monitoring to determine collective effectiveness of agricultural BMP installation and maintenance.	Cons-Part. IDEQ Tribe			
Action 13: Consider a tax incentive program to encourage agricultural landowners to restore natural vegetation buffers along creeks and drainage ways to minimize runoff from adjacent lands.	Counties	Cons-Part.		
Action 14: Consider zoning ordinances that limit the conversion of agricultural land to urban uses.	Counties Cities	Cons-Part.		

Comments and Rationale:

Action 1: The Conservation partnership uses the IDEQ 303(d) list of impaired waterbodies as well as the NRCS Stream Visual Assessment Program (SVAP) to identify problem areas and develop TMDLs. Some grant programs such as IDEQ 319 Non-Point Source Pollution program prioritizes requests according to approved TMDLs.

Action 2: Current available Farm Bill programs implemented by the NRCS include: Conservation Reserve Program (CRP), Continuous CRP, Wetland Reserve Program (WRP), and Environmental Quality Incentives Program (EQIP). The State agricultural cost-share program implemented by the ISCC is the Water Quality Program for Agriculture (WQPA). As of 2006, the NRCS and ISCC have combined the EQIP and WQPA programs to potentially offer up to 90% cost-share for eligible landowners.

Action 3: The LMP audit found that awareness of the above cost-share programs by eligible landowners has been lacking due to funding and Conservation District staff turn-over.

Action 4: The Cd'A Lake Stewardship Center could assist the Conservation Districts in their outreach programs.

Table C5. Agriculture

Comments and Rationale cont.

Action 5: Request that NRCS Area offices provide Farm Bill program project updates as they pertain to nutrient management and Coeur d'Alene Lake (keeping in mind landowner privacy rights).

Action 6: The LMP audit found there is an increasing trend of 5-20 acre "hobby farms" and there can be water quality issues on these small acreage farms. If tracts are < 20 acres they do not qualify for Farm Bill or WQPA programs. Districts need additional funding to assist with these small acreage farms.

Action 7: Many agricultural BMPs are installed with the help from NRCS engineering and surveying (Federal and Non-Federal).

Action 8: Funding and and new ideas are limiting factors for on-farm testing of new BMP technologies. One example of testing new BMP technologies is a riverbank stabilization design on the Cd'A River which utilizes EQIP dollars and is adjacent to agricultural land.

Action 9: Rapid Watershed Assessments (RWA) for the Coeur d'Alene Lake Basin was scheduled for the beginning of 2007. Examination of other RWAs show that this assessment provides valuable watershed information.

Action 10: Inventories of streambanks and riverbanks have identified areas of significant bank erosion adjacent to agricultural lands. Funding is limited for stabilization projects.

Action 11: Agricultural databases and GIS coverages can be very helpful in watershed assessments. The NRCS Performance Results System (PRS) is available on the web for public use and it hosts program specific reports and conservation practices information.

Action 12: Water quality monitoring is generally lacking in agricultural projects. For example, there were 3 water quality monitoring stations on Lake Creek for several years that monitored turbidity, TSS, and phosphorus to ensure that the agricultural BMPs were working. The stations have not been in use for the last 5 years due to the lack of funding.

Action 13: There are no tax incentives for riparian area restoration projects. Counties have not considered a tax break for this purpose. Kootenai County believes they have no taxing authority in this area.

Action 14: Shoshone County staff stated that very limited agricultural acreage remains for conversion. Kootenai County staff states that it is a low priority to conserve agricultural land and they question why this is an LMP issue. Benewah County does not having zoning ordinances related to the coversion of agricultural land to urban uses, however, staff stated that the County favors agricultural resources.

Table C6. Wastewater

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 1: Evaluate impacts (including inflow and infiltration problems), conduct a financial evaluation of alternatives, and recommend strategies for reducing phosphorus loads from wastewater treatment plants that discharge to surface waters in the Coeur d'Alene Lake Basin. Identify basin wide funding alternatives.	Sewer-Dists. IDEQ EPA Tribe	BEIPC		
Action 2: Inventory existing individul/subsurface sewage systems, community sewage systems, and wastewater reuse systems (lagoon/land application), located along tributaries and lakeshore in the Cd'A basin. a) Maintain a data base which can be used to locate and prioritize systems needing attention. b) Identify substandard and failed individual/subsurface sewage systems. c) Prioritize systems for upgrade and/or replacement based on their probable nutrient contribution to the lake.	PHD IDEQ Tribe	Counties developers private landowners		
Action 3: Fund studies that evaluate the effect of nutrients in wastewater on water quality, particularly in near shore areas. Studies would include potential impact of wastewater generated by future growth and development. Incorporate the use of IDEQ's Nutrient/Pathogen Evaluation Program. Where nutrients have been identified as a problem, develop and install alternative sewage systems which are more effective at removing nutrients from effluent.	IDEQ Tribe PHD			

Table C6. Wastewater

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 4: Encourage replacement of substandard individual/subsurface sewage disposal systems by: a) Allowing nutrient loads for new development to be offset with upgrades to existing offsite substandard indvidual/subsurface sewage systems (i.e. pollution trading). b) Developing cost share and other incentives. c) Investigate new and alternative technologies for improvement of substandard systems.	PHD IDEQ Tribe	Sewer Districts private landowners		
Action 5: Improve compliance with PHD rules regarding the reporting and identification of failed individual/subsurface sewage systems.	PHD private landowners			
Action 6: Improve compliance of reporting and maintenance requirements by homeowner associations connected to Large Soil Absorption Systems (LSAS). IDEQ should periodically inspect LSAS.	IDEQ	Private landowners		
Action 7: Improve maintenance of individual/subsurface sewage systems. This would primarily be through an information and education effort by PHD inspectors with private landowners, and also would be a function of the Cd'A Lake Stewarship Center (see Table C1).	PHD IDEQ Tribe			
Action 8: Ensure that PHD has sufficient funding and staff to adequately inspect the installation of new individual/subsurface sewage systems. Pursue additional funding for PHD staff to periodically inspect existing individual/subsurface sewage disposal systems.	PHD IDEQ			

Table C6. Wastewater

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 9: During plan reviews of both new and replacement individual/subsurface sewage systems, consider clustering of the systems if it will have less impact on water quality than small, individual systems.	PHD IDEQ Counties Cities	Private Landowners		
Action 10: Evaluate and promote the use of non or low phosphate laundry detergents, other cleaning products, and fertilizers in the Cd'A Lake Basin. Audit the compliance of the City of Coeur d'Alene's Phosphorus Laundry Detergent Ban (Ord. 2267). This could be a function of the Cd'A Lake Stewardship Center (see Table C1).	Counites Cities Tribe IDEQ			

Comments and Rationale:

Action 1: Wastewater Treatment Plant's (WWTP) contribute a portion of the nutrient loading to Coeur d'Alene Lake. Some evaluations have been started at the South Fork Cd'A River Sewer District, and the Plummer Waste Water Treatment and Disposal Facility. Inflow and Infiltration (I & I) of groundwater into deteriorating sewer lines is a problem for WWTP's throughout the entire basin. Funding needs to be secured for improvements.

Action 2: An updated inventory/mapping (in GIS format) of sewage disposal systems is underway to evaluate the impact of subsurface wastewater. These systems include: individul/subsurface sewage systems, community subsurface systems (2-10 homes serviced), Large Soil Absorption Systems (greater than 2,500 gpd), and wastewater reuse systems (lagoon/land application). This inventory will help identify "hot spots" of wastewater impacts to the lake. Substandard systems (action 2.b) are considered those installed prior to 1971 that are non-compliant by current PHD regulations. A system with surfacing sewage or if sewage is backing up, is identified as failed system. The wastewater inventory will in part be used to prioritize systems for upgrade and/or replacement (action 2.c).

Action 3: Scientific studies, including inventory information gathered in Action 2, are needed to identify any impacts of wastewater on the lake. There are no current rules governing the recommendations of Action 3 for existing subsurface wastewater systems (last sentence in Action item).

Action 4: Pollution trading concepts will be explored by the LMP team. Replacing substandard individual/subsurface sewage disposal systems is voluntary. Public outreach and cost-share program incentives could assist in getting substandard systems upgraded.

Action 5: PHD Repair Permit is required for a failed individual/subsurface sewage disposal system. PHD acknowledges that homeowners may not report a failed system due to the cost of an upgrade to current or "best fit" standards.

Action 6: IDEQ needs to improve the current audit procedure for required annual LSAS reports, and needs to conduct periodic field inspections.

Table C6. Wastewater

Comments and Rationale cont.

Action 7: It is possible that many homeowners around the lake and tributaries are unaware that periodic pumping of septic tanks is necessary for individual subsurface systems to function properly. PHD recommends that a rule change be made to make maintenance required.

Action 8: State rules require that septic system installers have to be liscensed, bonded, and insured, and PHD offers a one day training course for installers. PHD considers inspections for new individual/subsurface sewage disposal systems as adequate. Inspections of existing, substandard, and failed sewage systems are complaint based. Currently there is no rule requiring inspection of these existing systems. Additional funding and staff would be needed for these inspections.

Action 9: The LMP audit found that clustered or community systems are at times not feasible due to easement issues and the size requirements of communty drainfields. LSAS and Community systems have monitoring, reporting, and O&M requirements which would come from established homeowner associations that jointly maintain the systems. PHD encouragess clustering of lake cabins with a centralized LSAS where feasible. Advantages of clustered systems are the above listed requirements, and the requirement of 2 separate drainfields for the purpose of alternating and resting of drainfields. Kootenai County states that they do not play a role in the clustering of systems.

Action 10: There is very little promotion of using low or non phosphate detergents and fertilizers throughout the basin. The Operators of the WWTP's that were interviewed showed interest in learning more about the benefits, and were unaware that the City of Coeur d'Alene has a Phosphorus Ban Ordinance dated 1990.

Table C7. Rivers, Bays, and Southern Shallows

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 1: Control bank erosion & bottom scour on the St. Joe and Coeur d'Alene Rivers, and lakeshores by expanding and enforcing no-wake zones and speed of boats and improve signage for these zones.	Counties Tribe IDPR	Boaters		
Action 2: Develop an informational pamphlet for distribution to boat registrants educating them on the impacts caused by boat wakes to riverbanks and lakeshores. This could be a function of the Cd'A Lake Stewardship Center (see Table C1).	Tribe IDPR Counties	BEIPC		
Action 3: Continue to inventory rapidly and moderately eroding banks along reaches of the Cd'A and St Joe rivers.	Cons-Part Tribe IDEQ IDFG	USGS IDL, ACOE USFWS, BEIPC EPA, IDWR		
Action 4: Develop, fund, and use a suite of bank stabilization technologies for eroding riverbanks and lakeshores. Support legislation enabling counties to assess user fees dedicated to lake and river protection activities.	Cons-Part EPA IDEQ, ACOE Tribe, IDWR, IDFG Local legislators, BEIPC, Counties	PLRCD		
Action 5: Support funding for public land managers to implement bank stabilization on public lands. Stabilize banks at all existing recreation sites and newly developed sites.	IDL IDFG USFS BLM Tribe, EPA	USFWS BEIPC IDWR PLRCD		

Table C7. Rivers, Bays, and Southern Shallows

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 6: Identify sources of trace (heavy) metal loads in the Cd'A River between Enaville and Harrison with special attention to: a) Need for tailings removal from banks or channel b) Assess if bank stabilization will be effective in curtailing metals loading c) Monitor bank erosion rates where heavy metal laden sediments have come to lie d) Utilize USGS sediment transport models that have been developed using CWA funds	EPA USGS IDEQ	BEIPC Tribe IDWR IDFG		
Action 7: Mitigate and manage the effects of lake level fluctuations and management upon shoreline erosion and bank sloughing.	Avista, IDEQ, Tribe WDOE, IDFG IDWR, USFWS			
Action 8: Develop a pamphlet explaining the bank stabilization permit processes (ACOE, State, Tribal). The pamphlet could include: a) Stabilization design features including the utilization of softer vegetative components b) Recommendations on methods to develop beach and wildlife areas utilizing existing vegetation	ACOE IDWR IDL Tribe IDEQ IDFG Cons-Part			
Action 9: Contract with nationally recognized river hydrology experts to develop a total river system management plan for the North Fork and South Fork Cd'A River above Cataldo.	IDEQ, Tribe, EPA BEIPC	IDWR		

Table C7. Rivers, Bays, and Southern Shallows

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 10: Work with landowners (public or private) to improve riparian zone management by developing buffer strips and bank stabilization along rivers and streams.	Cons-Part, TNC, INLT, landowners Counties, Cities Tribe, IDEQ	IDWR		
Action 11: Develop & implement TMDLs for 303(d) listed waterbodies in the Cd'A Basin as required under the Clean Water Act.	Tribe, IDEQ, EPA	other Tribes		
Action 12: Continue to fund and implement comprehensive water quality monitoring efforts basin wide.	Tribe, IDEQ EPA, USGS	BEIPC		
Action 13: Continue to pursue funding for the study, inventory, and management of rooted aquatic plants with special attention to the invasive Eurasian watermilfoil species.	Counties, Tribe IDPR, IDEQ PLRCD, CWMA	UofI		

Comments and Rationale:

Action 1: The LMP audit found that "No-Wake Zone" signage throughout the lakes and rivers is insufficient and difficult to read and/or locate. County or Tribal (within Reservation boundaries) funding is necessary for repairing these signs. Enforcement and citations within "no-wake zones" could be improved and citation revenues could provide supplemental funding.

Action 2: County manuals have been printed and distributed in the past, however, existing pamphlets do not highlight "no-wake zones" and the impact that wakes can have on bank erosion. County and IDPR showed interest for improving education materials.

Action 3: Some inventories along the two rivers have been conducted, however, streambanks and riverbanks continue to erode annually. Ongoing inventories need to be established and funded.

Action 4: A Coordinated program among agencies needs to be established to produce a viable and accepted suite of stabilization technologies for future projects.

Action 5: Encourage interest groups to aid agency projects with labor and/or dollars for matching funding. Permits are required by ACOE, IDL, IDWR and Tribe within respective jurisdictions.

Action 6: Need to coordinate LMP process with EPA RI/FS (ROD) cleanup efforts.

Comments and Rationale cont.

Action 7: The parties involved in the FERC reliscensing process for the AVISTA, Spokane River Hydroelectric Project at the Post Falls dam, are currently involved in evaluating the impacts and implications of current lake level fluctuations and management.

Action 8: The LMP audit found that those agencies involved with bank stabilization projects agree, that the application process is confusing and not very "user friendly." All entities that were interviewed support a joint pamphlet explaining who, what, when, where, and why. There might be some reluctance to a "do it yourself" bank stabilization process, therefore, the detailed engineering should be left to professionals. There is an ACOE national brochure that could be adapted to make it more local to reflect local jurisdictions, needs, etc.

Action 9: Coordination is necessary for long-range planning of Coeur d'Alene River hydrology dynamics. This is a recommendation that came out of the National Academy of Sciences report concerning basin-wide planning and flood concerns.

Action 10: Utilize voluntary methods such as conservation easements, long-term leases, donation, purchase, etc. These methods can improve or maintain riparian areas of rivers and streams in order to minimize excessive nutrients and sediments from entering waterbodies.

Action 11: TMDLs for sediment, nutrients, temperature, metals, and bacteria have and are being developed. Funding for TMDL implementation is lacking and funds need to be identified and secured.

Action 12: Continue and expand monitoring programs such as: EPA- Basin Environmental Monitoring Program, IDEQ- Beneficial Use Reconnaisance Program, NRCS- Stream Visual Assessment Program, IDEQ and Tribe- Cd'A Lake monitoring program, and stream sampling by the Tribe's Water Resources Program.

Action 13: Various control methods of Eurasian milfoil include: herbicide treatment, diver hand pulling, bottom barriers, and surface raking. As per conversation with the Kootenai County Noxious Weed Dept., mechanical harvesting is not considered viable, at this time.

Table C8. Motorized Watercraft and Hazardous Materials

Management Actions	Lead Group	Other Participants	Estimated Costs	Funding Sources
Action 1: Pursuant to applicable codes (refer to Notes), on-board inspections conducted by County and Tribal marine deputies in the Cd'A Lake Basin shall include an examination of wastewater facilities on the craft to ensure their compliance with the referenced codes. Any violations shall be enforced according to said codes. On the Idaho Boat Inspection Report, add a line item for inspecting wastewater facilities.	IDPR Counties PHD Tribe			
Action 2: Review and strengthen present codes and regulations that manage wastewater facilities discharge from motorized watercraft.	PHD, Legislature, Counties, Tribe			
Action 3: Require that public and private marinas comply with applicable codes regarding pump-out and shore-based facilities.	Counties, PHD, Tribe, Marinas	IDL		
Action 4: Complete, implement, and enforce with existing codes, the Cd'A Lake Clean Marina Program. This program is currently being developed and is in draft form and includes a public outreach component. (See notes for details).	IDEQ, Tribe, PHD, Counties, IDL	USCG, IDPR, Marinas, Marine shops, EPA		
Action 5: Develop and strengthen an aquatic spill response partnership basin-wide.	IDEQ, Tribe, PHD, Counties, Cities	Marinas, EPA		
Action 6: Coordinate a program to address the removal of abandoned docks and other large debris which can become a hazard to navigation.	IDL, Tribe, Counties, Marinas, Private Businesses			

Comments and Rationale:

Action 1: Idaho Code §67-7501 *et. seq*. (Marine Sewage Disposal Act) disallows the discharge or disposal of sewage or other wastes from any vessel into waters of the state. Rules of Panhandle Health District 1, IDAPA 41.01.01.200.01, requires any boat with wastewater facilities to have those facilities sealed to prevent discharge into any waters within District 1. There are also federal laws within the Clean Water Act that would apply to "no sewage discharge" lakes which DEQ has determined is the status of Coeur d'Alene Lake. With Idaho Legislative action, the State could take on enforcement of Clean Water Act laws regarding marine sewage disposal. Note: The Idaho Boat Inspection Report was last revised 7/95. Adding a line item for wastewater facilities was recommended by the Kootenai County Sheriff's department.

Table C8. Motorized Watercraft and Hazardous Materials

Comments and Rationale cont.

Action 2: Recommend that IDAPA 41.01.01.200.01.(d) be amended as follows:

If any watercraft located upon the waters of Panhandle Health District 1 is found to have ~~a marine toilet~~ wastewater facilities which ~~is~~ are not in compliance with the requirements of this section, the Health Officer or enforcement person shall have the following alternative or cumulative powers to:

i. cause the ~~marine toilet~~ wastewater facilities to be locked and sealed to prevent usage;
ii. require such watercraft to be removed from the waters of Panhandle Health District 1 until the ~~marine toilets~~ wastewater facilities are made to conform with the requirements of this Code.

The rationale behind changing the wording of marine toilets to wastewater facilities in the Health Code is that many large boats on Coeur d'Alene Lake would have facilities that generate both black water (sewage) from toilets and gray water from sinks and showers. Some boat manufactures do not make a holding tank for the gray water generated; this water becomes pumped overboard. By changing the code to wastewater facilities instead of marine toilets, both sewage and gray water discharges become prohibited. Idaho Code §67-7501 (Legislative Intent) cites "that is necessary to provide a uniform system for control and treatment of such marine sewage, gray water and other wastes; and that violators should be penalized."

Action 3: Rules of Panhandle Health District 1, IDAPA 41.01.01.200.02, require that marinas providing moorage for vessels with on-board wastewater facilities, also provide pumpout stations to adequately clean waste retention tanks on the largest boat that could reasonably use the moorage. All marinas must provide shore-based toilet facilities for their users.

Action 4: The committee that is developing the Cd'A Lake Clean Marina Program considers the program as an educational tool for use by marina operators, however, there are many existing State, Federal, Local, and Tribal laws addressing hazardous and deleterious materials storage and spills. Compliance and enforcement of these laws should be incorporated into this program. For example: a common winterization procedure for marine inboard engines is to store the engine block with two gallons of anti-freeze. In spring when such boats are first launched and started, the anti-freeze is ejected into the lake and replaced by fresh water. This could translate to substantial gallons of anti-freeze ejected into Coeur d'Alene Lake each year. In some boat launch areas, water is taken from the lake for household potable uses. The regional DEQ office in Coeur d'Alene is of the opinion that such disposal of anti-freeze violates Idaho Water Quality Standards, IDAPA 58.01.02.800 (Hazardous and Deleterious Material Storage).

The current Cd'A Lake Clean Marina Program is in draft form and does not sufficiently present a comprehensive public outreach approach. A public I & E program is needed that includes the following: effective methods of winterization of boats; pumping of holding tanks; fuel and oil transfers and spillage cleanup; proper boat cleansing procedures; safe boat operation; and ways to assure that these and other lake-oriented activities are conducted in an environmentally sound fashion. The program targets boat owners, marina and resort owners, and the general public.

Comments and Rationale cont.

Action 4: *cont.*

The Clean Marina Program also needs to address the problem of debris and litter around and in the lake. Available dumpsters around the basin are commonly filled beyond capacity. If dumpsters are to be used, there is a need for additional funding to maintain the refuse load and provide recycling receptacles. The LMP audit found Kootenai County prefers, and suggests to the public, a "Pack it in, Pack it out" policy. There are inherent problems with this policy such as transporting empty alcohol containers in vehicles.

Action 5: Currently there is not an established communication system among the jurisdictions on spill response protocol.

Action 6: This action item was added based on a comment to the 2008 draft LMP as well as findings from the LMP audit. During the audit, DEQ and the Tribe were informed that abandoned docks and large floating debris can be extremely hazardous to lake users. Currently, there is not a coordinated program in place that addresses this issue. One suggestion was that IDL incorporate into their dock permit, a requirement that there be proper disposal of old docks when replaced with new docks.

Issue Analysis:
Contaminant Management for Coeur d'Alene Lake and the Spokane River upstream of Post Falls Dam, July 2007

Since August 2006 in response to Basin Environmental Improvement Project Commission (BEIPC) direction, the Executive Director and Contaminant Management Project Focus Team (PFT) have been working on contaminant management issues for Coeur d'Alene Lake (Lake) and the Spokane River upstream of Post Falls Dam (River). This was based on direction from the BEIPC to evaluate and make recommendations for some sort of institutional control "like" program outside the basin Institutional Controls Program (ICP) Administrative Area that would address under what circumstances, and in what areas, the institutional controls may be needed and address the who, what, where, when, and why. There may be areas that are outside of the geographical boundaries of the proposed Basin ICP where it would be appropriate to have some sort of control program where there may be the potential to discover a hot spot, etc. There needs to be a mechanism to properly reveal those areas and it would be very site specific. The purpose is for the PFT to look at approaches to determine when, where, or how it may be appropriate and make a recommendation to the BEIPC.

The contaminants of concern under consideration are mining related contaminants identified in the Bunker Hill Mining and Metallurgical Complex Superfund Facility/Site Records of Decision (RODs), which are primarily lead, arsenic, cadmium and zinc. As is the situation in other areas within the Facility/Site, additional contaminants of concern may be encountered if the Lake and River bed or bank sediments are disturbed. Such contaminants have not been considered by the PFT and may be subject to the Resource Conservation and Recovery Act (RCRA) or other applicable regulations. The toxicity of other such contaminants may result in prescriptive handling and disposal requirements but are not readily known until such time as testing procedures would identify hazardous material characteristics or known listed wastes.

The PFT and Executive Director have gathered data and applicable agency regulations, interviewed regulatory agency officials, held meetings to discuss the issues and agency and stakeholder positions, and reported to the BEIPC on a number of occasions concerning the findings and issues.

Following are narratives of findings and issues gathered and developed from the activities of the PFT and Executive Director. Because of concerns including the scope and potential environmental and community effects of the findings and issues, the PFT was unable to develop consensus on all of the conclusions and specific recommendations that could be made to the BEIPC. The PFT did agree to request direction from the BEIPC as is stated in the final paragraph of the paper. Therefore, the conclusions and recommendations at the end of the paper are those of the Executive Director.

General Issues and Findings – In the past there has been strong opposition by some stakeholders to Superfund involvement on the Lake and River. There has been a misunderstanding by some stakeholders that the Lake and River were not included in the Superfund Facility/Site. As defined in the Record of Decision (ROD) for Operable Unit #3 (OU-3) the Bunker Hill Mining and Metallurgical Complex Superfund Facility, located in the Coeur d'Alene Basin includes mining-contaminated areas in the CDA River Corridor, adjacent floodplains, downstream waterbodies, tributaries, and fill areas, as well as the 21-square mile Bunker Hill Box. The 9th Circuit Court of Appeals decision confirmed the Superfund Facility includes all areas of the CDA Basin where mining contamination has come to be located. Therefore, the Lake and River are included in the Facility/Site.

Some local officials and stakeholders believe that there already exists adequate regulation of activities around the Lake and River flood plains and within the bodies of water to address contaminant management, and any new requirements, if necessary, should be in the form of implementation of voluntary best management practices. Others support the implementation of enforceable rules to ensure compliance.

There are a number of governmental jurisdictions involved with the Lake and River including various Federal, State, Tribal, and local government agencies. Each of these agency's authorities must be recognized and accommodated in any contaminant management program for the Lake and River.

There is a general understanding that a lake management plan (LMP) outside the Superfund process was anticipated by the Interim ROD for OU-3 as the means to deal with contaminated sediments in the Lake and River. However, dredging of Lake and River bed sediments has not been specifically identified in LMP development efforts.

The language in the BEIPC Memorandum of Agreement (MOA) does not completely indicate the level of involvement envisioned for the BEIPC in the lake management process, but past BEIPC and Technical Leadership Group (TLG) meeting notes as well as the State's draft of its update of the LMP in 2004 indicate a much stronger BEIPC involvement than is currently being envisioned. These documents indicate that the BEIPC would coordinate the implementation of the LMP through a steering committee made up of representatives from the TLG.

The original intent of the BEIPC direction concerning contaminant management was to develop a mechanism to locate and deal with sites along the flood plain of the Lake and River that were "hot spots" of contamination and that any contaminant management program would be very site specific. After working on this for a year, it is apparent that the need for contaminant management involving the Lake and River is much more complicated and far reaching than determining how to deal with a few "hot spots".

Most stakeholders involved with the Lake and River seem to recognize the great natural resource value the community has in these bodies of water, but many are polarized as to the current condition and potential for deterioration of these valuable resources. Some indicate strong support for protecting the resource, but become very upset if proposed regulatory requirements will result in additional costs or more control over their activities. Others indicate that they would rather use extreme caution and increased regulatory authority to insure that the resource is not allowed to deteriorate.

Within the PFT there seems to be agreement that there is a need for some type of contaminant management involving the Lake and River. Continued growth and development around and within the Lake and River and the effects or lack of effects from upstream environmental cleanup require adaptive management to adequately deal with the contaminant management issues.

There has been some misunderstanding as to the purpose of the ICP in the Box and Basin and what the purpose of institutional controls for the Lake and River might involve. Some believe that the ICPs serve only to protect constructed or installed Superfund remedies. The ICPs in the Box and Basin were established for the purpose of protecting human health from exposure to and migration of contaminants. If contaminant management in the Lake and River came in the form of some type of institutional controls, a decision would need to be made concerning whether they should include only human health issues or ecological issues as well.

Kootenai County representatives have indicated that if an institutional controls type program is instituted for the Lake and River areas, that the Federal and State agencies should fund testing and remediation of properties in the same manner as is done in the Upper and Lower CDA River Basin and any ICP type program would be funded similar to the basin ICP. Their position is that owners of developed residential and commercial properties would not be responsible for soil or sediment testing and remediation of contaminated properties, and the agencies would provide repositories for excavated or dredged soils and sediments containing mining related contamination. There would also be no fees for ICP type permits. If the Federal or State agencies would not fund the program, they do not want to pursue the issue any further.

Interim Record of Decision (ROD) Issues - The Interim ROD for OU-3 states that OU-3 is mining related contamination in the broader CDA Basin. This definition is somewhat confusing because the ROD also states that the Superfund Facility/Site is located in the CDA Basin.

EPA's position is that OU-3 includes those areas within the defined Bunker Hill Facility/Site but outside OU-1 and OU-2 (the Box) where EPA has selected remedial actions. Thus, while the Lake and River may be within the Facility/Site, they are not part of the OU-3 ROD until and unless EPA selects additional remedial actions for these areas as part of an OU-3 remedy decision.

This position is confusing to some because the Lake and River are addressed in the Interim ROD for OU-3. The question is then, are the Lake and River in OU-3? The Executive Director and others interpret the Interim ROD definition to mean that OU-3 does not include the Box or every square mile of the broader CDA Basin, just areas within the CDA Basin outside the Box where mining related contamination has come to be located. From this interpretation, it would appear then that OU-3 includes any areas of the Lake and the River where mining related contamination has come to be located.

Although the Interim ROD focuses largely on the CDA River corridor and floodplain portion of OU-3, under one interpretation, it would include the Lake, portions of the Spokane River corridor and areas adjacent to the Trail of the Coeur d'Alenes right-of-way (ROW) if contaminated with mining related material. Under the EPA position, it may not. The OU-3 Interim ROD states "The Selected Remedy does not include remedial actions for Coeur d'Alene Lake. State, tribal, federal, and local governments are currently in the process of implementing a lake management plan outside of the Superfund process using separate regulatory authorities." Essentially the Interim ROD deferred a decision on a remedy under CERCLA for the Lake and River pending an attempt to revise, adopt, implement, and demonstrate that a LMP is effective in managing mining related contaminants in the waters and bed sediments of the Lake and River.

The Selected Remedy for OU-3 specified by the Interim ROD includes proposed actions for environmental clean-up in the Upper and Lower Basin, as defined in Section 5 of the ROD, and protection of human health in the communities and residential areas, including identified recreational areas, of the basin upstream of the Lake in the CDA River corridor and protection of human health in areas of the Spokane River. The Interim ROD does not select remedies for the Lake and Spokane River in Idaho. The Interim ROD also addresses institutional controls for human health protection in the Upper and Lower CDA Basin. It states that institutional controls will be required to limit future exposures to contaminated soil that is left in place and groundwater not addressed by the Selected Remedy.

The basin ICP addresses the portion of the basin upstream of the Lake in the CDA River corridor and does not address the Lake and Spokane River. Also, there are no remedies noted in the Interim ROD for areas adjoining the Trail of the Coeur d'Alenes (Trail) ROW south of the mouth of the CDA River. The area along the railroad/Trail ROW was included in a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) removal action; not part of the overall Superfund remedial action in the basin. Contaminant management issues on the Trail of the Coeur d'Alenes and adjacent ROW are to be jointly managed and implemented by the State of Idaho (State) and the Coeur d'Alene Tribe (Tribe) under a formal and legally-binding agreement and in conformance with the Remedial Action Maintenance Plan (RAMP) which was drafted by the State and Tribe.

The Interim ROD states that repositories constructed pursuant to the ROD can only receive material generated by cleanup actions associated with the Selected Remedy including ICP and related CERCLA Removals and that the repositories must be designed and constructed appropriately to contain the waste materials placed there. Repository sites for the remedial actions and ICP generated wastes are currently limited to areas that are contaminated with mining related wastes. This policy has been implemented to ensure that repositories are located within the defined boundaries of the Superfund Facility/Site (areas where the mining related contaminated has come to be located).

Institutional controls are tied to human health protection in the Upper and Lower Basin by the Interim ROD for OU-3. To include ecological protection in an institutional controls type program for the Lake and River would probably require additional remedial investigation type work and an amendment to the Interim ROD or a new ROD.

Environmental Situation - Two major contaminant management concerns in the basin that have not yet been adequately addressed include: 1) managing sediments containing mining related contaminants that may be disturbed during construction and development activities involving excavation and/or dredging in and along the shore of the Lake and River; and 2) management of the contaminated sediments in place on the bottom of the Lake and River by controlling nutrient loadings and biological productivity (eutrophication) that could result in depletion of dissolved oxygen in lake bottom waters and produce geochemical conditions leading to release of metals contaminants in the sediments into the water column. It has been anticipated that the second concern would be addressed by implementation of a LMP as noted in the Interim ROD. The LMP process is currently being developed under a formal mediation process by the State of Idaho (and its political subdivisions), the Tribe, and EPA.

Other concerns include the potential for upland contamination from disposal of contaminated materials from the Lake and River, and the potential contamination of property adjoining the ROW of the Trail outside the areas noted for remediation in the ROD where contamination may migrate from the ROW.

The Lake and River are areas of natural deposition of sediments containing mining related contaminants and other materials moving downstream from the CDA River corridor and other tributary streams. This natural deposition process has resulted in these sediments being a major repository of mining related contaminants within the Superfund Facility/Site and in the absence of remedial/restoration activities they need to be maintained and managed as such.

An estimated 44 to 75 million metric tons of metals-enriched sediments cover approximately 85% of the bottom of the Lake and range in thickness from 17 to more than 119 cm. The metals-enriched sediments generally are extremely fine-grained and are thus susceptible to physical remobilization by river- and wind-induced lake currents. In addition, the metals contaminants are primarily associated with an operationally-defined iron oxide phase which makes them substantially more available in the environment than if they were associated with sulfide minerals as in the original ore bodies, especially under the reducing conditions associated with low or depleted dissolved oxygen concentrations potentially encountered in lake bottom waters under conditions of thermal stratification.

The recently released Scientific Investigations Report on the Hydrogeologic Framework and Water Budget of the Spokane Valley-Rathdrum Prairie Aquifer indicates that the River from the Lake to Flora Road in the Spokane Valley is the largest single contributor of inflow to the Aquifer. The Lake also is a contributor. Although there is concern that water quality in the Lake and the River could affect the quality of water in the Aquifer without proper contaminant management, a 2003 U.S. Geological Survey (USGS) report on surface water/groundwater interaction of the River and the Aquifer indicated that losses from the River to the Aquifer do not appear to have human health implications at this time. While concentrations of some trace elements in River water and bed sediments were elevated, concentrations in the River and in near-River ground water never exceeded EPA drinking water standards in samples taken for the study. The Executive Director contacted drinking water officials at the regional office of IDEQ and verified that there currently were no known drinking water quality violations for metals in near-River wells under their jurisdiction. No information was found concerning the potential for groundwater contamination due to an increase in available metals contamination in the Lake and River water due to contaminated soil excavation or sediment dredging or a situation where metals were released from Lake or River bottom sediments due to eutrophication.

Regulatory Situation - Current federal, state and local agency regulatory processes do not adequately address handling and disposal of contaminated sediments and excavated materials from dredging and other excavation operations involving the Lake and River. There does not seem to be sufficient regulatory control over these activities at this time. Some stakeholders are anticipating that the amended LMP will adequately address this situation.

The Idaho Department of Water Resources (IDWR) has a Stream Alteration Permit process but it is not applicable to these bodies of water because they are considered slack water and through agreement with the Idaho Department of Lands (IDL), the latter exercises authorities over the bed and banks of the Lake and River in Idaho. Currently, IDL and U.S. Army Corps of

Engineers (COE) regulate activities up to the 2,128 ft. high water elevation on the northern portion of the Lake and River. IDL is currently undergoing a negotiated rulemaking process that may have some impacts on dredging activities. The COE, under Section 404 of the Clean Water Act, regulates activities in navigable waters to protect navigation and discharges of dredged or fill material into the Lake and River. Normally the Lake and River would be subject to Section 10 of the Rivers and Harbors Act, but this body of water has been exempted as a result of a congressional act some time ago. The Tribe regulates activities on the southern portion of the Lake and portions of the St. Joe River within the Coeur d'Alene Tribal Reservation Boundary. The Tribe issues permits for all encroachments on the portion of the Lake it manages and does not allow dredging activities. These agencies do not regulate the disposal of dredged or excavated materials above the high water mark or in upland areas.

Excluding the southern portion of the Lake and lower reach of the St. Joe River within Reservation boundaries, currently there are no state or local dredging regulations that exist and the development of State dredging guidelines seems to be stalled. The IDEQ currently does not appear to have adequate funding or authority to regulate disposal of contaminated materials generated from excavation and dredging activities involving the Lake and River. There is also no designated or approved repository for these materials and neither the EPA nor IDEQ have indicated that they have the funding authority to address the need for a repository. It remains a local government and waste generator problem.

Kootenai County (coordinating with the IDL, COE and Tribe where appropriate) regulates site disturbance activities above the high water mark in Kootenai County through its site disturbance ordinance. This ordinance is intended to protect property, surface water, and ground water against significant adverse effects from excavation, filling, clearing, unstable earthworks, soil erosion, sedimentation, and stormwater runoff. This ordinance is currently under amendment and revision, and current information indicates that enforcement of it may be somewhat lacking due to a large workload and lack of adequate funding for enforcement of the program.

CDA Tribe officials indicated that they do not have a means to regulate upland site disturbances on lands surrounding the portion of the Lake they manage except on Tribal fee and trust land areas. EPA may regulate site disturbances in excess of one acre for the purpose of preventing non-point source pollution, but the majority of site disturbance on the uplands around the Lake and River do not meet that criteria. Benewah County is in the process of developing site disturbance regulations for areas affected by development near the Lake and St. Joe River.

The Panhandle Health District (PHD) regulates septic systems that can affect nutrient loadings to the Lake and River, but recent attempts to tighten regulation have been rebuffed by the lake shore owners and the State Legislature for a number of reasons. The Idaho Department of Health and Welfare will be reviewing local recommendations to amend the current sizing limits on subsurface sewage disposal systems in the 2008 Legislature.

Because the Interim ROD for OU-3 addresses institutional controls for the purpose of human health protection in the Upper and Lower Basin, (Harrison to the head waters of the South Fork CDA River) EPA has indicated that they do not have funding authority to aid in the implementation of an institutional controls type program for the Lake and River without amending the ROD. IDEQ is reluctant to become involved in funding a contaminant management program for the Lake and River because of tight funding appropriations and a concern that funding this activity would reduce funding for the human health protection remediation program in the community and residential areas of the Upper and Lower Basin.

Conclusions and Recommendations by the Executive Director:

Lake and River sediments are acting as repositories for mining related contaminants. There is also an increased level of excavation and dredging activities around and in the Lake and River that may not have been anticipated when the OU-3 Interim ROD was prepared. Proper handling and disposal of potentially contaminated material (from dredging or other excavation processes) should be provided for. This should at least include a process for testing material to determine if it is contaminated with metals at specific action levels and requiring or providing for proper disposal. There are a number of potential approaches to regulating these activities.

Mining waste contaminated sediments in the bed and banks of the Lake and River may need to be managed under enforceable rules and regulations of CERCLA, or State, Tribal and/or local governments under regulatory frameworks such as land use and site disturbance ordinances and permitting authorities, and/or a LMP.

It appears that the intent of the Interim ROD for OU-3 was to deal with contaminant management issues through the LMP process, but that this may not now adequately address contaminant management needs. While the potential need for managing mining related contaminants in the Lake and River within the LMP development and implementation process is a valid concept for further consideration, it is premature to do so at this time because of the current status of the LMP process. Although there may be a difference of opinion concerning whether the Lake and River are in OU-3, it is apparent that the Interim ROD for OU-3 would need to be amended or a new OU and corresponding ROD be prepared before CERCLA (Superfund) funding for a contaminant management program for the Lake and River could be made available.

EPA views local enactment and implementation of Institutional Control Programs or similar "like" programs as critical to program success. An entity (or entities) who has legal authorities that would allow them to implement and enforce institutional controls (or institutional control-like measures) needs to be identified before any program and rule can be developed in a meaningful way.

The Spokane Valley-Rathdrum Prairie Aquifer Study indicates that the Lake and River are major contributors to the aquifer that is a sole source of potable water for thousands of people, but current data is not adequate to determine what impact increased releases of metals from sediments in the Lake and River would have on aquifer groundwater quality. Proper management of these sediments to prevent increased releases of metals may reduce the potential for metals contamination of the aquifer and would ensure protection of the Selected Remedies downstream in the River by preventing the release of hazardous substances into surface waters from dredging or excavation activities or the release of metals from the contaminated sediments. This is an important issue for the downstream stakeholders.

Following are some specific approaches or issues that could be explored further and vetted by the PFT and TLG if further staff effort is to continue:

- The Lake and River should be managed to control the disturbance and migration of mine waste contamination as well as natural resources.
- As managers of uplands, Kootenai and Benewah Counties could work with the State and Tribe to develop the contaminant management controls for upland activities.
- Kootenai County's site disturbance ordinance could be used as a model for contaminant management controls for ground disturbance activities in upland areas (another model is the joint State/Tribe management plan for the Trail of the Coeur d'Alenes).
- Contaminant management controls for managing flood plain excavation and dredging activities should be developed and coordinated with the COE and IDL. Some of the provisions of the basin ICP rules should be considered as models for dealing with excavation and dredging activities.
- Contaminant management controls should include provisions for testing of material to be excavated within the flood plain of the Lake and River and any material to be dredged from the Lake and River.
- Contaminant management should provide for control of ground disturbance activities and septic systems on the uplands adjacent to the Lake and River to ensure that activities and septic system effluents do not increase the nutrient loadings to the Lake and River.
- A regional repository should be developed for disposal of contaminated material associated with mining activities removed from the Lake and River by excavation or dredging. This repository should be developed in a manner consistent with others developed within the Bunker Hill Superfund Facility/Site.
- An agreement may need to be negotiated concerning the enforcement of contaminant management controls in the various jurisdictional areas of the Lake and River and their flood plains and uplands.
- The BEIPC through the TLG and PFT can be the agent to assist all responsible governments in developing a contaminant management program for the Lake and River.

Although the PFT could not come to consensus on all of the conclusions and recommendations above, the PFT and Executive Director are requesting that the BEIPC review the discussion presented and provide direction. If the BEIPC desires that development of a contaminant management/institutional controls process for the Lake and River continue to be pursued at this time, then by working through the PFT, TLG and CCC processes, a plan could be drafted for further review and endorsement. This plan would also include recommendations of how the responsible agencies might administer the plan and how it would be funded and implemented.

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Appendix D – DEQ and Tribal List of Impaired Waterbodies

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Appendix D – DEQ and Tribal list of Impaired Waterbodies

A compilation of stream and lake segments on the DEQ and Tribe CWA §303(d) lists within the Coeur d'Alene Lake Basin is presented in Table D1. These are waterbodies where beneficial uses have been assessed as being impaired by one or more pollutants of concern: sediment, metals, nutrients, and/or bacteria (most of these impairments are metals and sediment). Many of the waterbody segments have EPA approved TMDLs, and in some cases there are current efforts underway to develop TMDL Implementation Plans. Streams where excess water temperature has been listed as a pollutant of concern have not been included unless there have been improvement projects on those segments. Table D1 also includes streams not on the §303(d) list that have been identified by land management agencies, governments or other stakeholders as needing or would benefit from water quality improvement projects.

Table D1 includes improvement projects, and their approximate costs, that have been conducted on stream segments from 1996 – 2007. **This list of projects is known to be incomplete.** DEQ and the Tribe have not captured all of the projects conducted by the various land management agencies, and private businesses, over this period of time. The far right column includes a partial list of projects and estimated costs from 2008 and beyond. The Tribe and DEQ will have future discussions with the appropriate land management agencies to more comprehensively identify, plan, and estimate costs for future projects.

Again, the listed information in Table D1 is incomplete and should be viewed as a work in progress in accordance with the adaptive management approach. However incomplete, the Tribe and DEQ believe the list of improvement projects conducted from 1996 – 2007 illustrates the magnitude and cost of "on-the-ground" work required in the future. The approach to implementing future projects based on the goals of both TMDL implementation and the LMP would be to prioritize on a yearly basis those projects that make the most sense (environmentally and fiscally), and that offer the greatest potential for reducing pollutant inputs to the lake. Prioritization will be done within the TMDL implementation process, and with the results of the nutrient loading inventory discussed in Section 3.3. Other factors will also be used, such as available funding, favorable cost/benefit analyses, opportunities for project partnering and the ability to leverage other funds, etc. As projects are completed they will be removed from the list. Likewise, as other projects are needed they will be added to the list.

Table D1. DEQ and Tribal list of CWA §303(d) impaired waterbodies within the Coeur d'Alene Lake Basin; TMDL pollutants of concern[a]; identified Completed Projects with Project Costs by land management agencies from 1996 – 2007; and proposed future Estimated Project Costs.

Stream name	Listed pollutants[b]/ EPA approved TMDL	Completed Projects from 1996 - 2007	Project Costs	Estimated Project Costs
HUC[c] 17010301 - Upper Coeur d'Alene (North Fork Coeur d'Alene River) Subbasin				
Cub Creek	S/yes			
Calamity Creek	S/yes			
Tepee Creek - headwaters to Big Elk	S/yes			
Big Elk Creek	S/yes			
Tepee Creek - Big Elk to mouth	non-303(d)	Road Removal, in-channel and habitat improvements	3,000,000	
North Fork mainstem - Tepee Creek to Yellowdog	S/yes	Road removals, stream improvements	315,000	
lower Independence Creek	non-303(d)	Floodplain decompaction & revegetation	30,000	
Yellow Dog Creek	S/yes	Road removal, habitat improvements	500,000	
Downey Creek	non-303(d)			
Shoshone Creek	S/yes	Road & stream improvements	235,000	
Falls Creek	S/yes	Road & stream improvements	63,000	
Lost Creek	S/yes			
North Fork mainstem - Yellowdog to mouth	S/yes	USFS bank stabiliz. & habitat improve.	315,000	
East Fork Eagle Creek	S,M/yes	Stream improvements	133,000	
East Fork Eagle Creek	S,M/yes	Mining related cleanup		
Prichard Creek	S,M/yes for S, pending for M	Mining related cleanup		
Butte Gulch (trib to Prichard)	S,M/yes for S, pending for M			
Cougar Gulch (trib to Prichard)	S/yes			
Beaver Creek	S,M/yes for S, pending for M			
Steamboat Creek	S/yes	Road removal & stream improvements	2,040,000	
upper Little North Fork Cd'A River	S/yes	Stream and road realignments	900,000	

Table D1 cont.

Stream name	Listed pollutants[b]/ EPA approved TMDL	Completed Projects from 1996 - 2007	Project Costs	Estimated Project Costs
Iron creek	non-303(d)	Stream and road realignments	600,000	
Burnt Cabin Creek	S/yes	Stream rehabilitation	250,000	
Skookum Creek	non-303(d)	Stream and road realignments	200,000	
Copper Creek	S/yes	Fish passage	8,4000	
HUC 17010302 - South Fork Coeur d'Alene River Subbasin				
Canyon Creek	S,M/yes for S, pending for M			
Ninemile Creek	S,M/yes for S, pending for M			
East Fork Ninemile Creek	S,M/yes for S, pending for M			
Lake Creek	M/pending			
SFK Cd'A River - headwaters to mouth	S,M/yes for S, pending for M			
SFK Cd'A River - 1st & 2nd order tributaries	M/pending	Road removals	30,000	
Government Gulch	S,M/yes for S, pending for M			
Moon Creek	S,M/pending			
Pine Creek	S,M/yes for S, pending for M			
East Fork Pine Creek	S,M/yes for S, pending for M			
HUC 17010303 - Coeur d'Alene Lake & River Subbasin				
Cd'A River - SFK - NFK confluence to mouth	S,M/pending	Streambank stabilization		
Latour Creek and Baldy Creek	S/yes	TMDL Implementation	35,000	
Fourth of July Creek	S/yes			
Evans Creek (Tribal Reservation)	non-303(d)	Land restoration and channel improvements		4,000,000
Willow Creek (Tribal Reservation)	S/pending	Land restoration, stream rehab., stabiliz.		1,000,000
Black Creek (Tribal Reservation)	non-303(d)	Nutrient reduction		1,500,000
Black Lake (State & Tribe jurisdictions)	N/pending			1,500,000

Table D1 cont.

Stream name	Listed pollutants[b]/ EPA approved TMDL	Completed Projects from 1996 - 2007	Project Costs	Estimated Project Costs
Thompson Lake tributaries	S/pending			
Wolflodge Creek	S/yes	TMDL Implementation	131,000	
Marie & Cedar Creeks (tributaries to Wolf Lodge)	S/yes			
upper Fernan Creek	S/pending			
Cd'A Lake north of Hidden Lake	M/pending			
Beauty Creek	T/pending	Road Removal	37,500	
Cougar Creek	S/yes	TMDL Implementation	189,000	
Kidd Creek	S/yes	TMDL Implementation for Mica & Kidd	170,000	
Mica Creek	S,B/yes	upper North Fork road improvements	70,000	
Mica Creek	S,B/yes	Cattle exclusion and farm land improve.		
Mica Creek	S,B/yes	Streambank and stream rehabilitation	140,000	
Fighting Creek (Tribal Reservation)	S,N/pending	Land restoration, stream rehab., stabiliz.		400,000
Bellgrove Creek	B/pending			
Lake Creek (Tribal Reservation)	S/yes	Erosion control and enhancements	500,000	500,000
Lake Creek (Tribal Reservation)	S/yes	Land restoration and stream restoration	500,000	16,000,000
Lake Creek (Tribal Reservation)	S/yes	Sediment pond construction	1,000,000	1,000,000
Plummer Creek	non-303(d)	Land restoration		600,000
HUC 17010304 - St. Maries River Subbasin				
St. Maries River - headwaters to mouth	S/yes			
West Fork St. Maries River, Wood Creek, Hidden Creek	S/yes	Watershed rehabilitation	245,000	
Middle Fork St. Maries River	S/yes			
Gold Center Creek	U/pending			
Emerald Creek	S/yes	Rehab. of recreational garnet dig	80,000	

Table D1 cont.

Stream name	Listed pollutants[b]/ EPA approved TMDL	Completed Projects from 1996 - 2007	Project Costs	Estimated Project Costs
Carpenter Creek	S/yes			
Tyson Creek	S/yes			
Crystal Creek	S/yes			
Renfro Creek	S/yes			
Charlie Creek	S/yes			
Santa Creek	S/yes	§319 agricul. grant - stream rehabilitation	90,000	
John Creek	S/yes			
Thorn Creek	S/yes			
lower Alder Creek	S/yes			
Alder Creek (Tribe Reservation)	S/yes	Land restoration and stream restoration	500,000	2,000,000
Alder Creek, Benewah Creek, Lake Creek, Evans Creek (Tribe Reservation)	S for Alder & Benewah	Planting, stabilization, road improvements		700,000
HUC 17010304 - St. Joe River Subbasin				
Quartz Creek/Gold Creek	T/yes	Road decommissioning	400,000	
Eagle Creek	non-303(d)	Road and stream rehabilitation	80,000	
Loop Creek	T/yes	Stream rehabilitation	300,000	
Fishhook Creek	S/yes			
Bear Creek/ Little Bear Creek	S/yes			
Mica Creek	S/yes	Experimental Forest		
Big Creek	U/pending	Head cut stabilization	100,000	
Benewah Creek (Tribal Reservation)	S,DO/pending	Land restoration and stream restoration	7,500,000	10,000,000
Benewah Creek (Tribal Reservation)	S,DO/pending	Watershed improvements		2,000,000

a = With a few exceptions, streams with water temperature as a cause for impairment are not included in this table.

b = §303(d) listed pollutants of concern
S = sediment
M = metals
N = nutrients
B = bacteria
U = unknown
T = water temperature

c = HUC – USGS Hydrologic Unit Code

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Appendix E - Table of Authorities

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Table E1. Jurisdictions and authorities for activities that could impact surface or groundwater water quality within the Coeur d'Alene Lake Basin

Programs and Activities	Responsible Agency	Authority, Permit or Approval Process
Water Quality Standards (WQS)		
Administer Federal Clean Water Act (CWA).	U.S. Environmental Protection Agency (EPA)	33 USC §1251 *et. seq.*
Requires that States adopt WQS with EPA review every three years. EPA approved the Cd'A Tribe as eligible for "treatment in the same manner as a state" (TAS). Grants Tribal authority to establish WQS and CWA Section 401 WQS certifications within waters of Tribal jurisdiction.		CWA Section 303
Adopt and implement Idaho WQS.	Idaho Dept. of Environmental Quality (DEQ)	IDAPA[a] 58.01.02
Adopt and implement Coeur d'Alene Tribe WQS.	Coeur d'Alene Tribe (Cd'A Tribe)	Cd'A Tribal Code Ch. 42
Adopt and implement Washington WQS.	Washington Department of Ecology (DOE)	WAC 173-201A
Water Quality Limited Waterbodies & Total Maximum Daily Loads (TMDLs)		
Approve State CWA §303(d) list of impaired waterbodies. Approve State TMDL documents.	EPA	CWA Section 303(d)
Promulgate Tribal CWA §303(d) list of impaired waterbodies. Initiate TMDL with Tribe, and final approval of TMDL documents.	EPA	CWA Section 303(d)
Identify water quality limited waterbodies and develop/publish a CWA §303(d) list outside of Tribal Reservation boundaries.	DEQ	IDAPA 58.01.02
Identify water quality limited water bodies and develop/publish a Tribal list of impaired waterbodies within recognized Reservation boundaries. This list is forwarded to EPA for promulgation of a §303(d) list.	Cd'A Tribe	Cd'A Tribal Code 42

Table E1 cont.

Programs and Activities	Responsible Agency	Authority, Permit or Approval Process
TMDLs cont.		
Develop Subbasin Assessments and TMDL pollutant load allocations outside of Tribal Reservation boundaries. Develop TMDL Implementation Plans.	DEQ and an appointed Watershed Advisory Group. TMDL developed with partnership from Designated State Management Agencies: Idaho Soil Conservation Commission (ISCC) - Agriculture and grazing Idaho Dept. of Lands (IDL) - Timber harvest and mining Idaho Transportation Dept. (ITD) - Public roads	Idaho Code 39-3601 *et. Seq*
Develop TMDLs and TMDL Implementation Plans within Tribal Reservation.	EPA and Cd'A Tribe	CWA Section 303(d) Cd'A Tribal Code Ch. 42
Wastewater Treatment		
National Pollutant Discharge Elimination System (NPDES) permits for point source discharges from Municipal Wastewater Treatment Plants into waters of the U.S.	EPA	CWA NPDES Permit Program – EPA Permits
	Certification of EPA permit. DEQ and Tribe in respective jurisdictional waters	CWA Section 401
Operation of Municipal Wastewater Treatment Plants.	Sewer Districts and Cities within the Coeur d'Alene Lake Basin	Applicable Sewer District and Municipal codes and authorities
Individual/subsurface sewage disposal systems.	DEQ rules as administered by Panhandle Health District 1 (PHD1)	IDAPA 58.01.03 PHD1 Permit
Community drainfields (<2,500 gpd).	DEQ rules as administered by PHD1	IDAPA 58.01.03 PHD1 Permit
Large Soil Adsorption System (>2,500 gpd).	DEQ rules as administered by PHD1	IDAPA 58.01.03 PHD Permit with DEQ engineering review

Table E1 cont.

Programs and Activities	Responsible Agency	Authority, Permit or Approval Process
Wastewater Treatment cont.		
Sewage Lagoons, and Land Application Facilities including Reuse of wastewater.	DEQ for State jurisdictions	IDAPA 58.01.11 IDAPA 58.01.16 IDAPA 58.01.17 DEQ Permit
	Cd'A Tribe for Tribal jurisdictions	Tribal assessment and consultation with EPA
Stormwater Discharges and Construction Site Erosion Control		
Stormwater discharge into waters of the U.S. from construction sites disturbing 1 or more acres, and smaller sites that are part of a larger plan of development.	EPA	CWA NPDES Stormwater Permit Program – EPA Construction General Permit (CGP)
	Certification of EPA permit. DEQ and Tribe in respective jurisdictional waters	CWA Section 401
Stormwater discharge from a municipal separate storm sewer system leading to surface waters of the U.S.	EPA	CWA NPDES - Municipal Separate Storm Sewer System (MS4) Permit
	Certification of EPA permit. DEQ and Tribe in respective jurisdictional waters	CWA Section 401
Local municipal Stormwater Utility to fulfill portions of a MS4 NPDES permit.	City of Coeur d'Alene	City Ordinance No. 3177
Stormwater discharge from Industrial Activities (including mining) leading to surface waters of the U.S.	EPA	CWA NPDES – Multi-Sector General and Individual Permits for Stormwater Discharges Associated with Industrial Activities
	Certification of EPA permit. DEQ and Tribe in respective jurisdictional waters	CWA Section 401
Stormwater discharges to shallow injection wells.	Idaho Dept. of Water Resources (IDWR) rules as administered by PHD1	IDAPA 37.03.03 PHD1 Permit

Table E1 cont.

Programs and Activities	Responsible Agency	Authority, Permit or Approval Process
Stormwater and Erosion Control cont.		
All new development and redevelopment on sites not meeting criteria under the Federal CGP, including private roads and driveways.	Local Planning, Building and Zoning divisions within Cities and Counties of the Coeur d'Alene Lake Basin.	Permits and requirements under Local Ordinances: Stormwater Site Disturbance Flood Plain Hillside Overlay Subdivisions
Stormwater discharges and erosion control for public constructed and maintained roads.	ITD Local Highway Districts County Road Departments	Pertinent State, Highway District and Road Dept. Rules and Regulations.
Water-Related Activities		
Discharge of fill material into waters of the U.S. and wetlands.	U.S. Army Corps of Engineers (ACOE)	CWA Section 404
Dredge, excavation, and fill within navigable lakes and rivers (below ordinary high water mark, OHW) of State jurisdiction.	IDL	IDAPA 20.03.04
Encroachments on navigable waters (below OHW) of State jurisdiction; e.g., docks and piers, boat houses, shoreline alteration, river bank stabilization – may involve dredge and fill operations.	IDL	IDAPA 20.03.04
Alterations to flow, beds, and banks (below OHW) of perennial streams of State jurisdiction.	IDWR	IDAPA 37.03.07. Use "Idaho Joint Application for Permits" for all activities
	Certification of ACOE permit. DEQ and Tribe in respective jurisdictional waters	CWA Section 401
Dredge, excavation, fill, and stream channel alterations within Tribe jurisdiction.	Cd'A Tribe Law and Order Code	Cd'A Tribe Ch. 44 – 14.01 & 44-20.01 Encroachment Standards Sec. 7.10
Encroachments on navigable waters of Tribe jurisdiction.	Cd'A Tribe Law and Order Code	Cd'A Tribe Ch. 44 – 8.01 Encroachment Standards Sec. 5.03

Table E1 cont.

Programs and Activities	Responsible Agency	Authority, Permit or Approval Process
Water-related Activities cont.		
Suction dredge operations within waters of the U.S.	EPA	CWA NPDES – Suction Dredge General and Individual Permits.
	Certification of EPA permit. DEQ and Tribe in respective jurisdictional waters	CWA Section 401
Suction dredge operations within Tribe jurisdiction.	Cd'A Tribe Law and Order Code	Cd'A Tribe Ch. 44 – 20.01 Encroachment Standards Sec. 7.10
Discharge of wastewater from boats and houseboats into waters within PHD1.	PHD1 Kootenai and Benewah County Sheriff Depts.	IDAPA 41.01.01 and Idaho Code §67-7503 (Idaho Marine Sewage Disposal Act)
Discharge of wastewater from boats and houseboats into Tribal jurisdictional waters.	Cd'A Tribe Law and Order	Cd'A Tribal Code Ch. 43
Wastes and wastewater from float homes in State jurisdictional waters.	IDL	IDAPA 20.03.04
Wastes and wastewater from float homes in Tribal jurisdictional waters.	Cd'A Tribe Law and Order	Cd'A Tribal Code Ch. 44-7.14 & 16.01
Sewage waste disposal facilities at public and private marinas – boat pump-out stations and shore-based toilet facilities.	PHD1	IDAPA 41.01.01
	Kootenai County Parks and Waterways Department	County Ordinance No. 279D
	Benewah County	County Ordinances
	City of St. Maries	City Ordinances
	Cd'A Tribe Law and Order	Cd'A Tribal Code Ch. 44-14.01 &44-20.01 Encroachment Standards Sec. 7.05

Table E1 cont.

Programs and Activities	Responsible Agency	Authority, Permit or Approval Process
Water-related Activities cont.		
Watercraft operation relating to boat speed, no-wake zones, and riverbank erosion.	Kootenai County Parks and Waterways Dept. and Sheriffs Dept.	County Ordinance No. 279D
	Benewah County Sheriffs Dept.	County Ordinances
	Cd'A Tribe Law and Order	Cd'A Tribal Code Ch. 43
Control of nuisance aquatic organisms (e.g., Eurasian watermilfoil).	U.S. Department of Agriculture (USDA)	Plant Protection Act 7 USC §7701
	Idaho Dept. of Agriculture Idaho Invasive Species Council	IDAPA 02.03.03 IDAPA 02.06.22
	Kootenai and Benewah County Noxious Weed Departments	Local weed control authority Idaho Code 22-2405 & 2406
	Cd'A Tribe	Integrated Pest Management Title 40 CFR parts 156 and 171 EPA
Coeur d'Alene Lake water level and outflow rate of the Spokane River as maintained by the Spokane River Hydroelectric Project. Currently under relicensing process.	Federal Energy Regulatory Commission	FERC Relicensing 18 CFR Part 4, Subpart F, Sec. 4.51.
	DEQ Cd'A Tribe	WQ 401 certification Tribal Code 44 (encroachment permit)
	WA-DOE, WDFW, IDFG, Tribe, & DEQ	MOA with AVISTA for outflow rate
	AVISTA Corporation	Project operations
Land Use Activities		
Idaho State identification and implementation of nonpoint source Best Management Practices.	State agencies	1999 Idaho Nonpoint Source Management Plan
Forest Practices (including timber roads) on state land and private land.	IDL	IDAPA 20.02.01 Notification of Forest Practice

Table E1 cont.

Programs and Activities	Responsible Agency	Authority, Permit or Approval Process
Land Use Activities cont.		
Forest Practices and road systems on federal land.	U.S. Forest Service U.S. Bureau of Land Management	Various Federal Forest Acts National Environmental Policy Act (NEPA)
Forest Management within Tribal trust and fee lands.	Cd'A Tribe	Cd'A Tribal Forest Management Plan
Nonpoint source controls for agricultural and grazing lands.	ISCC – lead and Idaho Association of Soil Conservation Districts (IASCD), Soil & Water Conservation Districts (SWCD), DEQ	Agricultural Pollution Abatement Plan-2003 IDAPA 58.01.14 IDAPA 02.05.03 (Water Quality Program for Agriculture)
	Technical assistance and USDA farm bill cost-share programs provided by: National Resources Conservation Service (NRCS) Farm Service Agency (FSA)	
	Cd'A Tribe for Tribal trust and fee lands	Cd'A Tribal NPS Management Plan Aug. 2006
Mining – exploration and surface mining, and closure of cyanidation facilities.	IDL	IDAPA 20.03.02a Approval of Surface Mining Reclamation Plan
Mining – dredge and placer mining.	IDL	IDAPA 20.03.01 IDL Permit
Environmental cleanup within the designated administrative areas (Operational Units) of the Bunker Hill Mining and Metallurgical Superfund site (OU1, OU2, and OU3).	Federal agencies State agencies Coeur d'Alene Basin Environmental Improvement Project Commission (BEIPC)	Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. BEIPC Authority established by Idaho Code 39-8101 *et. Seq*
Construction and excavation activities for contaminant management within the designated Institutional Control Program areas of the Bunker Hill Superfund Site.	ICP program administered by PHD1 from their Kellogg office.	IDAPA 41.01.01 PHD1 - ICP Permit, license, and other requirements

Table E1 cont.

Programs and Activities	Responsible Agency	Authority, Permit or Approval Process
Land Use Activities cont.		
Land activities involving cultural resources.	Coeur d'Alene Tribe	Cd’A Tribal Code Ch. 52

a = IDAPA: Idaho Administrative Code; legally promulgated administrative rules, pursuant to Idaho Code, that are currently in effect and fully enforceable.