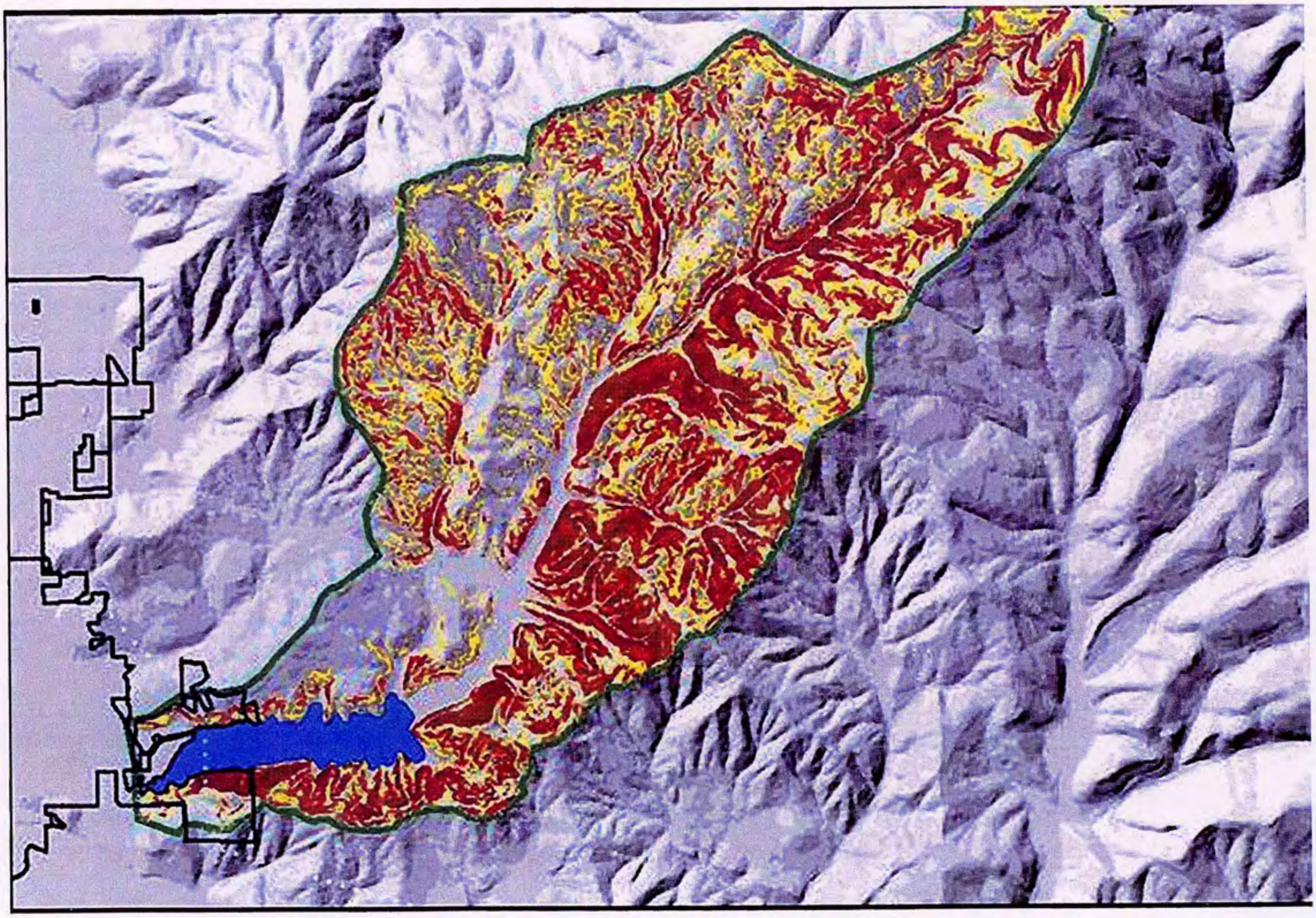
DRAFT FERNAN LAKE WATERSHED MANAGEMENT PLAN

Prepared by
Fernan Lake Watershed Technical Advisory Committee

Mission
To preserve the scenic and natural resource values of the Fernan Lake watershed, enhance its beneficial uses, both public and private, utilizing sound conservation practices.



Fernan Lake Watershed Technical Advisory Committee

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Funding by the City of Fernan Lake Village

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EXECUTIVE SUMMARY

The 18.76 square miles of the Fernan Lake Watershed is located in Kootenai County, Idaho. The Watershed area is approximately 12,038 acres in size. Approximately 251 acres of the Coeur d'Alene City limits lie within the watershed, and approximately 52 acres of Fernan Lake Village corporate limits lie within the watershed. Kootenai County's jurisdiction of the watershed is 11,735 acres, and 7,365 acres are in the USFS National Forest Land. The remaining 4,370 acres are private. Much of the watershed is forested, with steep slopes and shallow, erodible soils. Most of the land is used for timber production, with large-lot residential development and some grazing for livestock management. The lakeshore has the potential for urbanization with its close proximity to Cities of Coeur d'Alene and Fernan Lake Village. Homes within the jurisdiction of Kootenai County are on septic systems and drainfields, while areas within Fernan Lake Village and the City of Coeur d'Alene are on municipal sewer systems. (Figure 1 Watershed)

Fernan Lake itself has a surface area of 381 acres (without the wetlands area), and a maximum depth of 28 feet. Designated beneficial uses are: cold water aquatic life, primary contact recreation, salmonid spawning and domestic water supply (IDAPA 58.01.02.110.10). A small percentage of the residences on the lake shore use the lake for drinking water and the lake are a direct source of recharge to the EPA designated sole source Rathdrum Aquifer. This aquifer is the primary source of drinking water for over 400,000 residents of northern Kootenai County and Spokane County.

In the past several years area residents have become concerned about a perceived decline in lake water quality. Phosphorus was identified as the primary nutrient limiting algae growth. Sediment has also been identified as a contributing factor because it contains phosphorus, decreases the clarity of the water and causes lake shallowing. Phosphorus sources that have been identified include erosion from substandard roads and construction sites, erosion from timber harvest, runoff from residential areas, and substandard septic systems. If the lake is allowed to become more eutrophic (or nutrient rich), it will develop objectionable tastes and odors caused from blue-green algae blooms and other associated algae problems.

Because the lake is a direct source of recharge to the Rathdrum Aquifer, maintaining good lake quality is also important to maintaining good aquifer water quality. This Plan was developed to provide long-term protection of both of these valuable water resources. Water quality goals and management recommendations are presented in this document. A Technical Advisory Group was formed. The Technical Advisory Group included public agency representatives and citizens within the watershed. This group considered available water quality data, consulted with land management and water quality experts, and evaluated and selected appropriate management strategies.

There are several sections within this plan. The methodology of the document outlines how the data for this Plan was collected. As the data was being collected, the Technical Advisory Group comprised of public agency representatives and citizens within the watershed outlined the primary issues and concerns for the watershed. Once the information was collected, the Technical Advisory Group analyzed the information and then outlined the goals and action strategies necessary to implement the mission of the Plan.

A chronology of events completed by the Fernan Watershed Conservation and Recreation Association is included in the Plan. This chronology outlined studies that have been done and actions that have been taken to address water quality concerns in the watershed. Following the chronology is a section on general information, which summarizes the compilation of data collected about the watershed. The information includes, but is not limited to, land use, weather, soils, wetlands, water quality and geological and geotechnical information. Also in this section, several of the consultants that were hired to collect and analyze the data summarize their conclusions of their findings.

The Plan concludes with a general summary of the document and an explanation of how to implement the strategies that have been recommended by the Technical Advisory Group.

The Appendices of the Plan include definitions, a technical report by David Evans Associates related to the wetlands adjacent to the Fernan Lake Road, water quality history by Glen Rothrock from the Department of Environmental Quality and the geotechnical report by Strata, Inc., which delineates the hazard mapping that was completed within the watershed. The final Appendix consists of the citations used within the Watershed Plan.

This Plan presents a comprehensive, proactive approach to improving and then maintaining the water quality of Fernan Lake without unnecessarily restricting development within the watershed. Implementation of the Plan will occur primarily through the Fernan Watershed Conservation and Recreation Association, with involvement from public agencies. The Association's focus will be education, monitoring and providing public agencies the support to implement and enforce regulations to protect and improve water quality. This is a policy/planning document, designed to provide guidance to the many citizens and organizations whose activities affect, or are affected by, the lake. Finally, this Plan is intended to be a living document and will be reviewed and updated as new information becomes available.

Executive Conclusion

1. Monitoring of the Fernan Lake Watershed has been sporadic until 2003. Regular monitoring and inventories in 2003 have established a base line of data that can be used to evaluate trends for the watershed.
2. Past scientific data indicates that Fernan Lake is a moderate algae productivity lake (category B of Table 2). Lake studies in 2003 show that Feman Lake can exhibit high algae productivity characteristics (Category D of Table 2), and with its warm shallow depth, the lake is at risk for accelerated degradation with increased phosphates.
3. Scientific evidence indicates that phosphorus is carried to surface water by disturbed sediment.
4. Sediment is usually disturbed by man-made activities.
5. Scientific evidence indicates that there is a correlation between steep slopes, man-made activity and increased sediment loading into surface water.
6. New construction, including road building adjacent to the lake, is a primary cause of sediment loading into the lake.
7. Changes during 2003 in the Secchi depth and chlorophyll a readings are a serious concern and indicate accelerated algae production.

8. Control of phosphorus inputs is critical to managing the water quality of Fernan Lake.
9. Strict regulations on grading, erosion control and stormwater management are critical in preventing sediment loading into the lake.
10. Scientific studies indicate that the Fernan Watershed hillsides are much steeper than previously reported. The geology and the soils that surround Fernan Lake indicate that steep hillsides are prone to landslides and slumping.
11. The GIS Analysis of the watershed indicates that each parcel within the watershed has buildable areas that are less than a 35% slope.
12. The GIS Analysis of the watershed indicates that many properties adjacent to the lake have slopes in excess of 35%. There are also slopes on all of the properties within the Planning Area that are less than 35% slope.
13. Road building, infrastructure or structures should be prohibited on slopes over 35%, where the soil types and geology indicate a hazard.
14. Ranching and livestock grazing has declined in the watershed.
15. There are many underground springs on the hillsides around Fernan Lake and further inventory of the springs should be completed.
16. Septic tanks and drainfields are not the primary cause of phosphate loading into the lakes and streams. Current regulations require setbacks from surface water ranging from 100 to 300 feet, depending upon soil types.
17. The eastern shallows of Fernan Lake have characteristics making this area quite susceptible to the establishment of the invasive Eurasian watermilfoil.

In summary, Fernan Lake has had significant water quality changes in recent years. The lake system indicates a propensity for extensive algae blooms. Man-made activity on steep slopes with geology and soil types that are susceptible to landslides and slumping adjacent to the lake will increase the sediment loading into the lake. Phosphorus is incorporated into the sediment loading, either sorbed onto clay and silt particles or part of the organic component of sediment. Increased phosphorus will increase the rate of eutrophication of the lake. Development activities will accelerate the death of the lake. Steps to limit man-made development around Lake Fernan must be taken to slow down the rate of eutrophication and improve water quality.

INTRODUCTION

This Plan was developed to a) determine the current environmental status of the lake, b) identify activities which are affecting lake water quality, c) identify and evaluate strategies which might minimize these impacts, and d) present recommendations in the form of an Action Plan, which will afford long term protection of Fernan Lake.

Fernan Lake Village prepared this Management Plan and was assisted by a broad-based, citizen/ agency planning committee. Fernan Lake provides recharge to the Rathdrum Aquifer, and the entire watershed has been designated a Zone III Wellhead Protection Area in the Idaho Wellhead Protection Plan. According to this Plan, Zone III Wellhead Protection Areas should be managed to prevent microbial and chemical contamination of drinking water wells. This Plan applies to the City of Fernan Lake Village, the Fernan Lake Watershed (as defined by Idaho Department of Environmental Quality, known as DEQ), and to those areas that lie along the west lakeshore (Figure 1 Fernan Watershed).

The City of Fernan Lake Village hired land use professionals, geological and water quality experts in the preparation of this document. In addition, the Technical Advisory Group reviewed, summarized and evaluated existing information on Fernan Lake and the watershed. Several members of the Technical Advisory Group had participated or written other watershed plans and provided additional input. Most of the information is new data because there is very little information about the Fernan Lake Watershed. This new data was collected by consultants hired by the City of Fernan Lake Village.

Many different sources were used in developing the Plan. One of the sources was the Panhandle Health District (PHD) Lake Watershed Management Handbook (Panhandle Health District, 1994). Another source was information provided by David Evans Associates, a consulting group retained by the U.S. Highway Administration for the Fernan Lake Road Project. Fernan Lake Village also acquired geotechnical data, geographic information system data and maps of soil and slope data. Soil/slope and erosion risk data were derived from Strata Geotechnical Engineering, Inc. and their study has been incorporated into this plan. The Technical Advisory Group concluded that the information presented in this document is adequate for establishing a baseline for water quality and identifying manageable sources of sediment and nutrients.

This Plan presents a comprehensive, proactive approach to improving and maintaining the water quality of Fernan Lake, without unnecessarily restricting development. The Plan is a policy document, composed of recommendations made by a diverse, well-informed group of citizens and public agency representatives. This Plan will be implemented by the Fernan Watershed Conservation and Recreation Association with some involvement from public agencies. The Association will utilize the action strategies of the Plan to educate the public, monitor the watershed, and support public agencies in implementation and enforcement of regulations that will protect and enhance the water quality of the lake.

The Plan is intended to be a "living document", which will be periodically reviewed and updated by the Association as new information becomes available. This Plan is not a regulation. Any regulatory changes proposed as a result of this Plan must go through established public notification, hearing and adoption processes. This Plan advocates implementation of a management strategy immediately while water quality still has a chance to recover. As other communities have learned, lakes and aquifers are resources that are difficult, if not impossible to restore once water quality becomes unacceptable.

METHODOLOGY

This chapter briefly explains the methods used to gather and analyze watershed data, to involve the public and to select management options for implementation.

Fernan Lake Village contracted with Rick Lovel, GIS Analyst, to utilize the scientific data gathered to create layers of information and perform a comprehensive spatial analysis. The layers of data came from several sources, primarily Kootenai County GIS, with some from the City of Coeur d'Alene and the Idaho Geological Survey. Each GIS layer has an attached "metadata file" attesting to its spatial accuracy, projection information, and lineage. The data has been compiled either by digitizing from ultra-high resolution Avista aerial imagery, by survey grade GPS equipment, or by other photogrammetric extraction methodology. The surface data comes from the United States Geological Survey and is the standard used for slope analysis by the USFS, the DOE, and the DEQ.

A Windshield Land Use Survey of the watershed was done. Researchers drove in cars throughout the road network of the watershed to determine types and numbers of structures, ranches, timberland, and recreational sites. Research was collected on septic systems in the area. All of the residences within the watershed that are outside of the corporate limits of the cities of Fernan Lake Village and Coeur d'Alene are most likely on septic systems. Septic systems and their locations were identified using the County GIS system. Residences were mapped and it was assumed that each one has an on-site sewage disposal system.

A hydrologist completed water sampling and bathometric measurements. This information is provided in the Plan. Sampling was done approximately every other week and the lab results are identified.

A Geotechnical Hazard Mapping Study was completed for the watershed and that report is incorporated into this report. Volunteers with expertise in those fields researched geology of the area and soils.

The Audubon Society volunteers and committee members including two biologists identified wildlife in the watershed, including threatened and endangered species.

A Technical Advisory Group formulated the majority of this Plan. Public agency and citizen groups which chose to participate selected their own representatives, and these individuals identified watershed issues, selected water quality goals, and evaluated and selected management strategies. The Committee met from March, 2003 through October, 2003. Though many agencies and private organizations were represented on the Technical Advisory Group and the management strategies were reached by the consensus of that group, it should be noted that public agencies and organizations may not support all of the recommendations included in this Plan.

ISSUES AND CONCERNS

Early in the planning process, the Technical Advisory Group established a mission statement and a primary goal for Fernan Lake. The primary goal was to "improve water quality in the lake." It was the intent of the group that nutrient loads be reduced to improve water quality.

The group initially identified issues, concerns and proposed solutions:

- The City of Coeur d'Alene's Hillside Ordinance does not restrict construction on sites too steep/erodible for effective erosion control. The ordinance does not specify that there can be no transport of sediment off-site.
- The public and contractors are not well informed regarding grading permit and erosion control requirements. The Coeur d'Alene and Fernan Lake Village staff may need more training on evaluation of erosion control practices, and development of alternatives when *BMPs* are inadequate.
- Too much vegetation is being removed during and after construction.
- Kootenai County does not have specific hillside regulations that restrict construction on steep slopes.
- In all jurisdictions, the timing and frequency of traditional building inspections is inadequate for identifying and correcting erosion problems in a timely manner.
- No erosion control inspections are conducted until the foundation is poured and inspections are sometimes infrequent because they are not conducted unless building is occurring (erosion control inspections are conducted in conjunction with building inspections).
- All jurisdictions need more enforcement staff.
- Setbacks to surface water (25 feet) are inadequate to prevent sediment from reaching the lake.
- In all jurisdictions, erosion control and grading ordinances are not being consistently administered. Conscientious contractors who are complying with the ordinance are economically penalized when others are not forced to comply.
- In all jurisdictions, there are some building sites which are affecting water quality and are exempt from erosion control requirements (because they are less than 15% slope and greater than 500 feet from surface water).
- Buildings are sometimes not designed to be compatible with slopes. Rather than designing multilevel homes, contractors move tons of earth to form a flat pad for ranch style homes.
- In the cities of Fernan Lake Village and Coeur d'Alene, the applicability of the stormwater and erosion control requirements for roads built to access new, individual building sites is not clear. As a result, erosion control and stormwater management is often not required for driveways.
- All jurisdictions should adopt the classification and definition of Class I streams.
- Prohibit building of structures, roads and infrastructure on slopes of over 35%.
- Retain vegetation next to Class II streams.
- Exclude mechanical equipment from stream protection zones.

CHRONOLOGY

The Fernan Lake Conservation and Recreation Association have prepared a thirty-year chronology of "events, reports, and public comment" that outlines significant water quality issues and concerns of Fernan Lake.

1959: The City of Fernan Lake is incorporated.
1978: The City of Fernan Lake converts from septic systems to the City of Coeur d'Alene Sewer System.
1988: The Fernan Lake City Council opposes the City of Coeur d'Alene's annexation of Armstrong Park and an additional 54 acres directly on Fernan Lake over concerns of stormwater entering Fernan Lake.
1989: The City of Fernan Lake funds an engineering report to determine the 100-year flood capacity of the proposed design of the I-90 Off-ramp culvert.
1993: An Idaho Lake Water Quality Assessment Report is prepared by Jere Mossier, Ph.D. on Fernan Lake assessments conducted in 1990-1991 (Mossier 1993).
1995: A proposed 54-acre development directly across from Fernan Village is opposed by the City of Fernan Lake and its neighbors.
© A Memorandum by Scott Reed is prepared for the City of Fernan Lake, which is an analysis of the proposed 54-acre development and how the resulting phosphorous runoff would destroy the recreational and domestic uses of Fernan Lake, which are presently enjoyed.
© Fernan Lake Village established a Lake Protection Ordinance and a Navigable Water District. Fernan residents document interests in purchasing 54 acres for dedication as a Wildlife Preserve.
1996: The City of Fernan Lake and its watershed experience severe flooding conditions.
© The first public scoping by stakeholders of the proposed Fernan Lake Road improvement occurs. Serious public concern for lake and home sites occurs. The Fernan Lake Conservation and Recreation Association forms.
1997 The disturbance and alteration of Fernan Creek segments (above the lake) creates steep, unstable banks, and nutrient and sediment loading into Fernan Lake.
© The City of Fernan Lake resurfaces Lakeview Drive and installs a half dozen storm wells to correct stormwater runoff into Fernan Lake from Fernan Village.
© Surface foaming and high blue-green algae blooms continue to plague Fernan Lake.
© In late October, citizen complaints regarding IDL logging violations on State land (southeast end of Fernan Lake) prompts an Interdisciplinary Team Review.
1998: The Department of Environmental Quality proposes the "delisting" of Fernan Creek (input) from the EPA List of Impacted Surface Waters. The Fernan Lake Conservation Task Force (FLCTF) offers written opposition to this "delisting".
© IDEQ Water Quality Report notes high fecal coliform count (320/100ml. for F.C.).
© IDEQ Water Quality Report notes a nitrate-nitrite of 290ug/L as nitrogen which prompted a TMDL advisory on Fernan Creek (output) and lake under the Coeur d'Alene Lake sub-basin study. In this study, Geoff Harvey notes "the lake is currently in a state that intervention in the watershed could reduce phosphorous export to the lake and slow the pace of eutrophication (pg. 18)."
© The FLCTF submits a Fernan Wetlands Conservation Proposal to Senator Larry Craig. This document requests consideration of a federal land exchange with IDL involving State lands on Fernan Lake.
© A Health Advisory is placed on Fernan Lake.

1999: There is discussion and agreement between the Fernan Lake and Valley Association and the Eastside Highway District regarding guidelines for Fernan Road. The results are given to the Federal Highway Administration. No response.

2000: In January, Mr. Harvey observed an unusual dry count of phosphorous (10% to 15%) at the Fernan Ranger Station's meteorologic site. This pollution event is a direct consequence of the off-ramp placement adjacent to west end of Fernan Lake. Mr. Harvey did some analysis of Fernan Creek and then discontinued the study.

© The Federal Highway Administration presents "project checklist" to residents of the Fernan Lake watershed. The Fernan Lake Road Improvement Project meets local opposition, and alternate routes prove unpopular. The public submits numerous letters.

© Petitions are filed with the Federal Highway Administration, containing approximately 500 signatures, voicing concerns and recommending Road Project Construction Guidelines. No response.

© The Fernan Lake and Valley Association contacts the Environmental Protection Agency and local elected representatives demanding a full Environmental Impact Study be done prior to any decisions regarding Fernan Road Project construction.

2001: At a public scoping meeting on June 20th, the Western Federal Lands Highway Division announces plans for an Environmental Impact Statement (EIS), which delays the Fernan Project Status Update to 2005.

© In September, there is an IDL salvage operation on State lands in the vicinity of eagle nest. The USF&W is consulted, Montana interagency guidelines are applied, and the salvage of riparian shoreline is halted.

2002: Scott Reed contacts the Federal Highway Administration regarding lack of communication and response to the Fernan Lake and Valley Association's concerns regarding the Fernan Road Project and the status of the Environmental Impact Study.

© In March, 54 acres on Fernan Lake's steep south slope (west end heron rookery site) is put on the market. The 1995 full-backup offer is not honored. The Fernan Fundraising Committee seeks options. The Fernan Preservation, Inc. places an offer and opportunity to negotiate.

© In August, a developer places a full offer on the property.

© In August, home construction on Fernan Terrace occurs, creating road and hillside collapse, water main breaks, and damage to a home site below on Fernan Court.

© The City of Coeur d'Alene places a six-month Moratorium on hillside development and drafts a new Hillside Development Ordinance.

2003: In March, the Coeur d'Alene City Council passes a new Hillside Ordinance and grants an extension of a building moratorium for possible amendments to the Ordinance related to Fernan Lake.

© The City of Fernan Lake Village funds a six-month Water Quality Report on Fernan Lake and a Geotechnical Hazards Mapping of hillsides contiguous to Fernan Lake.

© In August, the incorporation of the Fernan Lake Conservation and Recreation Association occurs.

© In September, the City of Coeur d'Alene extends the building moratorium for the Fernan Lake Planning Area until December 31, 2003.

- © In October, the Technical Advisory Group prepares the final draft of the Fernan Watershed Plan.
- © In November, the Fernan Lake Watershed Plan is forwarded to the City of Coeur d'Alene for review and comments.

DATA COLLECTION AND GENERAL INFORMATION

General

Fernan Lake is protected for several beneficial uses. Designed beneficial uses listed in the Idaho Water Quality Standards and Wastewater Treatment Requirements (IDAPA 58.01.02) are: cold water aquatic life, salmonid spawning, primary contact recreation and domestic water supply.

Land Use

Land uses include timber harvest, cattle grazing, and residential development. The lake has two public access areas, one at the west end and one at the east end of the lake. A picnic area is located adjacent to the public boat access at Theis Street.

A small percentage of the shoreline is developed with cabins and homes. The hillsides in the northern part of the watershed are increasingly developed into urban densities. Due to problems with access, much of the south side is not developed. Due to the Fernan Lake Road Project, concern by the public has been raised because of the risk of increased intense urbanization. Most of the lakefront is in the County and is zoned Agriculture Suburban, permitting up to five homes per acre.

Soils

The land surface surrounding Fernan Lake is generally rough, consisting mostly of forested, mountainous, or hilly terrain. The United States Department of Agriculture Soil Conservation Service has identified five different soil types surrounding Fernan Lake. The north and east portion of the lake is primarily surrounded by Ramsdell silt loam (very deep, very poorly-drained soils). The south side is composed of three different soil types: Huckleberry-Ardenvoir association (this series consists of moderately deep, well-drained soils formed in loess and volcanic ash with material weathered from metasedimentary bedrock), McCrosket-Ardenvoir association, and McCrosket-Tekoa association (McCrosket series consists of deep well drained soils formed from metasedimentary bedrock and mantle of loess). The west portion is composed of Pywell muck (very deep, poorly-drained soil composed of organic material). Gradients in the area range from 10% to 40% on ridges and up to 60% along draws in some areas. The predominant material underneath the embankment along the lake is gravelly sand.

Climate and Rainfall

Climate in this region is characterized as relatively cold and wet in the winter and relatively dry in the summer. The mean minimum January temperature is -0.6° Celsius(C) (31° Fahrenheit (F), while the mean maximum July temperature is 18°C (65°F). The average annual precipitation is 75cm (29in). The average seasonal snowfall is 1.51 m (59.3 in), and the average frost free period is 120 days (SCS 1981).

The lower elevations surrounding Fernan Lake are associated with relatively high frequency of "rain on snow" events. These occur when a large, relatively warm moisture-laden air mass moves over an extensive snow pack. The warm air and rain can cause rapid snow melt, which results in very high runoff and flooding.

The mean summer temperature is 63.5 degrees (F), dropping to 31.5 degrees (F) in the winter. The annual average relative humidity is 46 percent. Note: As the elevation rises, there is a significant increase in the amount of precipitation within the Watershed.

Table 1

Climate and Rainfall

	Monthly Average Daytime Temperatures (F)	Monthly Average Precipitation
January	34 degrees	3.58 inches
February	41	2.50
March	48	2.28
April	59	1.68
May	69	2.02
June	76	1.93
July	86	.70
August	85	.99
September	75	1.25
October	61	2.10
November	44	3.10
December	37	3.81
Based on US Weather Service's 50- year average		

Wetlands

There are several wetlands surrounding Fernan Lake. The National Wetlands Inventory has identified wetlands on the east, west and northern areas of Fernan Lake. These wetlands have a variety of plant life, which provide the riparian area that supports fish and wildlife. In a Fernan Conservation Task Force letter to Senator Craig, it was stated, "According to the Academy of Natural Sciences, wetlands are "amongst the most important ecosystems on earth." The construction of the Interstate eliminated a large portion of the wetlands at the western boundary of the lake. Large wetlands on the east end of the lake are located on public lands. A Bald Eagle nest is located within this wetland riparian area.

The Idaho Department of Lands is considering advertising this area as surplus and scheduling a land exchange process, which may result in private ownership of the riparian area. There is considerable public and private community interest in acquiring this property for dedication as a wetland preserve. Since 1997, community organizations and public agencies such as Kootenai County Parks and Waterways and the Idaho Department of Fish and Game have actively pursued solutions to preserve the wetlands.

Fernan Lake Road Wetlands

According to David Evans Associates, consulting firm for the U.S. Department of Highway Administration, the wetlands along Fernan Lake Road are part of a large riparian system associated either with Fernan Creek or isolated units located at the base of the hill slopes, with hydrology provided by rain and runoff from intermittent draws or groundwater. Since the larger wetlands are associated with a large riparian system, the functional assessment is somewhat complex. The wetlands provide hydrology to surrounding areas, offer drinking water to stock, habitat for waterfowl, and probably most importantly, store floodwater to reduce local flooding.

The rural residential and agricultural uses near the open-water wetlands may cause fertilizers, pesticides or stock manure discharges to be added to the shallow water table. Thus, the functional value of on-site wetlands for toxicant removal is rated as moderate.

The wetlands receive some water from road runoff, but the majority of the toxicants come from residential and agricultural land uses. The existing road has no stormwater treatment system. As a result, it is possible that road pollutants may enter the wetlands along with the road runoff. Road pollutants, if present, would consist primarily of hydrocarbons and materials associated with automobiles. Discharge of hydrocarbons from Fernan Lake Road into the isolated wetlands has probably been occurring to some degree since the road was constructed. The on-site wetlands are mostly shallow, ponded or emergent wet areas adjacent to Fernan Creek with moderate to high vegetation cover. Most of the wetlands have weed species such as reed canarygrass.

Because of the degree of open water in Fernan Lake, Fernan Creek, and adjacent ponded areas, waterfowl habitat is considered excellent. Amphibians and insects are common. Thus, wildlife usage of these wetlands is moderate. A moose, a great blue heron, and several ospreys were observed near different sections of Fernan Creek and the wetlands during the field investigation. Passerine birds may use the cattails and tall reed canarygrass, as well as the upland shrubs, for food and cover, and small mammals are most likely present in the adjacent upland areas. Habitat value for wildlife is, therefore, very good.

Water Quality

Lakes are complex ecosystems influenced by a variety of chemical, physical and biological factors including the size, depth and shape of the lake basin, climate, local geology, the amount of water entering the lake from its watershed, transparency of the water, the composition of bottom sediments, vegetative land cover, and the occurrence of sediment and nutrient producing activities in the watershed.

Lakes can be classified according to their biological productivity or trophic status. Biologically unproductive or "oligotrophic" lakes are typically low in plant nutrient concentrations (phosphorus and nitrogen), low in concentrations of algae, have high water clarity and have only minor dissolved oxygen depletion in bottom waters. Nutrients (such as phosphorus), organic material and sediment flowing into a lake cause it to become more biologically productive.

Sediment deposited on the lake bottom causes it to become more shallow, and phosphorus attached to soil particles can accelerate algae growth through numerous in-lake processes which release the sediment-bound phosphorous into a biologically usable form. The lake gradually becomes more cloudy, algae concentrations increase, oxygen in the deep parts of the lake decrease, aquatic plants become more abundant and objectionable odors from decaying organic material become apparent. The lake becomes "mesotrophic" and then "eutrophic". Finally, over thousands of years, the lake becomes a marsh and then a meadow.

The trophic status of a lake is established based on several factors including the concentration of phosphorus in the water, clarity (measured with a black and white

Secchi disk), algal concentration (determined by measuring chlorophyll a, the main pigment in algal cells), the presence of blue-green algae, dissolved oxygen concentrations, and the number of prevalent submergent macrophyte (aquatic plant) species. Table 2 illustrates the relationship between lake characteristics and phosphorus concentrations.

Table 2
Relationship Between Lake Water Quality and Lake Water Phosphorus Concentration (Gilliom, 1983)

Lake Phosphorus Concentration (micrograms per liter)	Lake Characteristics
A (0-10)	Low algal productivity; high suitability for all recreational uses. Algal blooms are rare and water is extremely clear, with a Secchi-disk visibility that is usually 16 ft. or greater. Summer chlorophyll a concentrations generally average less than 3 ug/L.
B (10-20)	Moderate algal productivity; generally compatible with all recreational uses. Algal blooms are occasional, but generally of low to moderate intensity. Oxygen depletion is common in bottom waters and cold-water fisheries may be endangered in some shallow lakes. In many lakes, however, fishery may be enhanced by increased productivity. Secchi-disk visibility is usually 10 to 16 ft.; chlorophyll a averages 2 to 6 ug/L in most lakes.
C (20-30)	Moderately high algal productivity; still compatible with most recreational uses, but algal blooms are more frequent and intense, and oxygen deletion is more serious. This can increase fisheries problems, though productivity may still be enhanced. Water clarity is reduced and Secchi-disk visibility is usually 7 to 13 ft. Chlorophyll a averages 4 to 10 ug/L.
D (greater than 30)	High algal productivity; lake suitability for most recreational uses is often impaired by frequent and intense algal blooms which may form floating scum's. The water often takes on a "pea soup" color and becomes extremely murky. Fish kills may be common, especially in shallow lakes. Secchi-disk visibility is generally less than 10 ft, and chlorophyll a concentration is usually greater than 10.

The public generally considers the water quality of eutrophic lakes to be unacceptable for recreation because of algae blooms, increased growth of submerged aquatic plants, objectionable tastes and odors, the murky appearance of the water and because algae "slime" tends to foul fishing lines and grow on boats and docks.

Long before water quality becomes unacceptable to recreationists, however, the water becomes undesirable as a source of drinking water. DEQ discourages individual home owners to use untreated lake water as a drinking source. Lake water drawn into a home for drinking should pass through a small treatment system. Water should be chlorinated for bacteria and filtered for parasitic cysts. However, as certain algae concentrations increase in the lake (blue-green algae is one example), people may experience problems with unpleasant taste and odor compounds that pass through the treatment system. Algae may also clog the filtering systems. Blue-green algae blooms can also produce "cyanotoxins", presenting an additional hazard to those people swimming in or drinking lake water.

Extreme cases of cyanotoxin concentrations, for example, have been linked to the death of household pets in Black Lake in Northern Idaho, death of cattle from the drinking of water from the Cascade Reservoir, Idaho (DEQ 1996) and closures of Green Lake, Washington to all water contact activities (Jacoby, 2003). In 1985, due to the problems associated with algae, British Columbia adopted water quality standards for nutrients and algae. Because of the direct link between phosphorus and algae, their standard was based on phosphorus concentration. Their current standard for lakes used for drinking water is 10 ug total phosphorus per liter (mean for the entire water column), (Nordin, 1985).

Lake Eutrophication Process

Eutrophication is the progression of natural lake aging through nutrient-poor (oligotrophic) to nutrient-rich (eutrophic) stages (Figure 2). Hypereutrophy represents extreme productivity characterized by algal blooms or dense macrophyte populations (or both) plus a high level of sedimentation. Figure 2 depicts the natural process of gradual nutrient enrichment and basins filling over a long period of time (e.g. thousands of years). Human-induced or cultural eutrophication is a process in which lake aging is greatly accelerated by increased inputs of nutrients and sediments into a lake, as a result of watershed disturbance (EPA, 1990). Limnologists have developed various classification schemes to place lakes in a "trophic" state category. Two classifications are listed below (Table 3) which use ranges of three measured parameters to define trophic state. The three measurements are: in-lake total phosphorus concentrations, phytoplankton biomass as represented by chlorophyll a concentrations, and water clarity as measured by visibility depth of a Secchi disc.

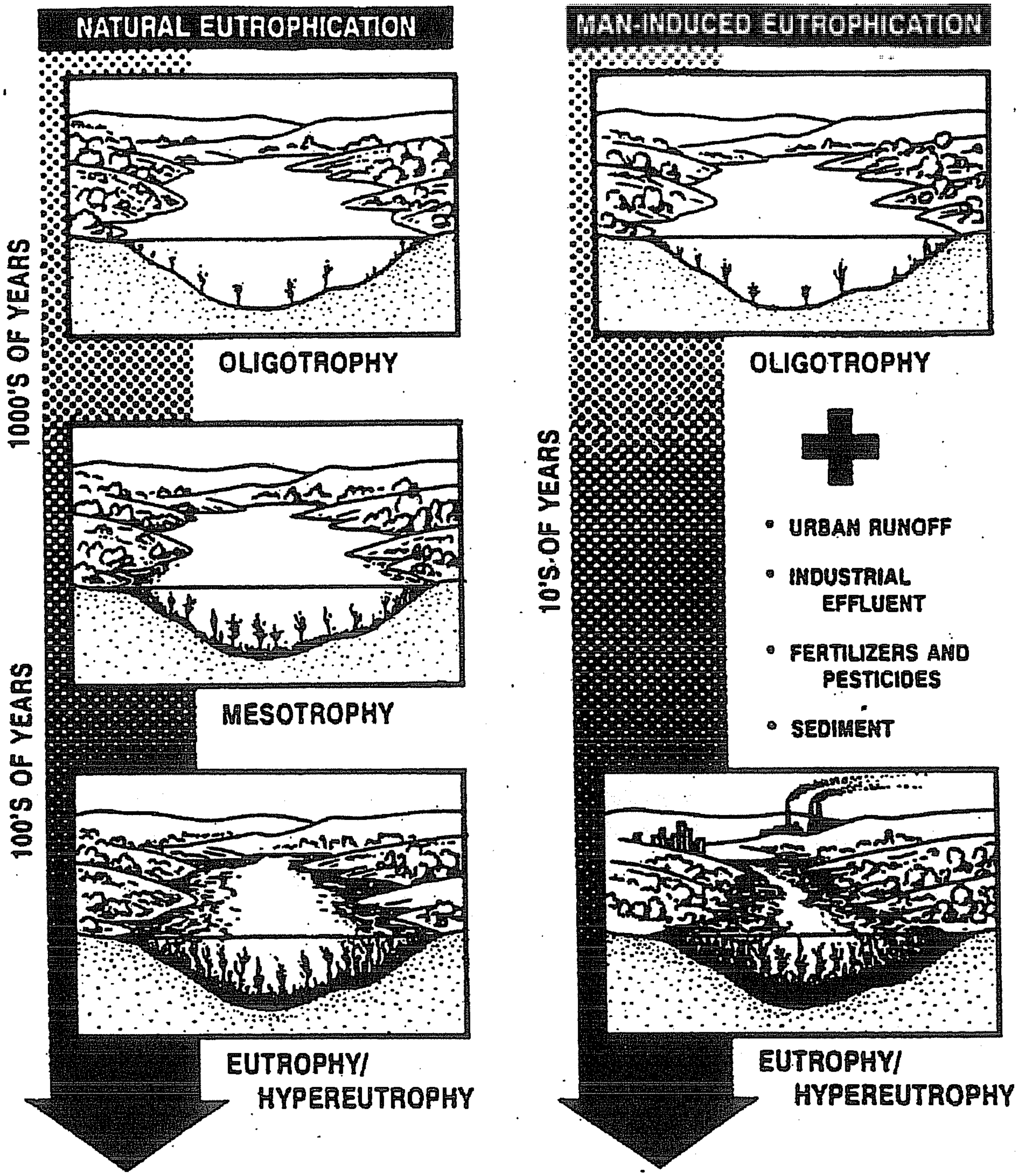

NATURAL EUTROPHICATION
1000'S OF YEARS
OLIGOTROPHY
100'S OF YEARS
MESOTROPHY
EUTROPHY/
HYPEREUTROPHY
MAN-INDUCED EUTROPHICATION
10'S OF YEARS
OLIGOTROPHY
• URBAN RUNOFF
• INDUSTRIAL EFFLUENT
• FERTILIZERS AND PESTICIDES
• SEDIMENT
EUTROPHY/
HYPEREUTROPHY

Figure 2

Table 3 Representative Values of Total Phosphorus, Chlorophyll a, and Secchi Disc Transparency Depth for Lake Classifications

Classification	Total Phosphorus (ug/L) Mean	Chlorophyll a (ug/L) Mean	Max.	Secchi Disc Depth (m) Mean	Min.
From Jones and Lee (1982)					
Oligotrophic	<7.9	<2.0	--	>4.6	--
Oligo-mesotrophic	8 - 11	2.1 - 2.9	--	4.5 - 3.8	--
Mesotrophic	12 - 27	3.0 - 6.9	--	3.8 - 2.4	--
Meso-Eutrophic	28 - 39	7.0 - 9.9	--	2.4 - 1.8	--
Eutrophic	>40	>10	--	<1.8	--
Modified from Ryding and Rast, (1989)					
Ultra-oligotrophic					
Oligotrophic	<4.0	<1.0	<2.5	>12	>6
Mesotrophic	<10.0	<2.5	<8.0	>6	>3
Eutrophic	10 - 35	2.5 - 8	8 - 25	6 - 3	3 - 1.5
Hypereutrhophic	35 - 100	8 - 25	25 - 75	3 - 1.5	1.5 - 0.7
	>100	>25	>75	<1.5	<0.7

The Clean Water Act and Water Quality Standards

Fernan Lake is a protected body of water under the Federal Water Pollution Control Act, or Clean Water Act (CWA), and Idaho Water Quality Standards (IDAPA 58.01.02). The CWA is the principal law governing pollution of the nation's surface waters. The CWA consists of two major parts, one being the provisions which authorize federal financial assistance for municipal sewage treatment plant construction, and the other being the regulatory requirements that apply to industrial and municipal dischargers. Certain responsibilities are delegated to the states, and this Act, like other environmental laws, embodies a philosophy of federal-state partnership in which the federal government sets the agenda and standards for pollution abatement, while the states carry out day-to-day activities of implementation and enforcement. The Clean Water Act makes it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions.

DEQ presented information on the Clean Water Act (CWA) and the Idaho Water Quality Standards and Wastewater Treatment Requirements. The CWA contains both laws and funding programs, and DEQ is the agency primarily responsible for implementing the Act in Idaho, through the Water Quality Standards. The Standards designate beneficial uses for larger water bodies in the State, include beneficial use criteria, specify wastewater treatment requirements, and address pollutants which might be entering the water.

Enforcement of the Standards is based on DEQ's ability to identify impairment of beneficial uses. Monitoring is time consuming, and it is often difficult to identify impairment even if it is occurring. Regardless of beneficial use impairment, there are regulatory mechanisms to halt deleterious effects from pollution. Sediment entering streams and lakes is a common pollutant. The standards currently have a narrative criterion for sediment, but not a numeric criterion.

Sediment entering a stream or lake can be determined to impair beneficial uses through DEQ processes of Water Body Assessment Guidance and development of Total Daily Maximum Loads (TMDLS). With determined impairment of beneficial uses, the DEQ process of TMDL Implementation Planning can identify projects and avenues for funding to reduce sediment yield to water bodies. However, for upper Fernan Creek and Fernan Lake, DEQ has determined that sediment has not impaired beneficial uses, and thus will not go through the TMDL Implementation Process (DEQ 1999). This makes the Fernan Lake Management Plan all that more important as a mechanism to work with watershed land owners and land managers for sediment load reductions.

<u>Historical Water Quality</u>

Information about past water quality sampling, studies and analyses of the watershed is located in Appendix C of this Plan. The information was provided by Glen Rothrock, a limnologist employed with the Department of Environmental Quality.

<u>Fernan Lake Monitoring 2003</u>

General
The City of Fernan Lake Village contracted with Allen Isaacson a hydrologist and water ecologist to monitor and analyze the watershed during the 2003 summer months. Mr. Isaacson has indicated in the following report that:

Fernan Lake water quality suffers from two main problems: 1) too many nutrients, 2) the temperature gets too high during the warm summer months (79 degrees measured in 2003 at the surface and 74 at the bottom). The lake is shallow, being only 27-28 feet deep at the deepest point. The lake lost over two feet of depth during the summer due to evaporation and seepage into the Rathdrum Prairie Aquifer. The top two feet make up a large amount of the volume of the lake.

Methodology
The water quality monitoring during 2003 followed a set protocol for field sampling and handling of the samples. The sampling was carried out at three main locations: 1) Kelly Creek above the lake inlet about .5 mile, 2) The outlet of the lake at the dam, and 3) The main lake deep profile. Each of these sites will be discussed individually below.

Monitoring in Kelly Creek
Kelly Creek is a perennial stream above the target range. Below this the stream becomes intermittent as it travels through pastures and hay fields. The water table is very high, with some wetlands mixed in at low spots in the valley. A spot was found close to the lake, where the flow surfaced during low flow periods, and where the majority of flow was carried during the higher flows of the snowmelt portion of the hydrograph. This site ran water continually during the long hot dry summer of 2003. The discharge was taken with a Price AA meter and top setting rod or with a pygmy meter

depending on the depth of the flow. The samples were collected with a DH 48 sediment sampler or by grab sample when the flows were at low stage. Field sampling was done for temperature, conductivity and pH during the runoff months. The rest of the season this was not done, as the samples were stable and consistent. The stream temperature was a steady 48 degrees Fahrenheit, showing that this was subsurface flow that had just surfaced at this location. The sample was put in a cooler on ice and transported to the Idaho State Laboratory.

Fernan Lake Outlet

The sampling at the outlet was done by collecting a grab sample off of the dam. The distance down from the top of the dam at a marked spot was measured with a tape. This was done to keep track of the depth and record the draw down of the lake as the summer progressed. There was no flow out of the dam except leakage and this was estimated by the length of time to fill a five-gallon bucket. The temperature was taken and a sample collected by dipping from the dam. The sample was transported in a cooler on ice directly to the Idaho State Laboratory.

Fernan Lake Sampling

The sampling site for the in-lake sampling was carefully chosen after sampling around the lake and surveying it to find the deepest part. This was found to be a depth of 28 feet and at a site about 15-20 meters from the south shore in the mid-point of the lake. This site was found using a depth finder and supplemental soundings.

The first step was to determine the Secchi depth. This was done with an eight-inch diameter white or white and black disk. The Secchi disk is lowered on the shady side of the boat until the depth is reached where the sampler, while wearing polarized glasses, cannot see the disk. This is recorded as the Secchi depth and relates to where 90 percent of the light is absorbed or refracted. This is the bottom edge of the photo zone. Photosynthesis will only take place above this depth.

The monitoring consisted of temperature, dissolved oxygen and conductivity readings from the surface at two-foot intervals until the bottom was reached. The same procedure was followed on every monitoring visit. A multi-probe Yellow Springs Instrument (YSI) was used for this data collection.

Next, the water samples for laboratory analysis were collected. The sample for chlorophyll a was collected at the Secchi depth. This was done with a Kemmer sampler lowered down to the correct depth and then triggered to pick up the sample. The sample was quickly transferred into a dark bottle, capped and placed on ice in the cooler. The next sample was collected for analyzed for nitrates and phosphates. This was an equally mixed sample covering the whole depth profile. The Kemmer sampler was lowered to the correct depth so that five samples were taken at different depths to cover the whole vertical profile of the lake. Each sample was poured into a five-liter churn-splitter. The samples were churned to mix and then a sub sample was taken in a one-liter bottle for the laboratory.

All sample bottles were from the laboratory and strict sanitary procedures were used to make sure there was no contamination of the samples. The time from sampling to the laboratory was about 30 minutes for the lake samples and 90 to 120 minutes for the stream and outlet samples.

Monitoring Information

Fernan Lake has outflow only during the spring snowmelt portion of the hydrograph and during rain on snow events during the winter. The lake becomes a "sink" during much of the year. In 2003, this was the situation from late June into the fall when there was enough precipitation to develop flow into the lake to raise the level, which could be the next spring runoff period. At the end of September in 2003 there was no surface flow in the main tributaries and there was no flow out of the lake. In 2003, data collection indicated that the lake is over two feet below the level of the dam and was not running water through the culvert that passes under Interstate 90 (the outlet of the lake). For example, when a lake acts as a "sink" it means that all of the nutrients that enter the lake are kept in the lake. The pure water evaporates, leaving the same amount of nutrients. This means that the concentration values per volume of water get higher as the summer months progress. In many lakes during times of drought, the lake will get high enough concentrations of chemicals to develop toxic conditions and result in fish kills. Past studies have shown a fairly short residence time in the lake that may not be correct due to the lack of outflow for much of the year.

Much of the nutrient level in Fernan Lake in 2003 was from recycling within the lake, as nutrients were added during rainstorms and rain-on-snow winter or early spring floods. There has been very little runoff for the past two years and no flooding. The last flood was in 1996-97 and resulted in large algae blooms and deteriorated water quality.

The sampling completed through mid-August in 2003 has shown better water quality than in the past, but during the end of August and into September there has been a noticeable algae bloom with the Secchi readings continuing down, with a reading of 3.6 feet On September 15, 2003. The August 28, 2003 laboratory findings for Chlorophyll a showed 20.7 µg/L. These readings indicated that Fernan Lake may be accelerating rapidly toward a eutrophic stage (see Table 4). The Chlorophyll *a* readings were higher in September. The September 4, 2003 reading was 30.3 µ/mg and the September 15, 2003 monitoring showed 36.4 µ/mg. With the combined Chlorophyll *a* and Secchi disk depths, Fernan Lake clearly exhibited eutrophic characteristics (See Table 4).

One explanation to the low nutrients and better Secchi readings in the early and mid-summer of 2003 are that the nutrients were tied up with growth of the expanse of rooted vegetation growing in Fernan Lake. When this starts to die back and decay, there will be an increase of nutrients in the water column and an increase in algal growth. The clarity of water in Fernan Lake continued to lessen as the 2003 summer and fall seasons progressed.

Typically, Fernan Lake receives abundant sunlight during the summer months to provide energy for algae to bloom. The nutrients are recycled along with new supplied from the watershed. The lake did not stratify in 2003. There are past records of some stratification, but typically this lake does not show records of stratification. There was continual mixing of the layers, as the temperature was almost isothermal from just below the surface to the bottom.

The last part of August and into September, 2003 indicated very high conductivity readings in the bottom part of the water column and then reaching up to nearly the whole profile. The dissolved oxygen profiles showed no D.O. depletion, except near to the bottom. When water temperatures were high, 74-79 (degrees Fahrenheit) in the whole profile, there was still adequate oxygen, except near the bottom. From studying the depth profiles over time, it seems evident that there is a lot of mixing and re-circulating of the nutrients in the lake.

Fernan Lake watershed may be divided up into three distinct and different areas that contribute runoff and nutrients to the lake. They are:

1) The Fernan Creek (Kelly Creek) valley to the east of the lake.
2) The North Slope of the lake, including Fernan Village.
3) The South slope of Fernan Lake.

Each of these areas should be treated differently, as the geology, slope, water contribution and water handling characteristics are extremely different for each area.

FERNAN CREEK

Fernan Creek flows from the east into the lake. The watershed has one main paved road that follows alongside the creek for part of its distance. There are many miles of logging roads in the headwater area. The watershed faces west to southwest and is located at the northeast of Coeur d'Alene Lake. This puts this watershed in a vulnerable position for rain-on-snow events. During the past forty years there have been many winter rain-on-snow events that have affected this watershed. The US Forest Service uses a procedure to determine the impacts of these conditions. Warm, rain-laden storms come in from the southwest and seem to cause excessive damage in the watersheds on the east and northeast of large water bodies such as Coeur d'Alene and Pend Oreille Lakes. The storms progress with warm winter temperatures in the 50-65 degrees Fahrenheit and heavy downpours of rain. The main damage occurs due to the warm winds accompanying the storms that melt the snow pack in the openings in timber at elevations below 3,800 feet elevation. This watershed has most of its area below this elevation level and also has been almost totally covered with roads and logging operations. The total snow cover is melted in about 24 hours and is available to run off over frozen ground. This results in very high volume floods in the 200-400 year frequency in the small watersheds. This can be verified with US Forest Service records and studies.

The result of these floods is the transporting of large amounts of sediment into the lake. Along with the sediment are phosphates and nitrates. Much of the area above the lake that borders the creek is used to pasture livestock. As floodwaters cover the bottomland, the nutrients are picked up and transported.

The groundwater table is very high, within a few feet of the surface in the flat bottom of this watershed. Any source of nutrients, septic tanks, livestock, campers, etc. will result in nutrients getting to the lake. At the present time, this part of the watershed to the east of the lake is the largest contributor to the lake.

FERNAN NORTH OF LAKE

The area to the north of the lake is characterized by housing on the northwest end and high above the lake on the top and mid-slope. This once was a source of nutrients, but is now sewered and the people that live here are very active in protecting the lake. The main concern in this area is the road that is adjacent to the lake for the total length of this side of the lake. The road is paved, but encroaches on the lake at many places. It is heavily used by fishermen and travelers to the National Forest, along with the residents that live in the creek area. The road is narrow and of poor quality and does produce sediment and dust into the lake. There is a risk of nutrients transported into the lake from this road source. Most any wide spot is used as parking for fishermen to spend time at the lake. There are no outhouse facilities, so this human source is another source of nutrients to the lake. The main concern now is the proposed rebuilding of this road and the possibility of sediment and additional nutrients reaching the lake during and after construction. Much of the route is in fragile geology and part of the proposal is to fill a wetland that is part of the lake. This will result in more nutrients in the lake and more degradation of the lake from algae blooms. All efforts must be made to protect the lake from any additional sediment from the watershed.

FERNAN SOUTH OF LAKE

Steep slopes of rock and timber characterize the south side of the lake. There are houses located in the western portion above the steep slope into the lake and in the Armstrong Park area above the lake. This area is part of the City of Coeur d'Alene and is connected to the City sewer collection system. There are many springs on this slope above the lake and fragile geology and soils with a steep slope (>35 %) on most of it, with rock outcrops and cliffs.

The slope is straight into the lake, with only a few small areas that offer any riparian area that might work as a buffer. This means that any stormwater, septic waste or runoff from intercepted groundwater would flow directly to the lake over a very short time and distance. Part of this area is proposed for development as housing and this would harm the lake, as there is not the right slope configuration or distance from the lake to allow any stormwater to be managed on the site. Any surface water from roads, roofs, etc. would end up in the lake, along with carried increase in nutrients and a decrease in water quality in the lake. The only solution would be to sewer and collect all surface water from all sources and transport it out of the watershed. This would be very difficult and expensive on this slope due to the fragile nature and the lake of benches or flats.

<u>WATER QUALITY CONCLUSION</u>

Fernan Lake is small, shallow and receives very heavy use by recreationists and fishermen. The geographic position of the lake and the land use around the lake has resulted in the degradation of the water quality of the lake. This must be reversed to prevent more and larger algae blooms that could become toxic. This study and report, along with the formation of the technical advisory group and the Fernan Lake Conservation and Recreation Association is a good start. The protection of this lake will take the cooperation of all who live here and visitors alike. The south side should be left in a natural state to buffer the lake and the proposed road on the north side should be located well away from the lake, or not rebuilt at all. It is well-documented that increases in sediment will increase the phosphate level in a lake, as the phosphate rides along attached to the sediment. The key to protecting the lake is by keeping sediment and runoff that has nitrates or phosphates from reaching the lake. Phosphate is the limiting factor in this lake because if more is available to the algae, there will be more and denser algal blooms.

FERNAN LAKE MONITORING
2003

Table 4

LOCATION	ITEM	6/24/03	7/01/03	7/11/03	7/21/03	7/29/03	8/07/03	8/19/03	8/27/03	9/04/03	9/15/03
Deepest point total profile	pH				6.1	6.4	6.1			7.8	6.0
	Secchi depth	14'	12.25	11.0	12.0	12.1	7.4	6.5	5.4	4.6	3.58
	Nitrates mg/L	0.05			0.09	<0.05	0.06	0.10	0.05	<0.05	<0.05
	Ammonia mg/L	0.014			0.016	0.013	0.005	0.011			
	Phosphates mg/L	0.016			0.020	0.021	0.016	0.022	0.016	0.027	0.030
	Chlorophyll a µ/L	3.0			5.4	6.1	5.3	7.2**	20.7	30.3	36.4
	Air Temperature			96	93	98	82	95 wind	85 wind	94	68
Lake Profile											
Surface	Temperature	67.5	71.8	76.4	77.44	79.04	76.0	75.4	72.86	72.15	64.67
	DO	6.9	6.8	7.2	7.14	7.9	6.99	7.5	8.1	8.69	7.67
	Conductivity	26	28	29	37	60	39	34	42	210	250
2-foot	Temperature	67.5	71.7	75.6	77.23	77.8	75.88	75.25	72.46	71.65	64.65
	DO	6.4	6.8	7.37	6.9	6.5	6.95	7.5	7.5	7.16	7.77
	Conductivity	26	28	29	36	60	33	34	35	208	247
4-foot	Temperature		71.57	72.65	76.58	77.44	75.87	75.24	70.96	71.00	64.62
	DO		6.8	7.6	6.24	6.11	6.47	7.29	7.07	7.35	7.80
	Conductivity		28	29	34	95	33	33	33	215	254
6-foot	Temperature	67.2	71.51	71.5	75.9	76.9	75.85	75.15	70.54	70.99	64.55
	DO	6.5	6.8	7.85	5.79	6.6	6.39	7.12	7.94	8.02	7.58
	Conductivity	26	28	29	33	66	32	32	32	215	259
8-foot	Temperature	65.5	71.15	71.3	74.7	75.05	76.28	74.55	69.51	70.80	64.50
	DO	6.4	6.9	7.99	6.08	7.09	6.58	7.23	8.12	8.12	7.34

	Conductivity	27	28	29	30	52	32	32	32	180	220
10-foot	Temperature		70.65	71.2	74.24	74.9	75.7	74.22	69.36	69.09	64.03
	DO		6.8	7.22	7.1	7.2	6.5	7.37	7.62	7.71	7.09
	Conductivity		28	29	30	37	32	32	32	159	199
12-foot	Temperature	65	70.08	71.12	74.1	74.77	74.5	73.2	69.31	69.05	63.21
	DO	6.9	6.8	7.75	7.1	7.2	6.5	8.09	7.29	8.22	7.08
	Conductivity	27	28	29	29	32	31	32	72	138	183
14-foot	Temperature		69.75	71.05	74.0	74.75	74.41	72.92	69.30	69.03	63.14
	DO		6.9	7.52	7.36	7.3	7.07	7.81	7.36	7.52	6.70
	Conductivity		28	29	30	32	31	32	79	158	169
16-foot	Temperature	65	69.55	70.97	73.87	74.76	74.35	72.89	69.26	69.02	63.08
	DO	7.02	7.01	7.4	7.3	7.32	6.68	7.6	7.14	6.71	6.90
	Conductivity	27	28	29	30	31	31	32	85	151	152
18-foot	Temperature	65.2	68.08	70.86	73.6	74.72	74.27	72.83	69.23	69.00	63.06
	DO	6.9	6.51	7.35	6.92	7.32	6.4	7.07	7.59	6.92	7.09
	Conductivity	27	28	29	30	53	31	45	87	282	251
20-foot	Temperature	64.9	67.1	70.10	73.4	74.73	74.22	72.84	69.22	68.98	63.05
	DO	4.8	5.17	6.12	6.5	7.00	6.36	7.56	7.6	6.88	7.01
	Conductivity	25	29	30	31	57	31	45	91	274	279
22-foot	Temperature		67.05	70.0	73.27	74.7	74.17	72.81	69.21	68.94	63.06
	DO		5.1	6.2	6.23	7.23	6.34	7.21	7.4	7.15	4.90
	Conductivity		29	30	48	79	31	76	110	269	277
24-foot	Temperature		67.08	69.75	72.83	74.75	74.15	72.82	69.23	68.92	63.06
	DO		5.06	5.95	5.6	6.6	6.16	6.9	6.70	7.29	6.6
	Conductivity		30	93	55	85	31	79	111	266	266
25-26 foot/bottom	Temperature			69.77	72.8	74.6	73.89		69.29	68.80	63.24
	DO			1.11	5.1	4.5	1.3		.05	.10	.09
	Conductivity			110	65	119	51		243	278	293

** Note—this reading on 8/19/03 is in error on the low side due to the sample being exposed to light on the way to the lab.

TABLE 5
FERNAN CREEK ABOVE LAKE

Table 5

Parameter Measured **Date Monitored**

Date	**4/28/03**	**5/19/03**	**6/04/03**	**6/24/03**	**7/01/03**	**7/17/03**	**7/29/03**	**8/07/03**	**8/19/03**	**9/14/03**
Discharge	7.4 cfs	3.5 cfs		1.0 cfs	1.0 cfs	1.0 cfs	1.0 cfs	1.0 cfs	1.0 cfs	1.25 cfs
Temperature			50F	48F	48F	48 F	48 F	48 F	48	48
pH	6.5		6.5							
Conductivity	30									
Ammonia as N							0.009	0.01	0.012	
Hardness	20		10ppm							
Nitrate mg/L	1.2	.4	0.0		.3	0.12	0.10	0.06	0.11	0.11
Nitrite mg/L	0.002									
T Phosphate mg/L	1.67	.06			.22	0.032	0.026	0.023	0.030	0.26
Chloride	3.0		3.5							
Alkalinity		42	45							

- The creek has gone dry, in July I, 2003 found where it is flowing, but it is emerging ground water and not the surface flow from up slope in the watershed. All measurements from June 4, 2003 until the stream begins flowing again are from the spring source.
- All chemistry before July 1, 2003 are field measurements, after that date are Laboratory-certified.

FERNAN LAKE OUTLET

Table 6

Parameter Measured	**Date Monitored**									
Date	**6/24/03**	**7/11/03**	**7/17/03**	**7/29/03**	**8/07/03**	**8/19/03***	**8/27/03***	**9/04/03***	**9/14/03**	
Flow out of Dam		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Depth from top of Dam		1.3'	1.2'	1.5'	1.8'	2.0'	2.3	Dry above dam	Dry above dam	
Temperature		76 F	77 F	80 F		78 F	74 F	72 F	65 F	
Nitrate mg/L	<0.05		0.08	0.07	<0.05	.010			<0.05	
Phosphate mg/L	0.017		0.029	0.023	0.032	0.026			0.031	
Ammonia mg/L	0.009			0.013	.008	.008				

The outlet is dry and becomes a pond below Interstate #90 where it is separated from the Lake. Will not monitor until flow connection reestablished.

Geotechnical/Geomorphology
The watershed has a diverse geomorphology. Parent materials include basalt portions of the watershed, and decomposing granite and meta-sedimentary bedrock in other portions of the watershed. The City of Fernan Lake Village contracted with Strata, Inc. to assist in delineating the hazardous areas throughout the watershed. The overlay contains the interpreted geologic and slope conditions for four types of "Geotechnical Terrain Units" or GTU's. Detailed GTU descriptions are found in Appendix D. The geology used for Strata's interpretation was obtained from the "Surficial Geologic Map of the Fernan Lake Quadrangle, Kootenai County, Idaho" prepared by the Idaho Geological Survey (Breckenridge and Othberg, unpublished as of this date). Strata, Inc. has conducted services in general accordance with the Geotechnical Standard of Practice, as it exists in North Idaho. The initial mapping has been conducted on a relatively large scale, and, as such, Geotechnical Terrain Units depicted may vary from those depicted. Using GIS analysis and ground truthing with a Geotechnical Engineer, site-specific mapping can be accomplished to clearly determine what should be updated periodically, as more detailed mapping data is made available.

GIS Analysis
Based upon the information available (Appendix D - 15 layers of data), the analysis performed by Mr. Lovel clearly shows documented geologic hazard and topographic hazard, but the State of Idaho will not allow a government to remove all reasonable economic use of a property. The City of Fernan Lake requested that Mr. Lovel determine whether any jurisdiction in the watershed with building permit authority, or any property owner who requested a building permit, would be affected by the Committee proposal of restricting building to less than 35% slopes. Mr. Lovel identified the slope percentage for each parcel surrounding the lake. The results show that no one parcel is completely consumed by slopes in excess of 35% and, therefore, ALL parcels have significant buildable area. This information is available in a digital format to any requesting jurisdiction. The results also compliment and confirm the findings of Strata Engineering.

The Idaho Geological Survey GIS coverage clearly shows "landslide and talus" deposits on a major portion of the hillside. Fractured underlying geology, combined with slopes in excess of 35% on the hillsides adjoining Fernan Lake, create building and road construction hazards due to potential for futures landslides or slumps. Fernan Lake, already suffering from near-eutrophic conditions, could not recover from such an event.

Wastewater
Fernan Lake Village owns and operates a wastewater collection system. The Village is the most densely populated area surrounding Fernan Lake. This collection system is tied into the City of Coeur d'Alene Municipal Wastewater Treatment System. Residential structures that are not within the Cities of Fernan Lake Village or Coeur d'Alene are served by an on-site sewage disposal system. On-site sewage disposal systems installed prior to 1971 are probably substandard. However, state regulations adopted in 1971 required separation distances from surface water of 200-300 feet. Current regulations require separation distances of 100-300 feet (depending on soil types) to permanent and intermittent surface water, as well as specified separation distances between the system and ground water.

The Panhandle Health District implements policies that require upgrades to substandard on-site sewage disposal systems if they have "failed", or if a property owner wishes to remodel or expand a lakefront structure. In addition, upgrades to meet current standards may be required by lending institutions prior to approving mortgage loans.

Parcel maps provided by Kootenai County indicate that there are residences that are probably using on-site sewage disposal systems within 300 feet of the lakeshore. It is unknown what percentages of those homes were built prior to 1971. Dick Martindale from the Panhandle Health District states, "Based on a study for Hayden Lake (Soltero etal. Ital., 1986), phosphorous loading from septic systems may represent less than 3% of the total load to that lake. Phosphorous loading from septic systems to Fernan Lake could be similar."

Boat Wastewater

Under Idaho Code §67-7505 and Kootenai County Ordinance No. 279, it is illegal to dump sewage or other wastes from any vessel into the water or onto the ground. Refuse drained or thrown into the lake or onto public property is a misdemeanor (Environmental Health Code ID-APA 41.1.1.200.1.a), (Idaho Code §39-117). Currently there are no dumping stations on Fernan Lake.

Stormwater

Nationwide, untreated stormwater from residential and commercial areas is being recognized as a significant source of sediment, nutrients, pesticides and petroleum contaminants.

In 1999, the Kootenai County Board of Commissioners adopted a Site Disturbance Ordinance (Kootenai County Site Disturbance Ordinance Number 283) that addressed grading, erosion control and stormwater management designed to reduce (though not eliminate) the effect of stormwater from new development. This ordinance requires that the first 1/2" of runoff from impervious areas be contained and treated using a grassed infiltration area or an "acceptable alternative." In addition, this ordinance requires that peak runoff flows be managed so that there is no increase in the peak rate of runoff for a 25-year storm, and so that components of the system and adjacent land and improvements are not damaged. Stormwater systems meeting the requirements of this Ordinance will treat approximately 85% of the stormwater flowing from impervious areas, with the remaining 15% a result of storms which exceed 1/2" of precipitation. Phosphorus removal efficiencies of stormwater systems range from 20%-90%. This ordinance has been held as a State model for addressing site disturbance.

AGRICULTURE

Livestock

There is conflicting evidence about the impacts of grazing livestock in the watershed area. In 1993, J.C. Mosley, a professor at the University of Idaho indicated that sediment and nutrient export from rangeland in this area is generally quite low compared to that from residential areas. He states that properly managed livestock can help control noxious weeds and can reduce the risk of fire, when they eat grass along roads. He indicates that in some cases, limited grazing of riparian areas can increase plant density and vigor and improve seedling establishment. He concludes that "this improved vegetation is more effective at slowing the velocity of incoming runoff, allowing sediment particles to settle out before they reach the water". (Mosley, 1993).

Current studies and local agriculture experts, indicate that there are livestock impacts to water quality. If livestock are too concentrated in riparian areas they begin eating the woody plants, such as willows (after they eat the grasses and forbes). This, combined with the weight of the animals, destabilizes the stream bank, as banks collapse and flattens out, and the creek becomes wider and shallower. Nutrient loads from animal waste and sediment can also increase, particularly if there is short cropped grass along the stream, or if the soil has been compacted, making it less permeable. Animal wastes may then be washed from the land into the water. (Jim Wilson, Kootenai County Extension Office Agent, 2003)

BMPs (Best Management Practices) can be used to minimize livestock impacts. These practices include rest/rotation of grazing systems, placing salt away from streams, herding the livestock away from the water, fencing off riparian areas, and developing alternate water sources away from the stream (such as springs).

Construction Erosion

Soil erosion from construction often has a major effect on surface water quality. Sediment smothers fish larvae and other aquatic life, fills in streambeds and lakes, increases drinking water treatment costs, and contains phosphorus which degrades lake water quality. It is not unusual to find sediment loading rates from construction sites which are 5-500 times higher than background levels (EPA, 1977).

Factors influencing soil erosion include the soil type, amount and type of vegetation, slope, and length of disturbed area, climate, and season. Rain-on-snow events are a particular concern in this region.

To help address this problem, Kootenai County adopted Ordinance Number 283 to address stormwater management and erosion control which requires control of erosion during construction of subdivisions, commercial and industrial developments, public projects, and residential buildings which are within 500 feet of surface water or on slopes exceeding 15%.

Another construction-related problem which was identified involves the burning of construction debris in road side ditches and on the lakeshore. Ashes rich in phosphorus then wash into drainage ways and eventually into the lakes.

As with most nonpoint source pollutants, lack of understanding contributes to this problem. Contractors, Building Officials and the general public sometimes don't recognize the connection between mud flowing off of a construction site and deteriorating lake and stream water quality. Even those who understand the problem may not be aware of *BMPs* that might be used to minimize erosion and sedimentation.

Timber Land and Other Private Roads

Phosphorus and sediment export from forested watersheds is generally much lower than that from residential and agricultural areas. Pollutant loads vary depending on climate, type and age of trees, soil type and topography. Areas in this region below the 4,000 foot elevation are also susceptible to erosion occurring during rain-on-snow events. Though timbered lands generally produce less phosphorus and sediment per acre than more intensive land uses, if they cover a large portion of the watershed their total contribution can be significant. Small changes in sediment and phosphorus export over a large area can result in large changes in the total contaminant load entering a water body.

Though generally quite low, sediment and phosphorus exports are increased by timber harvest, construction and use of roads and skid trails, burning and site preparation for reforestation, as well as natural events such as wild fires and mass slope failures. Non-silvicultural activities, such as camping and recreational travel, can also increase contaminant loads. The first year following a timber harvest, phosphorus loading increases from approximately .025 to .30-2.37 lb. per acre per year (Falter, Dec. 1987; Bellatty, 1987; USGS, 1994) and sediment export increases from about .03 to 1.4 tons per acre per year (Bellatty, 1987). Both can return to background levels in approximately 2-6 years.

Developing a dirt road increases sediment export even more dramatically. If surface water is allowed to flow down roads and trails, its speed accelerates resulting in increased erosion. Even when roads are cross-drained, water can be channelized by the ruts created when motorcycles and trucks use muddy roads. Road cuts may also intercept shallow ground water, compounding the problem. The quantity of sediment which reaches a stream channel varies based on a number of factors, including the slope steepness, slope shape, drainage density, the vegetative community, and soil particle size. A new road can export approximately 50-100 tons/acre of exposed soil for the first year after construction (USDA Forest Service 1981, Megahan and Kidd 1972). This export rate can be reduced by proper cross-drainage structures, and applying a gravel layer to the native road surface can significantly reduce export rate.

In addition to sediment from roads and the land itself, sediment can also enter stream channels directly from erosion of the stream bank. Timber harvest, soil compaction, removal of topsoil and surface litter, and road construction all increase peak runoff and water yield, resulting in increased erosion. Removal of conifers from the riparian area of streams also makes stream channels less stable and more susceptible to erosion during spring runoff.

Another problem caused by excessive runoff and the removal of conifers from riparian areas is increased bed load movement. In a natural state, large organic debris (LOD) such as logs fall into and across streams, reducing the velocity of the water, slowing runoff, and forming small pools for fish. When conifers along a stream are removed, this organic debris is no longer available and there is nothing to slow water velocities. Stream channels then become unstable, and the rocks which form the stream bed begin moving downstream, filling the pools necessary for fish survival.

Because of the potential water quality impacts of timber harvest and road construction, mandatory *BMPs* have been developed. These *BMPs* are required for any forest practice and are designed to prevent or minimize effects on water quality. Timber harvest on State and private land is regulated by the Idaho Department of Lands (IDL), and Federal land is managed by the U.S. Forest Service.

IDL provided information on the regulation of timber management activities on State and private land. Timber management on these lands is governed by the Idaho Forest Practices Act (FPA) and its associated regulations. Any time logs are sold commercially (to a mill), the operation is subject to the regulations and IDL must be notified before the forest practice is initiated. Mills will not accept logs unless they have a slash permit or "brush number" issued by IDL, to ensure that slash compliance is in place.

The FPA regulations are designed to protect water quality, minimize fire hazards, and maintain productive forests. Proper road construction and maintenance is a primary concern. The regulations are generally "descriptive" rather than "prescriptive", giving IDL a great deal of latitude to require additional measures when they are warranted. Bodies of water which are designated "stream segments of concern" are exceptions, having specific requirements developed by "local working committees." Different requirements apply to Class I and Class II streams. Class I streams are used for domestic water supply or are important for the spawning, rearing or migration of fish. Class II streams are headwater streams used by few, if any, fish. IDL does not evaluate road construction/timber harvest prescriptions.

Prior to a forest practice occurring, IDL tries to coordinate with other agencies when forest will be converted to other land uses. Land conversions to home sites can be a major water quality problem if temporary, low standard forest roads are put to bed in accordance with the FPA regulations, but are not upgraded to handle year round access traffic. If a land conversion is not accomplished within three years, IDL can require reforestation of the area by the fifth year. Cross-ditching is required before winter.

IDL is sensitive to the water quality impact of logging operations in lake watersheds. They try to get operators to pile and burn slashes away from tributary streams to reduce the flush of phosphorus to the stream. They try to do a pre-operational inspection before the start of each forest practice, and to conduct more inspections during the operation. Pre-op inspections are generally required on "stream segments of concern."

IDL is examining options to effectively reduce water quality impacts caused by problem operators. Bonding, certification and civil fines have been discussed as way to achieve this goal. IDL can require bonding of non-resident operators and has explored applying bonding to those with a Notice of Violation. They also keep a list of people with Notices of Violation, and will not issue another slash permit until prior problems are fixed. IDL has also considered implementing a civil penalty system; however, it may be difficult to collect fines which have been levied. Certification is not widely supported. Civil penalties and Operator's Certification are administratively expensive.

In 1991 the Idaho Legislature required IDL to begin managing cumulative water quality effects of multiple timber harvests. A Cumulative Effect's Task Force was formed and has developed a draft screening process to evaluate effects based on sediment, nutrients, temperature, destabilized stream channels, etc. If adopted, landowners in watersheds exhibiting signs of cumulative effects would be required to use additional *BMPs* or postpone logging for a few years. The Forest Service is already doing this on their land. The Cumulative Effects Proposal will soon be available for public review and comment. It will be important that citizens support its adoption.

DEQ has a role in the management of timberlands. DEQ periodically (every four years) evaluates the effectiveness of the *BMPs*. The last audit was conducted in 2000. During these audits the Forest Service, Department of Lands, Fish and Game, industry representatives, and landowners look at timber operations across the State and rate the effectiveness of *BMPs*. Generally the audits show that the *BMPs* work, when applied properly. This information is presented to the Forest Practices Advisory Committee who reviews it and makes recommendations to the Board of Land Commissioners.

Ed Lider, with the Fernan Ranger District, provided information on activities occurring on land managed by the Forest Service. Activities occurring on Federal land must, at a minimum, meet the requirements of the Idaho Forest Practices Act Regulations and Idaho Water Quality Standards. In some cases, additional requirements are imposed under an array of Federal regulations. About 4,500 acres (out of 25,000 acres) have been harvested, with 12% clear cut. Areas are generally burned following timber harvest, and there is a flush of nutrients following this burning. Road densities are about average compared to other drainages: 1-2 miles of main road per square mile and 6 miles per square mile for all road types. The Forest Service places a high priority on maintaining roads and drainage systems, cleaning ditches and culverts, blading and maintaining the road prism. There are many roads (half the total- primarily jammer roads) which are no longer needed and could be removed. Some roads that are still needed could be reconstructed to reduce water quality impacts.

There are some timber harvests planned on Federal land in the Fernan Lake watershed. Some of the stands need thinning and maintenance. Most migration barriers have been corrected. Due to the geology of the eastern part of the watershed, fine sediment does not appear to be a problem on Forest Service land. Fish live in pools in the tributaries until they are approximately three years old and then migrate to the lake. They return to the tributaries to spawn in April and May when they are 5-6 years old. Fish require different kinds of habitat. Riffles are important for food production and are the dominant type of habitat. Fish spend most of their time in pools. Woody debris (logs, etc.) are important in forming pools for fish, and in reducing stream velocities. In areas which have been logged, the amount of pools and pocket water (small pools) decline. In unstable stream channels, pools tend to fill with sediment and rock, making fish survival more difficult. Maintaining pools is critical to maintaining fish populations.

Fernan Lake Road Improvement Project

Fernan Lake Road is the primary recreational access to Fernan Lake. It also provides access to residences, an established shooting range, and approximately 500,000 acres of the Idaho Panhandle National Forest (IPNF), which includes campgrounds, picnic areas, and snowmobiling and hiking trails.

The purpose of the proposed project is to improve access to IPNF lands and reduce safety hazards on Fernan Lake Road. Specific improvements would include widening to achieve uniform width, realignments to reduce or remove substandard curves and improve sight distance, provide for turnouts, and installing guardrails, striping and signing to improve safety.

A Social, Economic, and Environmental (SEE) Study Team, composed of representatives from FHWA, USDA Forest Service, Kootenai County East Side Highway District (ESHD), and the Idaho Transportation Department (ITD) was established to identify and assess the potential environmental effects of improving Fernan Lake Road, and to recommend alternatives for evaluation.

During construction several areas need to be, and are, addressed in the Project Checklist of the Fernan Lake Road Improvement Project. These areas are:

- Soil Erosion
- Wetlands
- Sensitive plant species

- Critical Aquifer Recharge Area of Fernan Lake
- Flood Plain
- Adverse visual effects
- Accessibility of residences
- Accessibility of recreational areas
- Right of Way from private property owners

The overall purpose of the Project is to improve the safety of Fernan Lake Road. Project objectives include:

- Improving safety for current and future travelers
- Reducing road maintenance costs
- Correcting drainage problems
- Providing off-road parking for recreational users (Project Checklist 2000)

Although there is public support for improvement of safety and maintenance of Fernan Lake Road, much concern has been expressed by local property owners, the public and by petitions of recreational users of Fernan Lake regarding the significant environmental impact of the Federal Highway Administration's proposed extensive changes to Fernan Lake Road.

Recommendations have been made by the public that have been supported by the general public and by the Fernan Lake Conservation and Recreation Association. These recommendations are:

A. Road Recommendations
    1. The current roadbed position will not be changed.
    2. Paved road width for the first 2.5 miles along Fernan Lake would be 24 feet. The exception would be between milepost 0.9 to 1.2, which would be kept to 22 feet, to protect the main residential area around the Lake.
    3. The lanes would be painted at a width of 10 feet, with a wider paved shoulder on the lakeside.
    4. Minimize the size of the roadside ditch as much as possible.
    5. Respect the environmental needs of the Lake by using options such as retaining walls to minimize excavation.
    6. No lake fill.
    7. Utilize the Kootenai County Site Disturbance Ordinance and Idaho DEQ Best Management Practices in the development of a Site Disturbance Plan. This Plan would be reviewed and endorsed by Kootenai County and DEQ prior to construction.

B. Parking along Fernan Lake Road
    1. Develop parking options to stop hazardous lakeside parking.
    2. Discuss and negotiate with property owners on purchase of land for parking areas.
    3. All designated parking areas should be specifically posted with appropriate signage, including number of parking spaces, no overnight camping, and no fires.
    4. Garbage cans will be made available at all designated parking areas.
    5. Install permanent restroom facilities at each end of the Lake, as regulated by the Health District.

C. Guard Rail Issues

1. Use rocks or other natural features or materials as guardrails at appropriate sections along the road for safety.
2. Retain trees on the lakeside for erosion control and visual beautification.
3. Reforest the lake side of the road after construction is completed for erosion control, safety and beautification.

D. Post and Maintain Appropriate Signs
1. Adequate number of speed limit signs (25 mph).
2. Post road hazard signs along the road indicating sharp turns and merging traffic.

E. Public Relations
1. Minimize impact to property owners by consulting with them on access, structures, wells, property lines and vegetation.
2. Use of sound deflectors to minimize the traffic noise for homes adjacent to the road.

Other Public and Private Roads

Public and private roads not associated with timber harvest are a significant source of sediment and nutrients. In addition to erosion of the road surface, sediment export can be accelerated by repair and maintenance activities. The Planning Committee was particularly concerned about the poor condition of private dirt and gravel roads, the lack of soil stabilization following the cleaning and repair of road side ditches and culverts, the cumulative effect of multiple roads in geologically unstable areas, and wide road widths required by the County and Highway Districts. Wider roads result in more impervious area and greater quantities of runoff. In general, road ordinances and standards are based on safety and maintenance considerations and are not designed to reduce water quality impacts.

Poorly constructed and inadequately maintained private roads undoubtedly contribute a great deal of sediment to Fernan Lake and its tributaries. Some of these roads were originally constructed as temporary roads to access timber and are constructed of dirt, on steep slopes, and with little or no provision for drainage. Road ditching is often not present, or if present the ditches have filled with sediment. Road cuts and fills often exceed recommended slopes and soil is often left exposed for long periods of time. Long stretches of steep roads are not cross-ditched, causing water velocities to increase unchecked. Many private roads and driveways have significant gullies which form each winter and spring.

John Pankratz, Road Supervisor for the East Side Highway District, provided information on the administrative structure and responsibilities of the Highway District. The District has jurisdiction over all secondary roads not maintained by the State and cities, excluding forest service, other government entities and private roads. The District is governed by an elected Board of Directors. Road maintenance is their primary responsibility. They do very little new construction, but are involved in reconstruction projects. If new roads are to be maintained by the District, they must meet District Road Construction Standards. Homeowners Associations are often responsible for maintaining public roads which do not meet Highway District Standards.

The Highway District works closely with the Idaho Department of Fish and Game and the Department of Lands when construction is occurring in a stream. The District uses no salt, but does use liquid magnesium chloride de-icer. When utilities are installed in the road right-of-way, the District requires the use of hydro-seeding and straw bales to reduce erosion, depending on the scope of the project.

Current Highway District Construction Standards require 60 feet from shoulder to shoulder, which can vary, but require 28 feet of paved surface. Grades can be up to 9%. The Highway Districts recently adopted a variance procedure permitting the Districts to consider alternate construction standards. This could be used to approve designs which will reduce road-related impacts to water quality, such as narrower, steeper roads, with fewer cuts and fills.

Kootenai County is responsible for approving construction of private roads in new subdivisions, as well as new roads and driveways serving individual parcels. They recently adopted an Ordinance which requires that roads serving five or more parcels meet Highway District Standards, and other roads must meet the Uniform Fire Code. An all-weather surface (generally gravel) is required and the grade must be less than 12% within 150 feet of the structure. Prior to this Ordinance there were no construction requirements for private roads and driveways, and developers were not required to meet Highway District Standards if a Homeowners Association was to be responsible for maintenance.

MISCELLANEOUS

Motorized Watercraft

The use of motorized watercraft (boats, jet skis) on small lakes such as Fernan Lake can affect water quality by stirring up lake sediments in shallow waters, and their wakes can increase lake and stream bank erosion. It is also known that older, carbureted 2-stroke outboard motors and jet skis (prior to the manufacturing of 4-stroke and fuel injected 2-stroke motors) can add significant amounts of hydrocarbon pollution to lakes.

The Committee discussed erosion of the shoreline due to increased wave action from boats and jet skis. This does appear to be a problem, particularly on the south side of the lake because it is not as rocky, and because water skiers prefer the calmer water. This problem seems to be exacerbated by removal of shoreline rocks and vegetation. Peak usage of the lake is during the weekends and evenings. It was felt that the County does not consistently enforce their no-wake requirements.

Agitation of sediments in shallow areas was also discussed. This does not seem to be a problem because people prefer to stay out of the "weeds." Some residents on the east end of the lake are considering harvesting some of these macrophytes. Permits are not required for harvesting. Concern was also expressed about people modifying docks and the shoreline without obtaining required permits.

Fernan Lake, which is part of the public waters of Kootenai County, is regulated by County Ordinance Number 279B. This Ordinance regulates the operation of watercraft, establishes speed limits, no waterskiing zones, no wake zones and restricted zones for swimming. The Ordinance was established for the protection of the health, safety, and welfare of the general public. Currently there are no restrictions on the types of watercraft allowed on the lake. Idaho law declares that all motorboats are considered to be dangerous instrumentalities and the operator is responsible for their safe operation. Personal Watercrafts are considered motorboats.

Aesthetic Issues
The Committee identified several aesthetic issues. Noise from drag boats and jet skis appears to be a problem for many people. Newer jet skis are designed to be quieter; however, many areas are banning them due to noise. Management options could be either voluntary or mandatory, and might include: a) limiting the times and numbers of hours jet skis are on the lake, b) limiting their use to certain areas of the lake, and c) limiting noise levels.

Preservation of the natural setting of the shoreline is an emerging issue. Management options include:

a) Developing viewshed building and development design standards. Standards could address building size and materials, vegetation removal and planting, and minimization of lighting.
b) Developing a vegetation/ tree ordinance limiting removal of existing trees within 100 feet of the shoreline.
c) Developing building bulk restrictions to protect view corridors. Variable side yard setbacks relative to the size of the building could be considered, where greater building bulk would require larger setbacks, to provide view corridors. Overall height limits could also be considered.

Fisheries and Wildlife
Fernan Lake, located on the outskirts of the City of Coeur d'Alene, provides one of the finest natural urban fisheries in the State. This lake receives heavy angling pressure. Nearly 23,000 fish per year are stocked, primarily catchable rainbow trout and fingerling cutthroat trout. Channel catfish are also hatchery supported. Wild cutthroat trout, brook trout and stocked rainbow trout account for over 40% of the catch in Fernan. Warm water species also play a critical role.

With an overall shallow depth, and warm summer waters, and good fish cover including aquatic plant beds on the east side, good habitat is provided for species such as large mouth bass, bullhead catfish, channel catfish, crappie, perch and pumpkinseed. Northern pike can also be found in Fernan.

Fernan Lake Watershed also supports a variety of large mammals such as deer, elk, moose, black bear, cougar, bobcat, and fox. Other animals characteristic to the area are beaver, muskrat, ground squirrel, snowshoe hare, porcupine, skunk, and other mammals.

The lake also supports many species of waterfowl and other birds. There is documented evidence of an active Bald Eagle nest on the east end of the lake and a Great Blue Heron rookery of approximately 28 active nests on the southwest slope. Federal regulations prohibit destruction of these nests during certain periods of time throughout the year.

In March 2000, Fish and Wildlife Service indicated that there may be threatened and endangered or sensitive wildlife and fish species in the Fernan Lake Watershed, and these include:

- Bald Eagle
- Gray Wolf
- Wolverine

- Black-backed woodpecker
- Flammulated owl
- Goshawk
- Boreal toad
- Coeur d'Alene salamander
- Northern leopard frog
- Fisher
- Torrent sculpin
- Westslope cutthroat trout (Project Checklist 2000)

Some of the above species are documented in this watershed and some are suspected of residing in the watershed. For example, if there is documentation supporting the fisher, wolverine, or goshawk in the watershed, then steps will be taken such as road closures to protect these species. There are road closures in other forest watersheds that have documented evidence of these species.

Bird Species using the Fernan Lake Watershed have been documented for over thirty years and records are part of the Coeur d'Alene Audubon Society's database. Biologists have provided data on all levels of "priority species".

Other Issues

Gas and oil contaminants were discussed. Due to the design of venting systems, most boat gas tanks tend to overflow when they are filled. Exhaust from two-cycle engines also contains petroleum products. Oil leaking from seals may be a problem. Concern was expressed regarding people filling gas tanks from five-gallon cans, but this does not appear to be an important issue on Fernan Lake.

Burning of driftwood and dock debris on the beach was discussed. This is a common way to clean up in the spring. If left on the beach and in the water, large wooden debris makes good fish and wildlife habitat.

The use of Thompson's Waterseal to preserve docks was discussed. Since the decking lasts much longer than the supporting structure, preserving the wood with these types of products is unnecessary. The Association felt education on this issue is needed. Educational ideas were discussed including public service announcements, distribution of pamphlets at area businesses, and publication of newspaper articles.

Atmospheric deposition of dust and nutrients was discussed. This contributes to the total phosphorus load to the lake. This material probably comes as dust from Eastern Washington and the Palouse, smoke from slash and grass burning, and roads in the watershed. In the spring, paved roads are often cleaned without water, which stirs up a great deal of dust (enough that cars must turn on their lights).

Concern was also expressed regarding erosion control procedures (silt fence, timing of projects, re-vegetation of cuts and fills) used by the East Side Highway District.

SUMMARY AND GENERAL CONCLUSIONS

In examining the history of the Fernan Lake Watershed, it is clear that monitoring of the Lake from a scientific standpoint has been sporadic until March of 2003. The City of Fernan Lake Village, along with dedicated citizens and public agency representatives developed a plan that not only included research on many different areas; the plan established a base line of scientific data that can be used to evaluate trends for the watershed. Past scientific data indicated that Fernan Lake was a moderate algae productivity lake, and now current studies in 2003 show that Fernan Lake can exhibit high algae productivity characteristics. Changes during 2003 in the Secchi depth and chlorophyll a readings are a serious concern and indicate accelerated algae production

With its warm shallow depth, the lake is at risk for accelerated degradation with increased phosphates. Scientific evidence indicates that phosphorus is carried to surface water by disturbed sediment, which is usually disturbed by man-made activities.

Scientific evidence also indicates that there is a correlation between steep slopes, man-made activity and increased sediment loading into surface water. New construction, including road building adjacent to the lake, is a primary cause of sediment loading into the lake.

Control of phosphorus inputs is critical to managing the water quality of Feman Lake. Strict regulations on grading, erosion control and stormwater management are critical in preventing sediment loading into the lake. Recent scientific studies indicate that the Fernan Watershed hillsides are much steeper than previously reported. The geology and the soils that surround Fernan Lake indicate that steep hillsides are prone to landslides and slumping

Many of the slopes surrounding Fernan Lake are over 35% slope, and there are many underground springs on the hillsides surrounding the lake. .It is imperative to require site specific hydrologic and geologic studies prior to man made development. Road building, infrastructure or structures should be prohibited on slopes over 35%, where the soil types and geology indicate a hazard

The GIS Analysis of the watershed indicates that currently, in 2003, each parcel within the watershed have areas that are less than a 35% slope, and as such can be built on without a risk of losing private property rights.

It was the consensus of the Technical Advisory Group that Fernan Lake is at a critical stage and immediate action is necessary. Many of the strategies outlined in the following action plan seek to not only stabilize but improve the water quality of the Lake.

IMPLEMENTATION AND ACTION

The Technical Advisory Group reviewed the history of water quality in the Watershed, reviewed the chronology of actions taken by citizens to improve the water quality and studied the data that was collected in 2003. The following pages reflect the action plan that the group felt was necessary to begin improving the water quality of Feman Lake and watershed. Goals have been established with accompanying strategies to achieve those goals. Each strategy envisions a lead agency or authority that will be primarily responsible to implement that strategy.

FERNAN LAKE WATERSHED ACTION PLAN
November 2003

The following tables outline the actions which are recommended to improve the water quality of Fernan Lake Watershed. Each action is followed by a "lead group" designation and an "action level" rating. Lead group acronyms are defined at the end of these tables. Action levels are defined as:

1 = Immediate Action Needed 2 = Action Needed Following Implementation of Action Level 1 Items
3 = Action Needed - Not As Imperative As Levels 1 and 2

Wastewater

Goal 1: Reduce other contaminant loading from new and existing septic systems.

Management Actions	**Action Level**	**Lead Groups**
Replace existing substandard septic systems when they have failed with new systems. Utilize State of Idaho Cost Share Program	3	PHD/DEQ
Encourage an upgrade of substandard septic systems when they have been identified during evaluation for lending or mortgage purposes	2	PHD
Continue to work with the State of Idaho Technical Guidance Committee on system design standards. Recommend to Technical Committee guidelines on steep slopes.	3	DEQ/PHD
Work with Legislators to strengthen regulations for septic systems distance from surface water	3	Fernan/ CdA/ Association

Stormwater and Erosion From Future Development

Goal 2: Minimize quantity of runoff and associated contaminants entering Fernan Lake

Management Actions	Action Level	Lead Group(s)
Prohibit grading and development on sites over 35% that have hazardous or erodible soils and geology	1	KC/Fernan/CdA
Adopt performance based hillside grading and development standards which are scientifically based and which are consistent with the intent of this plan.	1	KC/Fernan/CdA
Increase building officials, contractors and the general public awareness of erosion and sedimentation impacts to water quality	1	KC/Fernan/CdA
Modify hillside, zoning, subdivision shoreline and site disturbance ordinances to increase surface water setbacks in conjunction with native vegetation buffers as follows: Existing platted lots adjacent to Lake: 75' horizontal buffer of native vegetation with ability to vary standards with topographic hardship/ New lots and subdivisions adjacent to Lake: 75' no build horizontal buffer of native vegetation/New lots and subdivisions within 250' of Lake: building envelopes with vegetative buffers	1	KC/Fernan/CdA
Minimize removal of vegetation during construction; establish clearing limitations before, during and after construction	1	KC/Fernan/CdA
Adopt Kootenai County Site Disturbance Ordinance as the standard document for jurisdictions to follow regarding grading, erosion control and site disturbance.	1	Fernan/CdA
Improve enforcement of grading, erosion control and site disturbance	1	KC/Fernan/CdA
Work with landowners to voluntarily reduce development of sensitive/hazardous or high impact (steep, highly erodible landslides). Examine Transfer of Development Rights as an option to development of sensitive sites.	2	KC/Fernan/ CdA/ Association

Stormwater From Existing Development (excluding roads)

Goal 3: Minimize quantity of runoff and associated contaminants entering Fernan Lake Watershed.

Management Actions	Action Level	Lead Group(s)
Encourage homeowners to reduce stormwater flows and sediment/ phosphorus export by converting lawns to native vegetation. Recognize with T-shirts, certificates, etc. Develop cost share program. Develop tax incentives.	3	Association
Educate homeowners on stormwater (and general lake) impacts and management options so they recognize problems when they see them. Exhibit at Home and Garden Show(s) (e.g. info on drip line trenches, level spreaders, "lake friendly" no P fertilizer, slow release fertilizer, frequency of fertilization, seeding of cuts/ fills/ cleaned ditches/ defoliated areas, burning on beaches and in ditches etc.). Distribute flyers and/or door hangers. Contact local nurseries and garden stores regarding distribution of information. Ask landscapers to provide information. Mail info to watershed residents. Provide info to new residents, through title companies. Provide information to lakefront homeowners, schools and Eastside Highway District. Use media to inform the public about stormwater issues and options. Distribute bumper stickers (school fund raiser?).	3	Association
Recognize contractors who do a good job controlling erosion and managing stormwater.	2	KC/Fernan/ CdA
Explore outside funding sources.	3	Association
Explore IGA tree program as a source of trees for revegetation.	3	Association

Runoff From Public and Private Roads and Driveways (excluding logging roads)

Goal 4: Reduce the quantity of runoff, sediment and phosphorus being exported from roads in the watershed.

Management Actions	Action Level	Lead Groups
Expand Highway District, Fernan Lake Village, Coeur d'Alene and County road ordinances, policies and procedures to address water quality and slope stability concerns. Evaluate cumulative water quality effects of new roads and associated development prior to subdivision/road approval (slope stability, erosion, stormwater runoff etc.). Modify road maintenance procedures to reduce water quality impact (e.g. control dust on unpaved roads and parking areas, clean paved roads with water to reduce dust, time projects to avoid rainy seasons, provide erosion control and revegetation during cleaning of ditches, replacement of culverts etc.).	1	HWY/KC/ Fernan/ CdA
Improve construction and maintenance of private roads and driveways, to minimize their effect on water quality. Inventory location and condition of private roads. Develop incentives for improving private roads. Develop construction and maintenance guidelines for private roads and driveways.	1	KC/Fernan/ CdA
Identify and correct stormwater problems with existing roads, to reduce their effect on water quality. Develop no net increase in phosphorus regulations in conjunction with a mitigation program for existing private, Highway District and Forest Service roads. Retrofit existing roads with stormwater treatment systems. Retrofit existing drainage structures which are not accessible to fish.	2	HWY/KC/ Fernan/ CdA
Adopt the recommendations of the Fernan Conservation and Recreation Association on rebuilding and improving Fernan Lake Road. Recommend to USFS and Hwy District to establish Fernan Lake Road as a scenic byway.	1	HWY/ Association
Discontinue conversion of temporary, forest roads to year round, residential use without upgrading the construction of the road to make it adequate for residential traffic.	2	KC

Runoff From Timber Land (USFS, State and privately owned)

Goal 5: Minimize sediment and phosphorus export from lands used for timber production.

Management Actions	Action Level	Lead Groups
Continue public education with recreational clubs regarding water quality impacts.	1	USFS
Develop standards to protect water quality from recreational impacts.	1	USFS
Remove unneeded roads and reconstruct substandard logging roads, to reduce their effect on water quality.	1	USFS/ IDL/ KC
Develop and implement a plan to maintain, and if necessary, improve the stability of stream channels on private, state and federal land which has been over harvested.	1	USFS/ IDL
Participate in County, City, State and USFS planning efforts to ensure that other plans are consistent with or more stringent than this plan.	1	KC/ USFS/ IDL/ CdA/ Fernan/ PHD
Distribute forest management information and studies.	2	USFS/ IDL/ IFIA
Encourage landowners to maintain land in timber production by preventing neighboring property values from affecting the value of timber land (e.g. through conservation easements).	2	KC/ Association/ Fernan/ CdA
Develop additional *BMPs* in the watershed where streams and water quality are impaired by the cumulative effects of timber harvest.	1	IDL/ DEQ
Support Department of Lands to hire additional staff to monitor and inspect timber harvest and road building activities.	2	IDL
Eliminate property tax inequities for preserving trees (i.e. higher taxes for those who conserve trees).	1	KC/ Association
Develop an enforcement mechanism to ensure that property tax breaks for land in timber production are contingent upon compliance with a harvest management plan and the Forest Practices Act regulations.	1	KC
Manage timber to minimize potential water quality impacts of wildfire, such as wildlife habitat.		USFS/ IDL

Agriculture		
Management Actions Goal 6: Prevent increases in sediment and nutrient loading from grazing	Action Level	Lead Groups
Encourage the continued use of good livestock management best management practices	1	SCS,SCD
Identify farms which are impacting water quality, provide them with information on livestock management *BMPs*	2	KCE,SCS, SCD
Establish recommended animal densities to minimize their effect on water quality.	3	SCS,KCE
Retain native vegetation buffers along lake, creeks and drainage ways to help remove sediment and pollutants, maintain bank stability and provide good fish habitat	1	KC
Use incentives to encourage the use of *BMPs* and conservation plans	2	SCS, SCD

Miscellaneous		
Management Actions	Action Level	Lead Groups
Improve State Water Quality Standards to make them easier to enforce and more effective at protecting water quality and beneficial uses; continue to revise *BMPs* for construction activities and adopt local and/or State sediment standards for Fernan Lake Watershed and its tributaries.	1	DEQ
Maintain the existing citizens volunteer monitoring program, and support additional monitoring in the watershed to: -Evaluate the effectiveness of actions implemented pursuant to this plan, -Identify water quality trends, --Quantify sediment and nutrient export from residential developments, on varying slopes and soils.	1	DEQ/ Association
Discourage the use of wood sealants and preservatives on the decking of docks.	2	KC/ Fernan/ CdA
Request that Dept. of Lands require permits for removal of docks which are replaced.	3	IDL
Request that the Cities of CDA and Fernan sponsor an annual clean up day for small debris on the beach (to reduce the amount of burning which occurs).	2	Fernan/ CdA/ Association

Implementation		
Management Actions	Action Level	Lead Groups
Continue to hold regular Fernan Lake Conservation and Recreation Association meetings	1	Association
Research funding opportunities for continued education, training, research and monitoring	2	Association
Actively support public agencies in implementation and enforcement of the Plan	1	Association
Monitor water quality of the lake and watershed on a regular basis	2	Association
Propose legislation that will be used to improve water quality for the watershed	3	Association
Propose to amend or modify ordinances to increase sensitive surface water buffers and to reflect standards for distances based upon slope	1	Association
Work with agencies to increase ability to obtain information on any encroachment permits that will affect the Watershed	2	Assoc/DOL
Develop a "Partners in Preservation" that will work toward programs of acquiring sensitive land through purchase, exchange, or dedication. Assist in the formation of conservation easements. Pursue transfer of development rights programs and propose to public agencies adoption of regulations that support transfers, easements and exchanges.	2	Association

Abbreviations:

Fernan- City of Fernan Lake
KC- Kootenai County
HWY- East Side Highway District
IDL- Idaho Department of Lands
USFS- U.S. Forest Service
ITD- Idaho Transportation Department
PHD- Panhandle Health District
CdA- City of Coeur d'Alene
DEQ- Division of Environmental Quality
F&G- Idaho Department of Fish and Game
SCS- Soil Conservation Service
Association- Fernan Watershed Conservation and Recreation Association

APPENDIX A
GLOSSARY

Acidic deposition: Transfer of acids and acidifying compounds from the atmosphere to terrestrial and aquatic environments via rain, snow, sleet, hail, cloud droplets, particles, and gas exchange.

Adsorption: The adhesion of one substance to the surface of another. Clays, for example, can absorb phosphorus and organic molecules.

Aerobic: Describes life or processes that require the presence of molecular oxygen.

Algae: Small aquatic plants that occur as single cells, colonies, or filaments.

Allochthonous: Materials (e.g., organic matter and sediment) that enter a lake from the atmosphere or drainage basin (see autochthonous).

Anaerobic: Describes processes that occur in the absence of molecular oxygen.

Anoxia: A condition of no oxygen in the water. Often occurs near the bottom of fertile stratified lakes in the summer and under ice in late winter.

Autochthonous: Materials produced within a lake, e.g., autochthonous organic matter from plankton versus allochthonous organic matter form terrestrial vegetation.

Bathymetric map: A map showing the bottom contours and depth of a lake. Can be used to calculate lake volume.

Benthos: Macroscopic (seen without aid of a microscope) organisms living in and on the bottom sediments of lakes and streams. Originally, the term meant the lake bottom, but it is now applied almost uniformly to the animals associated with the substrate.

Best Management Practice (BMP): A method of minimizing nonpoint source pollutants.

Biochemical Oxygen Demand (BOD): The rate of oxygen consumption by organisms during the decomposition (= respiration) of organic matter, expressed as grams oxygen per cubic meter of water per hour.

Biomass: The weight of biological matter. Standing crop is the amount of biomass (e.g., fish or algae) in a body of water at a given time. Often measured in terms of grams per square meter of surface.

Biota: All plant and animal species occurring in a specified area.

Chemical Oxygen Demand (COD): Nonbiological uptake of molecular oxygen by organic and inorganic compounds in water.

Chlorophyll: A green pigment in algae and other green plants that is essential for the conversion of sunlight, carbon dioxide, and water to sugar. Sugar is then converted to starch, proteins, fats, and other organic molecules.

Chlorophyll a: A type of chlorophyll present in all type of algae, sometimes in direct proportion to the biomass of algae.

Cluster Development: Placement of housing and other buildings of a development in groups to provide larger areas of open space.

Consumers: Animals that cannot produce their own food through photosynthesis and must consume plants or animals for energy (see producers).

DEQ: Idaho Department of Environmental Quality.

Decomposition: The transformation of organic molecules (e.g., sugar) to inorganic molecules (e.g., carbon dioxide and water) through biological and non-biological processes.

Delphi: A technique that solicits potential solutions to a problem situation from a group of experts and then asks the experts to rank the full list of alternatives.

Density flows: A flow of water of one density (determined by temperature or salinity) over or under water of another density (e.g., flow of cold river water under warm reservoir surface water).

Detritus: Nonliving dissolved and particulate organic materials from the metabolic activities and deaths of terrestrial and aquatic organisms.

Drainage basin: Land area from which water flows into a stream or lake (see watershed).

Drainage lakes: Lakes having a defined surface inlet and outlet.

Ecology: Scientific study of relationships between organisms and their environment. Also defined as the study of the structure and function of nature.

Ecosystem: A system of interrelated organisms and their physical-chemical environmental. If this term is used in the document, the ecosystem would be usually defined to include the lake and its watershed.

Effluent: Liquid wastes from sewage treatment, septic systems, or industrial sources that are released to surface water.

Environment: Collectively, the surrounding conditions, influences, and living and inert matter that affect a particular organism or biological community.

Epilimnion: Collectively, the surrounding conditions, influences, and living and inert matter that affect a particular organism or biological community.

Epilimnion: Uppermost, warmest, well-mixed layer of a lake during summertime thermal stratification. The epilimnion extends from the surface to the thermocline.

Erosion: Breakdown and movement of land surface, which is often intensified by human disturbances.

Eutrophic: From Greek for "well-nourished", describes a lake of high photosynthetic activity and low transparency.

Eutrophication: The process of physical, chemical, and biological changes associated with nutrient, organic matter, and silt enrichment and sedimentation of a lake or reservoir. If the process is accelerated by man-made influences, it is termed cultural eutrophication.

Fall overturn: The autumn mixing, top to bottom, of lake water caused by cooling and wind-derived energy.

Fecal coliform test: Most common test for the presence of fecal material from warm-blooded animals. Fecal coliforms are measured because of convenience. They are not necessarily harmful, but indicate the potential presence of other disease-causing organisms.

Floodplain: Land adjacent to lakes or rivers that is covered as water levels rise and overflow the normal water channels.

Flushing rate: The rate at which water enters and leaves a lake relative to lake volume, usually expressed as time needed to replace the lake volume with inflowing water.

Flux: The rate at which a measurable amount of a material flows past a designated point given amount of time.

Food chain: The general progression of feeding levels from primary producers, to herbivores, to planktivores, to the larger predators.

Food web: The complex of feeding interactions existing among the lake's organisms.

Forage fish: Fish, including a variety of panfish and minnows, which are prey for game fish.

Groundwater: Water found beneath the soil's surface. Saturates the stratum at which it is located and is often connected to lakes.

Hard water: Water with relatively high levels of dissolved minerals, such as calcium, iron and magnesium.

Hydrographic Map: A map showing the location of areas or objects within a lake.

Hydrologic cycle: The circular flow or cycling of water form the atmosphere to the earth (precipitation) and back to the atmosphere (evaporation and plant transpiration). Runoff, surface water, groundwater, and water infiltrated in soils are all part of the hydrologic cycle.

Hypolimnion: Lower, cooler layer of a lake during summertime thermal stratification.

IDL: Idaho Department of Lands.

Influent: A tributary stream.

Internal nutrient cycling: Transformation of nutrients, such as nitrogen or phosphorus form biological to inorganic forms through decomposition, occurring within the lake itself.

Isothermal: The same temperature throughout the lake.

Lake: A considerable inland body of standing water, either naturally formed or man-made.
Lake District: A special purpose unit of government with authority to manage a lake(s) and with financial powers to raise funds through a mill levy, user charge, specials assessment, bonding, and borrowing. May or may not have police power to inspect septic systems, regulate surface water, use, or zone land.

Lake management: The practice of keeping lake quality in a state such that attainable uses can be achieved.

Lake protection: The act of preventing degradation or deterioration of attainable lake uses.

Lake restoration: The act of bringing a lake back to its attainable uses.

Lentic: Relating to standing water (versus lotic, running water).

Limnology: Scientific study of fresh water, especially the history, geology, biology, physics, and chemistry of lakes. Also termed freshwater ecology.

Littoral zone: That portion of a waterbody extending from the shoreline lakeward to the greatest depth occupied by rooted plants.

Loading: The total amount of material (sediment, nutrients, oxygen-demanding material) brought into the lake by inflowing streams, runoff, direct discharge through pipes, groundwater, the air, and other sources over a specific period of time (often annually).

Macroinvertebrates: Aquatic insects, worms, clams, snails, and other animals visible without aid of a microscope, that may be associated with or live on substrates such as sediments and macrophytes. They supply a major portion of fish diets and consume detritus and algae.

Macrophytes: Rooted and floating aquatic plants commonly referred to as waterweeds. These plants may flower and bear seed. Some forms, such as duckweed and coontail (Ceratophyllum), are free-floating forms without roots in the sediment.

Mandatory Property Owners Association: Organization of property owners in a subdivision or developments with membership and annual fee required by Covenants on the property deed. The Association will often enforce deed restrictions on members' property and may have common facilities such as bathhouse, clubhouse, golf course, etc.

Marginal zone: Area where land and water meet at the perimeter of a lake. Includes plant species, insects, and animals that thrive in this narrow, specialized ecological system.

Mesotrophic: A stage of the lake that includes moderate algal productivity; generally compatible with all recreational uses. Algal blooms are occasional, but generally of low to moderate intensity. Oxygen depletion is common in bottom waters, and cold-water fisheries may be endangered in some shallow lakes.

Metalimnion: Layer of rapid temperature and density change in a thermally stratified lake. Resistance to mixing is high in the region.

Morphometry: Relating to a lake's physical structure (e.g., depth, shoreline length).

Nekton: Large aquatic and marine organisms whose mobility is not determined by water movement, for example, fish and amphibians.

Nominal group process: A process of soliciting concerns/issues/ideas from members of a group and ranking the resulting list to ascertain group priorities. Designed to neutralize dominant personalities.

Nutrient: An element or chemical essential to life, such as carbon, oxygen, nitrogen, and phosphorus.

Nutrient budget: Quantitative assessment of nutrients (e.g., nitrogen or phosphorus) moving into, being retained in, and moving out of an ecosystem. Commonly constructed for phosphorus because of its tendency to control lake trophic state.

Nutrient cycling: The flow of nutrients from one component of an ecosystem to another, as when macrophytes die and release nutrients that become available to algae (organic to inorganic phase and return).

Oligotrophic: "Poorly nourished," from the Greek. Describes a lake of low plant productivity and high transparency.

Ooze: Lake bottom accumulation of inorganic sediments and the partially decomposed remains of algae, weeds, fish, and aquatic insects. Sometimes called mulch (see sediment).

Ordinary high water mark: Physical demarcation line, indicating the highest point that water level reaches and maintains for some time. The line is visible on rocks, or shoreline, and by the location of certain types of vegetation.

Organic matter: Molecules manufactured by plants and animals and containing linked carbon atoms and elements such as hydrogen, oxygen, nitrogen, sulfur, and phosphorus.

Pathogen: A microorganism capable of producing disease. They are of great concern to human health relative to drinking water and swimming beaches.

Pelagic zone: This is the open area of a lake, from the edge of the littoral zone to the center of the lake.

Perched: A condition where the lake water is isolated from the groundwater table by impermeable material such as clay.

Ph: A measure of the concentration of hydrogen ions of a substance which ranges form very acid (Ph=1) to very alkaline (Ph=14). Ph 7 is neutral and most lake waters range between 6 and 9. Ph values less than 6 are considered acidic, and most life forms can not survive at a Ph of 4.0 or lower.

Photic zone: The lighted region of a lake where photosynthesis takes place. Extends down to a depth where plant growth and respiration are balanced by the amount of light available.

Phytoplankton: Microscopic algae and microbes that float freely in open water of lakes.

Plankton: Planktonic algae float freely in the open water. Filamentous algae form long threads and are often seen as mats on the surface in shallow areas of the lake.

Primary productivity: The rate at which algae and macrophytes fix or convert light, water, and carbon dioxide to sugar in plant cells. Commonly measured as milligrams of carbon per square meter per hour.

Producers: Green plants that manufacture their own food through photosynthesis.

Profundal zone: Mass of lake water and sediment occurring on the lake bottom below the depth of light penetration.

Reservoir: A man-made lake where water is collected and kept in quantity for a variety of uses, including flood control, water supply, recreation and hydroelectric power.

Residence time: Commonly called the hydraulic residence time. The amount of time required to completely replace the lake's current volume of water with an equal volume of "new" water.

Respiration: Process by which organic matter is oxidized by organisms, including plants, animals, and bacteria. The process releases energy, carbon dioxide, and water.

Secchi depth: A measure of transparency of water obtained by lowering a black and white, or all white, disk (Secchi disk, 20 cm in diameter) into water until it is no longer visible. Measured in units of meters or feet.

Sediment: Bottom material in a lake that has been deposited after the formation of a lake basin. It originates from remains of aquatic organisms, chemical precipitation of dissolved minerals, and erosion of surrounding lands (see ooze).

Seepage lakes: Lakes having either an inlet or outlet (but not both) and generally obtaining their water from groundwater and rain or snow.

Soil retention capacity: The ability of a given soil type to absorb substances such as phosphorus, thus retarding their movement to the water.

Stratification: Layering of water caused by differences in water density. Thermal stratification is typical of most deep lakes during summer. Chemical stratification can also occur.

Swimmers itch: A rash caused by penetrations into the skin of the immature stage (cercaria) of a flatworm (not easily controlled due to complex life cycle). A shower or alcohol rubdown should minimize penetration.

Thermal stratification: Lake stratification caused by temperature-created differences in water density.

Thermocline: A horizontal plane across a lake at the depth of the most rapid vertical change in temperature and density on a stratified lake (see metalimnion).

Topographic map: A map showing the elevation of the landscape at contours of 2, 5, 10, or 230 feet. Can be used to delineate the watershed.

Trophic state: The degree of eutrophication of a lake. Transparency, chlorophyll a levels, phosphorus concentrations, amount of macrophytes, and quantity of dissolved oxygen in the hypolimnion can be used to assess state.

Voluntary Lake Property Owners Association: Organization of property owners in an area around a lake that members join at their option.

Water column: Water in the lake between the interface with the atmosphere at the surface and the interface with the sediment layer at the bottom. Idea derives from vertical series of measurements (oxygen, temperature, phosphorus) used to characterize lake water.

Water table: The upper surface of groundwater. Below this point, the soil is saturated with water.

Watershed: A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.

Zooplankton: Microscopic animals that float freely in lake water, graze on detritus particles, bacteria, and algae, and may be consumed by fish.

APPENDIX B

PRELIMINARY WETLAND RESULTS

This section describes the results from the data obtained during field investigations for hydrology, soils, and vegetation. Final determination of jurisdictional wetlands in the area is used to determine the category of each wetland.

<u>Hydrology</u>

Fernan Creek and Fernan Lake are the major hydrological features in the vicinity. The wetlands in Segment 1 are located to the north of Lily pad Bay and the road fill that crosses it. Two intermittent streams and seepage from the south side of the existing road provide hydrology to this area. Wetlands in Segment 2 are associated with Fernan Creek. Fernan Creek and runoff from the east hillside provide hydrology for the wetland areas on the east side of the project corridor. Runoff from perennial and intermittent draws on the west side of the road and groundwater seepage from Fernan Creek provides hydrology to the wet areas on the west side of the project corridor. Fernan Creek and its tributaries have been channeled, ditched, and diverted for agricultural ponds and farming in several locations in the project area.

Observations concerning existing wetland hydrology along Fernan Lake Road include:

- Fernan Lake is located at the toe of the slope on the south side of the existing Fernan Lake Road from the beginning of the project to MP 2.2.

- From MP 2.05 to MP 2.10, a ponded wetland area exists on the north side of the road.

- From MP 2.2 to MP 2.35, Fernan Lake transitions from shallow, open water closer to a wetland area containing emergent and shrub vegetation with pockets of standing water by MP 2.35. There are several braided meandering channels of the creek in this area, ranging across the full width of the valley.

- From MP 2.35 to MP 2.6, the creek channel is more than 150 m (500 ft) from the road. There is also a man-made channel (ditch) about 1.5 m (5 ft) paralleling the road. A wetland meadow exists between the two channels.

- Between MP 2.6 and MP 2.8, the main channel meanders back toward the road and parallels the road at a distance of 15 to 30 m (50 to 100 ft). The second, man-made channel continues to follow the road closely about 1.5 m (5 ft) from the edge of pavement. A wet meadow is located between the man-made channel and beyond the main channel of Fernan Creek.

- From MP 2.8 to MP 2.95, the main Fernan Creek splits and a portion of the channel moves to the base of the hillside and a portion connects with the man-made channel adjacent to the road. A wet meadow is located between the man-made channel and the main channel of Fernan Creek.

- From MP 2.95 to MP 3.45, water from the main channel of Fernan Creek (which is dry during a part of the year) is diverted into man-made agricultural ponds approximately 120 m (400 ft) from the road. There is a still a man-made channel approximately 1.5 m (5 ft) from the edge of pavement. A wet meadow exists between the man-made channel and the agricultural ponds.

- From MP 3.45 to MP 3.6, the man-made channel immediately east of the road transitions to a roadside ditch with wetland vegetation. The main creek channel approaches the road, moving from 120 m (400 ft) to about 60 m (200 ft) from the road, and is dry during a part of the year. The wet meadow ends at MP 3.52. The hydrology in this area has been altered by past and ongoing adjacent land uses, including the construction of livestock ponds, which are fed by the creek. Flows are seasonal due to the alteration of the streambed, which has broken through the clay layer allowing subsurface flows during low flow periods (summer months).

- From MP 3.6 to MP 3.9, Feman Creek meanders closer to the road. The channel is deeply incised and there are no associated wetlands. Flows are seasonal in Fernan Creek in this area. The topography rises sharply on the west side of the road from the toe of slope.

- At MP 3.9, concrete slabs have been placed to redirect the creek channel to the east, away from the residences.

- Between MP 3.9 and MP 4.2, Fernan Creek flows behind residences, approximately 90 m (300 ft) east of the road. The creek begins to resurface in this area and flows year-round.

- From MP 4.2 to MP 4.8, the creek flows through a topographically low, wet area with pockets of standing water. There are several natural springs, which provide hydrology to the wetland area and creek.

- At MP 4.8, the creek has been altered by agricultural practices, and several man-made agricultural ponds have been constructed in this area.

- From MP 4.8 to MP 5.1 north of the residences, the stream bed is dry during part of the year. The creek is located between about 60 m (200 ft) to 23 m (75 ft) from the road.

- From MP 5.1 to MP 5.3, the creek resurfaces and moves farther east, approximately 61 m (200 ft) from the eastern side of the road, toward the mountains.

- From MP 5.3 to Feman Saddle, the topography rises to an elevation of 1,238 m (4,061 ft) at Feman Saddle. Eleven ephemeral and two intermittent draws cross under the road. The ephemeral draws are located at approximately MP 6.0 (Smith Gulch); MP 6.9 (Jungle Gulch); and MP 7.2, MP 8.2, MP 8.5, MP 8.8, MP 8.9, MP 9.3, MP 9.6, and MP 9.8, which are all unnamed drainages. Intermittent drainages are located at MP 7.1 (State Creek) and MP 10.3 (Feman Creek). The road reaches Feman Saddle at MP 10.7.

Soils

The Soil Survey of Kootenai County Area (SCS, 1981) maps the soil in the vicinity from MP 0.0 to MP 5.0 (Segments 1 and 2), but does not map the area within the IPNF from MP 5.0 to MP 10.7 (Segment 3). In the IPNF portion of the corridor, the topography rises sharply and hydric soils are not likely present. During field investigations, no wetlands along the study corridor in Segment 3 were found. Soil profiles examined during the field investigation confirmed the presence of the mapped soil associations. Typically, the wet areas had profiles of very dark gray (10YR 3/1), black (10YR 2/1), dark grayish-brown (10YR 4/2) with medium mottling, greenish-black (10Y 2.5/1), light greenish-gray (10Y 7/1), dark gray (10YR 4/1), gray (10YR 5/1), black (2.5Y 2/0), dark reddish-gray (2.5Y 4/1), dark gray (10Y 4/0), and very dark brown silt loams (10YR 3/2) with medium mottling. These are considered hydric soils. The soils in the dry areas that were examined during the field investigation displayed non-hydric soil profiles of dark brown (10YR 3/2), brown (10YR 4/3), very dark brown (10YR 2/2), light brownish-gray (2.5Y 6/2), and dark grayish-brown (10YR 4/2) with no mottling.

Vegetation

Vegetation in the area can generally be classified into four associations. The first association, most commonly found in the upland areas located on the west and east sides of the road from MP 0.0 to MP 5.0, is dominated by upland tree, shrub, and herb species (Table 7). Many of the species in this association are non-hydrophytic or upland species. Plant communities that are dominated by these species are considered non-hydrophytic or upland plant communities.

Table 7. Plant species observed in Association 1.

Stratum	Common name	Scientific name	Wetland Indicator Status*
Trees	Cascara	Rhamnus purshiana	FAC–
	Ponderosa pine	Pinus ponderosa	FACU
Shrubs	Blue elderberry	Sambucus caerula	FACU
	Red elderberry	Sambucus racemosa	FACU
	Snowberry	Symphoricarpos alba	FACU
Herbs	California oatgrass	Danthonia californica	FACU
	Canada thistle	Cirsium arvense	FACU+
	Common plantain	Plantago major	FACU+
	Common timothy	Phleum pratense	FAC–
	Dandelion	Taraxacum officinale	FACU
	Foothill sedge	Carex tumulicola	NL
	Lupine	Lupinus micranthus	NL
	Meadow foxtail	Alopecurus pratensis	FACW
	Mullein	Verbascum thapsus	UPL
	Perennial ryegrass	Lolium perenne	FACU
	Quackgrass	Agropyron repens	FAC–
	Red clover	Trifolium partense	FACU
	Reed canarygrass	Phalaris arundinacea	FACW
	Sheep sorrel	Rumex acetosella	FACU+
	Spotted knapweed	Centaurea biebersteinii	UPL
	St. Johns wort	Hypericum perforatum	NL
	Tansy	Tanacetum vulgare	NL
	White sweet clover	Melilotus alba	FACU
	Yarrow	Achillea millefolium	FACU

Source: Reed, 1993

The second association includes the wetland species located from MP 1.95 to MP 3.04. This area includes both sides of the road at Lily pad Bay and the east side of the road in the wetland meadow adjacent to Fernan Creek and is dominated by herbs found in standing water or on the periphery of standing water and are listed in Table 8. Many of the species in this association are hydrophytic. The third association is most commonly found in the wet areas associated with Fernan Creek and topographically low areas on the east and west sides of the road from MP 3.04 to MP 5.0. These areas contain wetland tree, shrub and herb species, which are listed in Table 9. Many of the species in this association are hydrophytic.

Table 8. Plant species observed in Association 2.

Stratum	Common name	Scientific name	Wetland Indicator Status*
Herbs	American speedwell	Veronica americana	OBL
	American water-lily	Nymphaea odorata	OBL
	beaked sedge	Carex utriculata	OBL
	broadleaf water-plantain	Alisma plantago-aquatica	OBL
	Canada waterweed	Elodea canadensis	OBL
	common bladderwort	Utricularia vulgaris	OBL
	common duckweed	Lemna minor	OBL
	creeping spikerush	Eleocharis palustris	OBL
	different leaved water-starwort	Callitriche heterophylla	OBL
	field mint	Mentha arvensis	FACW–
	floating leaf pondweed	Potamogeton natans	OBL
	giant burreed	Sparganium eurycarpum	OBL
	large duckweed	Spiradela polyrhiza	OBL
	large-leaf pondweed	Potamogeton amplifolius	OBL
	marsh speedwell	Veronica scutellata	OBL
	meadow foxtail	Alopecurus pratensis	FACW
	narrowleaf burreed	Sparganium ermersum	OBL
	needle spikerush	Eleocharis acicularis	OBL
	northern clustered sedge	Carex arcta	OBL
	ovoid spikerush	Eleocharis ovata	OBL
	prostrate knotweed	Polygonum aviculare	FACW–
	reed canarygrass	Phalaris arundinacea	FACW
	sawbeak sedge	Carex stipata	OBL
	slenderbeak sedge	Carex athrostachya	FACW
	slough sedge	Carex obnupta	OBL
	small-flowered forget-me-not	Myosotis laxa	OBL
	small-fruited bulrush	Scirpus microcarpus	OBL
	tule	Scirpus acutus	OBL
	water horsetail	Equisetum fluviatile	OBL
	western water hemlock	Cicuta douglasii	OBL
	yellow pond-lily	Nuphar polysepalum	OBL

Table 9. Plant species observed in Association 3.

Stratum	Common name	Scientific name	Wetland Indicator Status*
Trees	black cottonwood	Populus balsamifera	FAC
	western red cedar	Thuja plicata	FAC
	willow	Salix sp.	at least FAC
Shrubs	Douglas hawthorne	Crataegus douglasii	FAC
	pacific ninebark	Physocarpos capitatus	FACW–
	red-osier dogwood	Cornus stolonifera	FACW
	serviceberry	Amelanchier alnifolia	FACU
	snowberry	Symphoricarpos alba	FACU
Herbs	cattail	Typha latifolia	OBL
	cow parsnip	Heracleum lanatum	FAC
	creeping buttercup	Ranunculus repens	FACW
	curly dock	Rumex crispus	FAC+
	field horsetail	Equisetum arvense	FAC
	field mint	Mentha arvensis	FACW–
	lady fern	Athyrium felix-femina	FAC
	meadow foxtail	Alopecurus pratensis	FACW
	Menzies' larkspur	Delphinium menziesii	UPL
	quackgrass	Agropyron repens	FAC–
	redtop bentgrass	Agrostis alba	FAC
	reed canarygrass	Phalaris arundinacea	FACW
	small flowered bedstraw	Galium trifidum	FACW+
	small flowering wood rush	Luzula parviflora	FAC–
	small-flowered forget-me-not	Myosotis laxa	OBL
	spirea	Spiraea douglasii	FACW
	stinging nettle	Urtica dioica	FAC
	tall managrass	Glyceria elata	FACW
	thimbleberry	Rubus parviflorus	FAC–
	water parsley	Oenanthe samentosa	OBL
	white clover	Trifolium repens	FAC
	wild strawberry	Fragaria vesca	NL

Source: Reed, 1993

The fourth association is most commonly found in the upland areas on both the west and east sides of the road from MP 5.0 to the Fernan Saddle. The vegetation along the edge of both sides of the road consists of mullein, spotted knapweed, Canada thistle, and white sweet clover. Some of these are noxious weeds (see DEA, 2002a). The vegetation farther to the west in the seasonal drainages that cross under the road and in the adjacent forest consists of Ponderosa pine, western larch, Douglas-fir, western red cedar, baldhip rose, snowberry, Queen's cup, wild strawberry. Many of the species in this association are non-hydrophytic, upland species. See Table 10.

Table 10. Plant species observed in Association 4.

Stratum	Common name	Scientific name	Wetland Indicator Status*
Trees	Douglas fir	Pseudotsuga menziesii	FACU
	Ponderosa pine	Pinus ponderosa	FACU
	western larch	Larix occidentalis	FACU+
	western red cedar	Thuja plicata	FAC
Shrubs	baldhip rose	Rosa gymnocarpa	FACU
	snowberry	Symphoricarpos alba	FACU
Herbs	Canada thistle	Cirsium arvense	FACU+
	mullein	Verbascum thapsus	UPL
	queen's cup	Clintonia uniflora	NL
	spotted knapweed	Centaurea biebersteinii	UPL
	white clover	Trifolium repens	FAC
	wild strawberry	Fragaria virginiana	FACU

Source: Reed, 1993

WETLANDS

Based on the presence of hydrophytic vegetation, hydric soils, and positive indicators of wetland hydrology, seven areas were identified during the on-site investigation as jurisdictional wetlands (Wetlands A–H, Figs.3-11). Wetland locations closely resemble the wetlands identified on the NWI maps but were field-verified during the wetland delineation. Table 11 lists characteristics and approximate locations of Fernan Lake, Lily pad Bay, and Wetlands A through H.

Table 11. Wetlands identified within the project corridor.

Wetland	MP	FWS classification*	Wetland classification**	Area in project corridor	Dominant vegetation	Comments
Fernan Lake	0.0- 2.2	L1OWH	Waters of the U.S.		Open water	
Lily pad Bay	1.95- 2.15	L2AB4H, PEM1F	Waters of the U.S.		Emergent	Considered part of Fernan Lake
A	2.85- 3.05	PSS1C	Category II	0.35 ha (0.9 ac)	Forested, scrub-shrub, and emergent	Isolated topographical depression Hydrology from unnamed draw and groundwater from Wetland C
B	3.2- 3.45	PEM1C	Category II	0.17 ha (0.4 ac)	Forested, scrub-shrub, and emergent	Isolated topographical depression Hydrology from Stacel Draw and groundwater from Wetland C
C	2.2- 3.6	PEM1F, PSS1F, and PEM1C	Category II	11.4 ha (28 ac)	Open water, aquatic beds, Forested, scrub-shrub, and emergent	Associated with Fernan Creek
D/E	4.2- 4.3 4.4- 4.8	PSS1C	Category II	5.0 ha (12.4 ac)	Forested, scrub-shrub, and emergent	Associated with Fernan Creek and underground springs
F	2.65- 2.75	PEM1C	Category II	0.4 ha (1.0 ac)	Forested, scrub-shrub, and emergent	Isolated topographical depression Hydrology from unnamed draw and groundwater from Wetland C
G	4.25- 4.3	N/A	Category III	0.03 ha (0.08 ac)	Scrub-shrub and emergent	Isolated topographical depression Hydrology from Stacel Draw and groundwater from Wetland D
H	2.03- 2.08	PEM1F, PSS1C	Category II	2.7 ha (6.7 ac)	Open water, forested, scrub-shrub and emergent	Associated with Fernan Lake and two unnamed streams
Total				4.6 ha (11.52 ac)		

*FWS classifications
AB4= aquatic bed, floating vascular
C = seasonally flooded
EM = emergent
EM1= emergent, persistent
F = semi-permanently flooded
H = permanently flooded

L1 = lacustrine, limnetic
L2 = lacustrine, littoral
N/A = not available
OW = open water
P = palustrine
SS1= scrub-shrub, broad-leaved deciduous

** Defined in Appendix D

Fernan Lake
The deep-water portion of Fernan Lake is adjacent to Fernan Lake Road from the beginning of the project to approximately MP 2.2 and on the south side of the road (Fig.12). Fernan Lake is classified as "Waters of the United States" by the COE and as L1OWH (lacustrine, limnetic, open water, and permanently flooded) on the NWI maps (FWS, 1987).
Lily pad Bay

Lily pad Bay extends from approximately MP 1.95 to MP 2.15. This area is permanently flooded and vegetated predominantly with American water lily and yellow pond-lily. The two seasonal drainages flowing from north to south toward Fernan Lake had free flow to the lake prior to the construction of the road. A 0.6-m (2-ft) culvert beneath the road was intended to provide a hydrologic link between the lake and the drainages. The culvert is clearly silted in and does not permit the free flow of water. During field visits in September 2002, there was a noticeably higher water elevation on the upstream side of the road. Some buffer wetland trees and shrubs grow on the north side of the road, but the dominant vegetation is emergent. The soil on the north side of the road at Lily pad Bay is mapped as Cougarbay silt loam, according to the Soil Survey of Kootenai County Area, Idaho (SCS, 1981). The area located on the south side of the road at Lily pad Bay is a shallow portion of Fernan Lake. The soil in this area is classified as a Pywell muck (SCS, 1981).

The open-water, emergent, scrub-shrub, forested wetland area on the north side of the side (Wetland H) is an extension of Lily pad Bay, but is separated by the road. This wetland receives hydrology from two seasonal drainages to the north and from Fernan Lake to the south.

Wetland A
Wetland A is a forested, scrub-shrub, emergent wetland on the west side of the road at the toe of the hillslope from approximately MP 2.85 to MP 3.05 (Figures 3-11). The portion of the wetland within the study corridor is approximately 0.35 ha (0.9 ac) in area. Hydrology comes from two unnamed drainages on the west side of the road and groundwater from Fernan Creek lying on the east side of the road. In the southern portion of the wetland, a culvert carries water under the road from the west into Wetland C and Fernan Creek. The wetland is a topographical depression that maintains pockets of standing water at the south end and is saturated long enough during the growing season to sustain wetland characteristics. Wetland vegetation at the south end consists primarily of willow, red-osier dogwood, Douglas hawthorn, Douglas spirea, cattails, reed canarygrass, creeping buttercup, climbing nightshade, stinging nettles, tall managrass, small water forget-me-not, quackgrass and redtop bentgrass. To the north, the wetland makes a transition into a field dominated by reed canarygrass to the north with a buffer of black cottonwood, willow, and Douglas hawthorn. A portion of the field is considered wetland because it meets the three parameters of a wetland (hydric soils, hydrophytic vegetation, and hydrology). Soil in Wetland A is mapped as Ramsdell silt loam throughout Wetland A, according to the Soil Survey of Kootenai County Area, Idaho (SCS, 1981). The soil profiles found in Wetland A consist of greenish-black (10Y 2.5/1), black (10YR 2/1), and black (2.5 Y 2/00), all considered hydric soils.

Wetland B
Wetland B is a forested, scrub-shrub, emergent wetland at the toe of slope, on the west side of the road from approximately MP 3.2 to MP 3.45 (Figures 3-11). Within the study

corridor, the wetland covers 0.17 ha (0.4 ac). Hydrology comes from Stacel Draw in the southern portion of the wetland and on the west side of the road. A culvert in the southern portion of the wetland conveys water north and south under a driveway, but there is no culvert under Fernan Lake Road to Fernan Creek. The wetland is a topographical depression that receives groundwater from Stacel Draw. The wetland is saturated to the surface in the southern portion and supports vegetation such as Douglas hawthorn, willow, serviceberry, creeping buttercup, cow parsnip, field horsetail, stinging nettles, and small-flowered bedstraw. The wetland transitions into a non-jurisdictional roadside wetland ditch approximately 1.5 m (5 ft) wide farther north, which contains cattails, small-flowered forget-me-not, reed canarygrass, and slenderbeak sedge. The ditch is considered a non-jurisdictional roadside ditch and is not included in the wetland area totals. An upland, mowed field lying west of the non-jurisdictional ditch area contains pockets of hydric soils, but it has been planted with ryegrass. Soil is mapped as Ramsdell silt loam within the project corridor and McCrosket-Ardenvoir directly to the west of the wetland, according to the Soil Survey of Kootenai County Area, Idaho (SCS, 1981). The soils found in Wetland B typically showed soil profiles of dark brown (10YR 3/2) with distinct mottling and dark grayish-brown (10YR 4/2) with distinct mottling, both considered hydric soils.

Wetland C

Wetland C is an open-water, aquatic bed, forested, scrub-shrub, emergent wetland located at the toe of the road fill slope on the east side of the road, from approximately MP 2.2 to MP 3.6 (Figs 3-11). Within the study corridor, the wetland is approximately 11.4 ha (28.0 ac) in area. The hydrology for this wetland comes from Fernan Creek, which has two channels- one that is approximately 1.2 m (4 ft) from the east side of the road and another that is approximately 61 m (200 ft) east of the east side of the road. It appears that the streambed adjacent to the road was created or moved to this location, while the more easterly creek channel has a more natural appearance.

Wetland F is located on the western side the road from MP 2.65 to MP 2.75. However, Wetland C and F are not connected. Wetland F receives the majority of its hydrology from the hillslope to the west ,while Wetland C receives its hydrology from Fernan Creek. Wetland C maintains an open-water component in both channels of Fernan Creek and a wet meadow component to the east of the channelized Fernan Creek adjacent to the road. Wetland C extends for the width of the valley beyond the study corridor from MP 2.2 to approximately MP 3.1. From MP 3.0 to MP 3.6, the wetland is narrower, but still extends beyond the study corridor.

The wet meadow portion of the wetland contains wetland herbs such as meadow foxtail, slenderbeak sedge, sawbeak sedge, needle spikerush, reed canarygrass, creeping buttercup, small-fruited bulrush, giant burreed, and marsh speedwell. The open-water portion of the wetland (the channel of Fernan Creek adjacent to the road) is surrounded by a riparian buffer of scrub-shrub and herb vegetation such as mountain alder, cascara, Douglas hawthorne, Douglas spirea, Nootka rose, different leaved water-starwort, floating leaf pondweed, common bladderwort, quackgrass, meadow foxtail, redtop bentgrass, and cattails. The soil in Wetland C is mapped as Ramsdell silt loam according to the Soil Survey of Kootenai County Area, Idaho (SCS, 1981). Field investigations showed soil profiles of black (10YR 2/1), dark gray (10 YR 3/1), light gray (2.5Y 7/1), light grayish brown (10R 6/2) with distinct mottling, dark brown (10YR 3/3) with distinct mottling, dark gray (10YR 4/1), dark brown (10YR 3/2) with distinct mottling, dark grayish-brown (10YR 4/2) with distinct mottling, and dark grayish-brown (2.5 Y 4/2) with mottling, which are all considered hydric soils.

Wetland D/E

Wetlands D and E are discussed as one wetland because they are connected by a riparian area that lies outside the study corridor. Wetland D/E is forested, scrub-shrub, emergent wetlands on the east side of the Fernan Lake Road. Wetland D extends from MP 4.2 to MP 4.3 and Wetland E from MP 4.4 to MP 4.8 at the toe of the slope of Fernan Lake Road (Figs.3-11). Wetland D/E is approximately 8.0 ha (20 ac) in area, of which 5.0 ha (12.4 ac) lie within the study corridor. Hydrology for the wetland comes from Fernan Creek, located about 23 m (75 ft) from the east road edge, from an unnamed drainage on the west side of the road that crosses through a culvert to join the creek, and from underground springs. The wetland is a topographical depression that receives groundwater from all of these sources, contains several small pockets of water throughout, and supports a variety of vegetation, including western red cedar, Douglas fir, black cottonwood, Douglas spirea, thimbleberry, pacific ninebark, red-osier dogwood, western water hemlock, water horsetail, small flowering wood rush, small-flowered forget-me-not, creeping buttercup, water parsnip, and cattail. Soil is mapped as Ramsdell silt loam within the study corridor according to the Soil Survey of Kootenai County Area, Idaho (SCS, 1981). Soils found during field investigations showed soil profiles of dark gray (10YR 3/1), dark grayish brown (10YR 4/2) with distinct mottling, light brownish gray (2.5Y 6/2), dark gray (2.5Y 4/1), and black (2.5Y 2/0), all considered hydric soils.

Wetland F

Wetland F is a forested, scrub-shrub, emergent wetland on the west side of the road at the toe of slope from MP 2.65 to MP 2.75 (Figs 3-11). The wetland is a topographical depression approximately 0.4 ha (1.0 ac) within the study corridor that receives runoff from the mountains to the west of the wetland and groundwater from Fernan Creek and Wetland C, located across the road. An area of standing water was found in the center of the wetland during field investigations. Vegetation is primarily Douglas hawthorn, willow, Douglas spirea, reed canarygrass, and sedge species.

Access to the wetland was denied by the property owner during the 2000 field investigation, so no plots could be selected for data collections. However, photographs, soil survey, and visual observations were used to determine the characteristics of the wetland. The boundaries of the wetland are very clear because the road is located on the east side of the wetland and an upland slope is located on the western side.

Wetland G

Wetland G is scrub-shrub, emergent wetland on the west side of the road at the toe of slope from MP 4.25 to MP 4.3 (Figs 3-11), of approximately 0.03 ha (0.08 ac) within the study corridor. The wetland is a topographical depression that receives groundwater from an unnamed tributary to Fernan Creek on the west side of the road. Soils are saturated long enough during the growing season to exhibit hydric characteristics. Vegetation includes primarily Douglas hawthorn, thimbleberry, wild strawberry, water horsetail, and stinging nettles. Soil is mapped as Ramsdell silt loam, according to the Soil Survey of Kootenai County Area, Idaho (SCS, 1981). Field investigations found soil profiles of dark grayish-brown (10YR 4/2) with distinct mottling and gray (10YR 5/1), both considered hydric soils.

Wetland H

Wetland H is an open-water, emergent, scrub-shrub, forested wetland on the north side of the road at the toe of slope at Lily pad Bay from MP 2.03 to MP 2.08 at Lily pad Bay. It is approximately 2.7 ha (6.7 ac) and is entirely within the study corridor. The wetland is a topographical depression that receives surface water from two unnamed creeks to the north and also subsurface water flow from Fernan Lake (seepage through the road fill), since the culvert under the road is blocked. Standing water exists in the southern portion of the wetland containing aquatic vegetation such as yellow pond lily, western water hemlock, cattails, water milfoil, large duckweed, and small water forget-me-not. Riparian trees and scrub-shrub such as willow, red-osier dogwood, Douglas spirea, Douglas hawthorn and snowberry surround the open-water portion of the wetland. The wetland field north of the open water contains vegetation such as Douglas hawthorn, silky lupine, creeping buttercup, small fruited bullrush, Canada thistle, spotted knapweed, slough sedge, wood rose, western St. John's wort, curly dock, red top, field mint, meadow foxtail, snowberry, reed canarygrass, and red clover. Soil in the southern portion of the wetland is inundated year-round and soil in the northern portion of the wetland adjacent to the open water is saturated long enough during the growing season to exhibit hydric characteristics. The soil in Wetland H is mapped as Cougarbay silt loam within the project corridor according to the Soil Survey of Kootenai County Area, Idaho (SCS, 1981). The soils found on-site in Wetland H showed soil profiles of dark gray (10YR 4/1) and dark brown (10YR 3/2) with mottles, which are both considered hydric soils.

Functional assessment

A functional assessment was performed for the seven wetlands in the study corridor using the rating form developed by the Washington Department of Ecology. Since the Idaho Department of Environmental Quality (IDEQ) does not provide functional assessment ratings, the COE accepts the Washington form for North Idaho (Rayner, 2000). Functional assessment categories range from I (very high quality) to IV (very low quality). Wetlands A, B, C, D/E, F, and H were rated as Category II and Wetland G as Category III. The completed rating forms and definitions of functional categories will be included in the Environmental Impact Statement. That statement is due for public review in May, 2004.

There are no high-quality natural heritage wetlands along Fernan Lake Road because of the proximity of Fernan Lake Road, structures, and agricultural uses that could bring contaminants into the system. The study corridor does not contain irreplaceable ecological functions (such as peat wetland). The functional assessment of each wetland on the project site is discussed below and summarized in Table 13.

Wetland A

Wetland A is approximately 0.6 ha (1.6 ac) in area, of which 0.35 ha (0.9 ac) is within the study corridor. Wetland A presents an emergent, scrub-shrub and forested class with a moderate diversity of plant species. Interspersion between wetland classes is moderate. There are at least three standing dead trees per acre and at least one of these trees is greater than 25 cm (10 in) in diameter, but the trees are less than 15 m (50 ft) tall. Wetland A is not connected to a stream, but receives its hydrology from two unnamed intermittent drainages. The wetland is buffered by Fernan Lake Road, a pasture, and an open hillside or forest. On the west side of Wetland A, across Fernan Lake Road, is the riparian corridor of Wetland C. Wetland A is categorized as Category II.

Wetland B

Wetland B is approximately 0.17 ha (0.4 ac) in area and is entirely within the study corridor. The wetland contains an emergent, scrub-shrub, forested class with a low diversity of plant species. Only a small part of the southern portion of Wetland B contains scrub-shrub and forested class. The interspersion between the wetland classes is moderate. There are no standing dead trees or snags, but there are telephone poles and fence posts that can be used as bird perches. Wetland B is not connected to a stream, but received hydrology from Stacel Draw, an intermittent drainage that flows into the southern portion of the wetland at certain times of the year. Wetland B is buffered by Fernan Lake Road, a driveway, and a mowed lawn area. Wetland B is categorized as Category II.

Wetland C

Wetland C, which extends to the east and south outside the study corridor, is approximately 20 ha (50 ac) in area, of which 11.4 ha (28 ac) is within the study corridor. Wetland C contains an open-water, aquatic bed, emergent, scrub-shrub and forested class with a high diversity of plant species and a high level of interspersion between the wetland classes. Wetland C contains healthy populations of the scrub-shrub and forested classes, but none of the trees is taller than 15 m (50 ft). There is evidence of beaver use in the Fernan Creek channel adjacent to the road. There are at least three dead trees or snags and several telephone poles in which birds can perch or nest. Fernan Creek runs through Wetland C, which is connected to Fernan Lake at the south end of the wetland. Both Fernan Creek and Lake contain several different native and introduced fish species. Wetland C is buffered by Fernan Lake Road, a pasture, and forest. Wetland C is directly across the road from Wetlands A, B, and F. Wetland C is categorized as Category II.

Wetland D/E

Wetlands D and E are discussed as one wetland because they are connected by a riparian area that lies outside the study corridor. Wetland D/E covers approximately 8.0 ha (20 ac), of which 5.0 ha (12.4 ac) is within the study corridor. Wetland D extends easterly outside the study corridor, where it connects to Wetland E from approximately MP 4.3 to MP 4.4. Wetland D/E contains an emergent, scrub-shrub and forested class with a moderate diversity of plant species. Interspersion between the wetland classes is moderate. There are at least three standing dead trees per acre and at least one of these trees is greater than 25 cm (10 in) in diameter.

Wetland D/E is connected to Fernan Creek, which flows on the west border of the wetland, and is buffered by Fernan Lake Road, a pasture, and a forested area. Wetland D/E is categorized as Category II.

Wetland F

Wetland F is approximately 0.4 ha (1 ac) in area and is contained entirely within the study corridor. The wetland presents an emergent, scrub-shrub and forested class with a moderate diversity of plant species. The interspersion between the wetland classes is moderate. There are no standing dead trees or snags, but there are telephone poles and utility wires that can be used as bird perches. Wetland F is not connected to a stream, but receives water from sheet flow from the hillside above and groundwater from Fernan Creek. Wetland F is buffered by Fernan Lake Road and an open hillside or forest and is across the road from Wetland C. Wetland F is categorized as Category II.

Wetland G

Wetland G is approximately 0.03 ha (0.08 ac) in area and is fully contained within the study corridor. The wetland presents an emergent and scrub-shrub class with a low diversity of plant species. Only a small part of the southern portion of Wetland G contains the scrub-shrub and forested class. The interspersion between the wetland classes is low. There are no standing dead trees or snags, but there are telephone poles and utility wires that can be used as bird perches. Wetland G is not connected to a stream, but receives water from an unnamed draw that flows into the southern portion of the wetland at certain times of the year. Wetland G is buffered by Fernan Lake Road and by a forested area and is directly across the road from Wetland D. Wetland G is categorized as Category III.

Wetland H

Wetland H is approximately 2.7 ha (6.7 ac) in area and is fully contained within the study corridor. Wetland H provides an open-water, aquatic bed, emergent, scrub-shrub and forested class with a high diversity of plant species and a high level of interspersion between the wetland classes. Wetland H contains healthy populations of the scrub-shrub and forested classes, but none of the trees is taller than 15 m (50 ft). There is evidence of beaver use in the Fernan Creek channel adjacent to the road. One dead ponderosa pine was observed, as well as telephone wires on which birds can perch or nest. Wetland H was previously connected to Fernan Lake through a culvert beneath Fernan Lake Road, but the culvert appears to be silted in and does not allow free flow of water. Although Fernan Lake contains several different native and introduced fish species, the unnamed seasonal tributaries that flow into Wetland H from the north do not contain fish populations. Wetland H is buffered by Fernan Lake Road, a lawn, and a narrow forested area. Wetland H is directly across the road from Fernan Lake and within 0.8 km (0.5 mi) of Wetland C. Wetland H is categorized as Category II.

Table13- Fernan wetland functional val

Wetlands rating field data forms, used to determine the functional values, are in Appendix D.

	Wetland													
	A		B		C		D/E		F		G		H	
Function	Comment	Pts	Comment	Pts	Comment	Pts	Comment	Pts	Comment	Pts	Comment	Pts	Comment	Pts
High-quality natural heritage wetland	No		No		No		No		No		No		No	
Irreplaceable functions	No		No		No		No		No		No		No	
Category IV	No		No		No		No		No		No		No	
Area in study corridor	0.35 ha (0.96 ac)		0.17 ha (0.4 ac)		11.4 ha (28 ac)		5.0 ha (12.4 ac)		0.4 ha (1.0 ac)		0.03 ha (0.08 ac)		2.7 ha (6.7 ac)	
Total area (including estimated off-site)	0.6 ha (1.6 ac)	3	0.17 ha (0.4 ac)	2	20 ha (50 ac)	6	9.5 ha (23 ac)	5	0.4 ha (1.0 ac)	2	0.03 ha (0.08 ac)	1	2.7 ha (6.7 ac)	3
Classification	Emergent, scrub-shrub, forested	5	Emergent. scrub-shrub, forested	5	Open water, aquatic beds, emergent, scrub-shrub, forested	11	Emergent. scrub-shrub, forested	5	Emergent. scrub-shrub, forested	5	Emergent, scrub-shrub	3	Open water, aquatic beds, emergent, scrub-shrub, forested	11
Plant species diversity	Mod	7	Low	4	High	10	Mod	6	Mod	6	Low	3	High	10
Structural diversity		3		2		3		3		2		2		3
Interspersion	Mod	2	Mod	2	High	3	High	3	Mod	2	Low	1	Mod	2
Habitat features	Yes	3	Yes	1	Yes	6	Yes	4	Yes	1	Yes	1	Yes	2
Connection to stream	No		No		Yes	6	Yes	6	No		No		Yes	10
Buffer	107 m (350 ft)	2	46 m (150 ft)	1	87 m (285 ft)	1	183 m (600 ft)	3	46 m (150 ft)	1	183 m (600 ft)	3	198 m (650 ft)	3
Total points		31		23		52		39		25		20		45

Appendix C
Historic Water Quality

Unfortunately, of the medium sized lakes in the Idaho Panhandle which have residential lakeshore development and receive a high recreational usage, Fernan Lake has been assessed the least from a limnological standpoint. Several lakes in the 1980's and early 1990's were assessed either through contracts by Lake Associations with local universities, or studies conducted under the Clean Water Act (CWA) §314 Grant Program. Assistance and/or field study was provided by the Panhandle Clean Lakes Coordinating Council, the Panhandle Health District, DEQ and the U.S. Geological Survey. In most cases, Lake Management Plans were written following the limnological assessments. Panhandle lakes that were assessed during this period and had Management Plans written included: Cocolalla, Hauser, Spirit, Hayden, Twin, Priest, Upper Priest, Coeur d'Alene, and Pend Oreille Lakes. These Management Plans can serve as guidelines in the formulation of a Fernan Lake Management Plan. There were, however, some in-lake assessments of Fernan Lake in the past.

In 1983, a comprehensive Classification of Idaho's Freshwater Lakes was published (Milligan et al. 1983). Fernan Lake was selected as one of 85 Idaho lakes for a sampling visit, which occurred in September 1981. Conditions measured on that sampling trip included: Secchi disc depth = 3.0 m, total phosphorus (TP) = 29 ug/L, and chlorophyll a (chl a) = 4.2 ug/L. Using an array of 11 target parameters to form an integrated trophic status index, the 85 Idaho lakes that were sampled were classified and ranked. Fernan Lake was classified at the border of oligrotrohpic and oligo-mesotrohpic, or a low-productive lake. It was also within the Milligan publication that depth contour maps were produced, along with lake morphometry data. Figure 2 presents the depth contour map for Fernan Lake and Table 14 presents selected lake morphometry parameters.

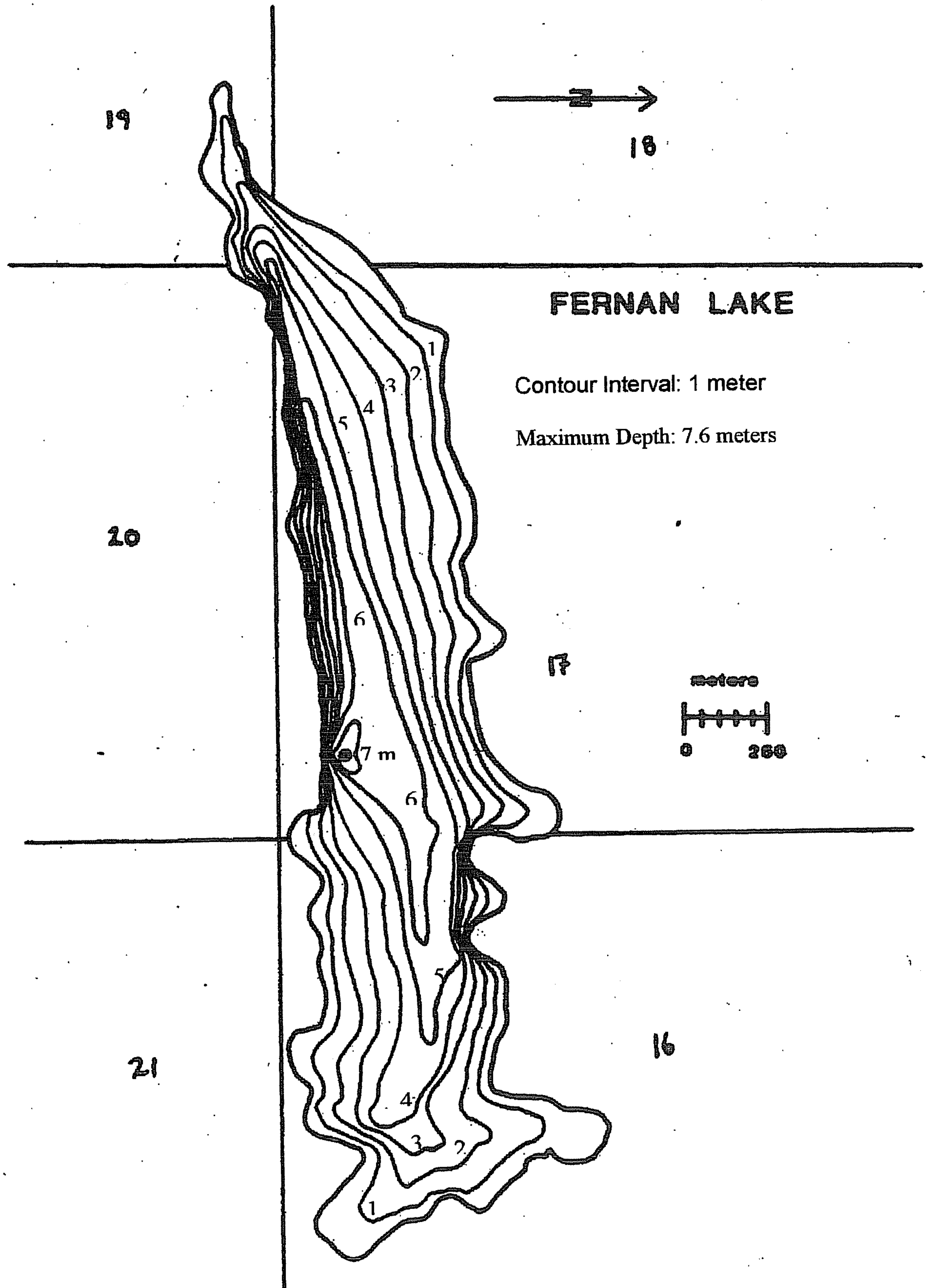


Figure 2 Depth Contour Map of Fernan Lake

Table 14. Morphometric Data for Fernan Lake, Idaho

Parameter	Estimates from Milligan et al. (1983) Mossier (1993) DEQ (1997)	Estimates from Falter (2001)
Elevation at Shoreline	2125 feet	-
Maximum Length	1.8 miles	2.2 miles
Maximum Width	-	0.25 miles
Maximum Depth	7.0 – 7.6 meters	7.6 meters
Mean Depth	3.0 – 3.7 meters	6.0 meters
Surface Area	355 acres	381 acres
Volume	3550 acre feet	6000 acre feet
Shoreline Length	5.3 miles	5.4 miles

In 1990 and 1991, DEQ conducted a fairly comprehensive Lake Water Quality Assessment of several small to medium-sized lakes under the CWA §314 grant program (Mossier 1993). Fernan Lake was visited five times in 1990, between May and October, for sampling of standard limnological parameters at a single deep station, and visited once in July 1991 for sampling and characterization of the submergent aquatic plant populations. In 1990, the mean TP=21 ug/L, the mean Secchi disk depth=3.2 m, and mean total inorganic nitrogen=54 ug/L. For an unknown reason, chl a samples were not taken in 1990. Chl a was taken at several sites on the single July 1991 sample day and the mean chl a was 3.8 ug/L. The 1991 sample was examined under the microscope for phytoplankton composition, and the major algal group present on that day was blue-green algae. The macrophyte survey of 1991 showed a good plant diversity condition with 17 total species recorded and five prevalent or dominant species. The maximum depth at which macrophytes were found to grow in Fernan Lake ranged from 3.2 to 4.5 meters.

Table 15 is a modified Trophic Status table presented by Mossier (1993). DEQ has selected out medium size Panhandle lakes for comparison with Fernan Lake (lakes within 300-1500 surface acres). For several lakes, the data collected by Mossier has been updated through either subsequent CWA funded studies, or from data collected each year by the Citizen Volunteer Monitoring Program (CVMP) in which some lake associations have collected data yearly from 1988-2003.

Table 15. Trophic Status and Water Quality Indices of Seven Medium Sized North Idaho Lakes Originally Presented in Mossier (1993), and Updated by DEQ (2003).

Name of Lake	Surface area (acres)	Sample station depth (m)	Trophic status	Mean Secchi depth (m)	Mean Chl *a* (ug/L)	Mean Total P at Secchi depth (ug/L)	Min. hypo-limnion oxygen (mg/L)	Max. hypo-limnion total P (ug/L)	Number preval. macro-phyte species
Fernan	355	7	M	3.2	3.8	21	no hypo. last meter occas. <1.0 mg/L	no data	5
Cocolalla	805	12	E	2.5	13.5	24	always anoxic <1.0 mg/L	293	5
Hauser	625	12	M-ME	3.6	5.1	21	always anoxic <1.0 mg/L	652	3
Upper Twin	483	6	M-ME	3.1	6.4	22	no hypo. last meter 5.0 mg/L minimum	44	4
Lower Twin	391	18	M	4.1	3.7	13	always anoxic <1.0 mg/L	400	6
Spirit	1,446	25	M-OM	4.6	3.5	12	occass. anoxic <1.0 mg/L	180	8
Upper Priest	1,338	90	O	7.2	2.0	6	never anoxic 4.7 mg/L minimum	6	6

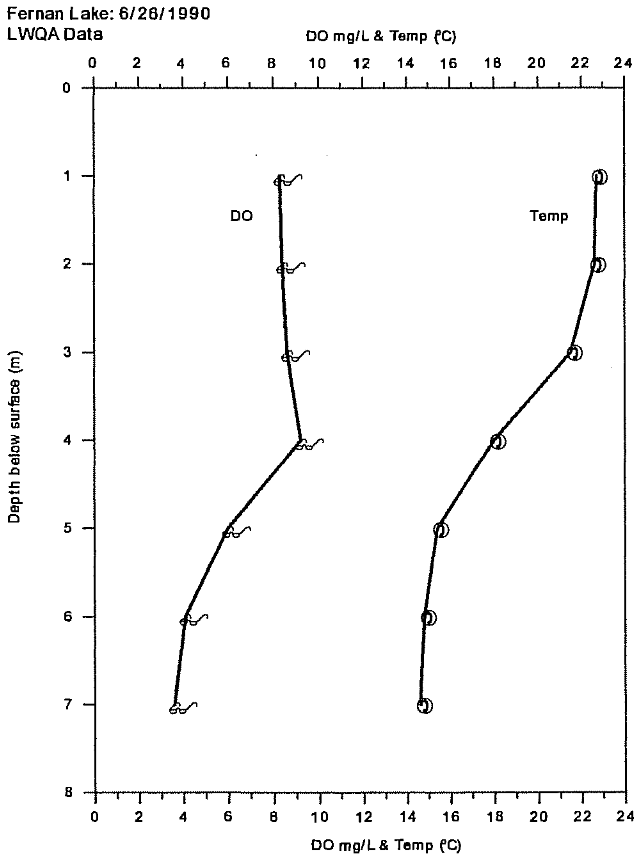
Trophic Status: O = oligotrophic OM = oligo-mesotrophic M = mesotrophic
ME = meso-eutrophic E = eutrophic

Data from all lakes represent seasonal values with sampling occurring between April – October.
Fernan Lake data is from 1990 LWQA (Mossier 1993).
Cocolalla, Hauser, Twin Lakes, and Spirit Lake from CVMP, 1988 – 2002.
Upper Priest Lake from DEQ study, 1993 – 1995.

A key set of 1990 data from Mossier was temperature and dissolved oxygen (DO) profiles from surface to 7 m depth (Figure). What this data shows is that under calm conditions, Fernan Lake can develop a weak thermal stratification, as depicted by the June 26, 1990 profile. There also can be depressed DO levels near the bottom.

On the June 26, 1990 profile, DO at 6 m depth was 4.1 mg/L, and near the bottom at 7 m, it was 3.6 mg/L. On the August 8, 1990 profile, DO at 7 m was 0.8 mg/L. However, because of the overall shallow depth of Fernan Lake, summer windy periods mix the lake and re-introduces atmospheric oxygen to depth. This isothermal and uniform oxygen condition is clearly shown in Figure 12 on the profile taken August 23, 1997 (DEQ 1997).

Because of Fernan Lake's shallow depth, a stable thermocline and underlying cold hypolimnion does not develop during summer months. In deeper lakes, such as Cocolalla, Lower Twin and Hauser, stable thermoclines and an anoxic hypolimnetic layer (DO<1.0 mg/L within the cold bottom layer), persist throughout the summer and part of September. In turn, the anoxic condition leads to release of dissolved orthophosphate from the bottom sediments. This internal phosphorus loading is depicted in Table 15 under the column maximum hypolimnion total P. Internal phosphorus loading related to an anoxic bottom water layer either does not occur or occurs to only a very minor extent in Fernan Lake.


Fernan Lake: 6/26/1990
LWQA Data
DO mg/L & Temp (°C)
DO
Temp
Depth below surface (m)
DO mg/L & Temp (°C)

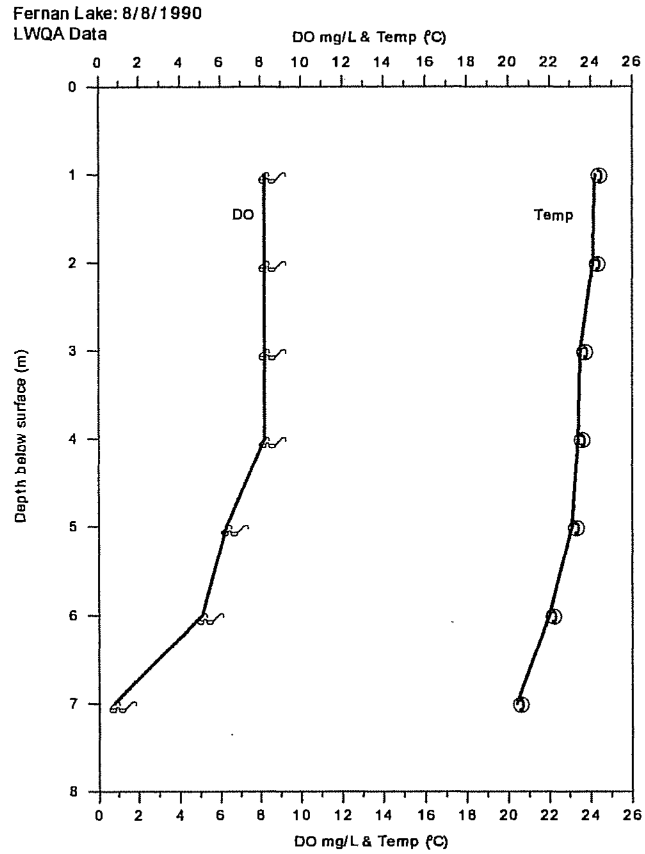
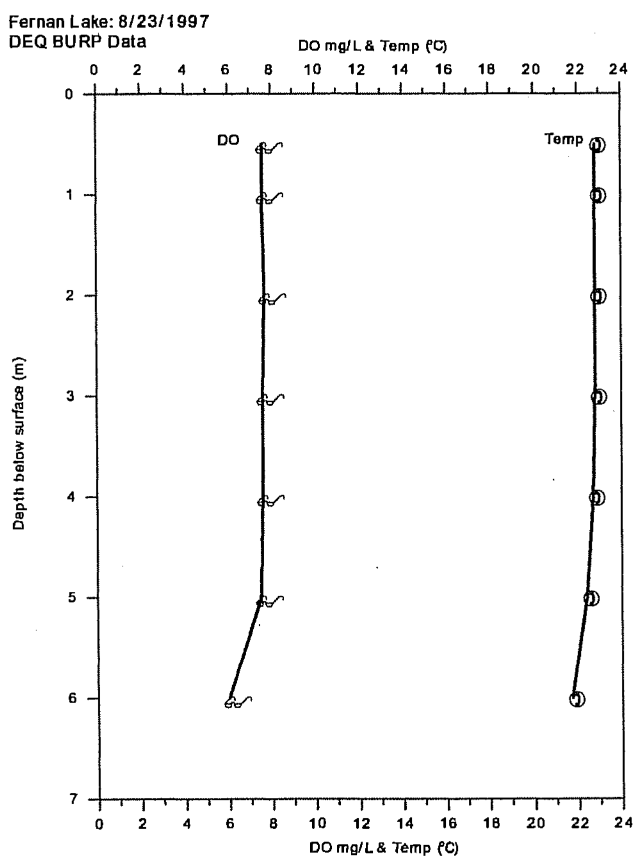

Fernan Lake: 8/8/1990
LWQA Data
DO mg/L & Temp (°C)
DO
Temp
Depth below surface (m)
DO mg/L & Temp (°C)

Figure ______


Fernan Lake: 8/23/1997
DEQ BURP Data
DO mg/L & Temp (°C)
DO
Temp
Depth below surface (m)
DO mg/L & Temp (°C)

In 1993, the Idaho Department of Fish and Game (IDFG) conducted a fishery survey and an angler survey to assess the fishery. Ten species of game fish and two species of non-game fish were found (1993, IDFG). The Fernan Lake fishery is considered by IDFG to be one of the finest urban fisheries in the State (Falter 2001). A temperature and oxygen profile was taken by IDFG on September 10, 1993 and the water was isothermal down to 5.5 m with good oxygen levels. Secchi disc depth was 3.0 m.

In 1997, Fernan Lake was visited by a DEQ crew doing lake work under the Beneficial Use Reconnaissance Project (DEQ 1997). There was a single sample day, August 23, 1997. TP was high at 35 ug/l, TIN was low at 54 ug/L, chl a was high at 9.2 ug/L and Secchi disc transparency was low at 2.0 m. This data would fall into the meso-eutrophic status (Table 3). A water sample was examined under the microscope for phytoplankton composition. The sample was dominated by the blue-green algae, Anabaena sp. Coupled with the chl a concentration, this would qualify as a moderate blue-green algae bloom. The water column profile showed uniform temperature down to 6 m, and a minimum DO value of 6 mg/l (Figure 12).

Between December 1999 and June 2000, DEQ conducted a sampling program of water flowing into Fernan Lake via upper Fernan Creek and water flowing out of the lake via lower Fernan Creek (Harvey, unpublished data). Gauging stations for water flow were established on upper and lower Fernan Creek, as well as water sampling sites. The objective of the program was to gain estimated hydrologic and nutrient budgets for the Lake. The budget portion of the study was met with difficulties. Problems encountered included: a portion of Fernan Creek upstream of the upper gauging site was discovered to go subsurface; flow from upper Fernan Creek enters a large wetland prior to the lake, and it is uncertain how the wetlands affect lake nutrient loading; and the lower Fernan Creek gauging station could not be located above a significant storm drain, which altered the data as being representative of lake outflow. The results were hydrologic and nutrient budgets that were not considered as reliable estimates.

There was, however, some valuable data collected on upper Fernan Creek. There were six water samples collected during the late winter to early spring runoff of February 1 through April 20, 2000, with mean daily flows ranging from 20-290 cfs. Five TP concentrations during moderate flow ranged from 32-87 ug/L, and a TP sample on the April 14th peak flow was 254 ug/L. This latter value occurred at the two-day peak of the hydrograph (214 and 290 cfs) and was most likely associated with a peak total suspended sediment event. This is a fairly high TP value (translating to a load of 140kg TP/day for two days) and clearly indicates a significant suspended load during peak watershed flow. It is not known what portion of this sediment bound phosphorus is trapped by the inlet wetlands. Total nitrogen (TN) samples during the moderate flow period ranged from 197-564 ug/L (n=5) and on the peak flow sampling day TN=1,076 ug/L. This TN data compares fairly closely to upper Cocolalla Creek (Rothrock 1995), a stream with similar characteristics to Fernan Creek. These TN values are not considered excessive.

In 1999 DEQ published a Subbasin Assessment and Total Maximum Daily Load for selected water bodies in the Coeur d'Alene Lake basin (DEQ 1999). Assessments in this report concluded that Fernan Lake conditions do not violate the Idaho Water Quality Standards and recommended that Fernan Lake be removed from the CWA §303 (d) list of impaired water bodies with nutrients as the pollutant of concern.

Finally, in 2001, Michael Falter, University of Idaho limnology professor, prepared for David Evans and Associates (Falter 2001) an assessment of Fernan Lake. Some changes in the historically reported lake morphometry data were suggested by Falter (See Table 14). Falter's assessment of Fernan Lake morphometry was that several lakeshore slopes were steeper than depicted by the contour map originally presented by Milligan et al. (1983- Figure 12), and the deepest 6 m contour area is wider and extends further to the north toward Fernan Village. Falter suggested that the mean depth is more around 6.0 m, than the 3.0 to 3.7 m earlier estimated. With a deeper contour profile, Falter estimates that the lake volume may be closer to 6,000 acre feet than the earlier estimated 3,500 acre feet.

In examining oxygen profiles taken in 1981 (Milligan et al. 1983) and 1990 (Mossier 1993), Falter concludes that oxygen supersaturation is not apparent in upper waters. Falter states "the fact that oxygen supersaturation has not been observed in Fernan Lake suggested only modest algal production is present." Falter also took samples of lake sediments in the deep central bottom area of the lake. These sediments depict an aerobic condition, indicative of overlaying bottom waters that stay well-oxygenated throughout the year.

With examination of historic data and his own assessments, Falter concurs that an appropriate trophic status label for Fernan Lake is mesotrophic. However, the low mean depth of the lake does render it susceptible to further eutrophication. Falter's assessment of available chl a data, with a mean around 4 ug/L, indicates phytoplankton productivity less than what might be predicted from in-lake TP concentrations between 20-30 ug/L. However, the three chl a samples from the 1992 CVMP samples of around 10 ug/L, and the single DEQ sample in 1997 of chl a = 9.2 ug/L, with an identified dominance of Anabaena sp, does show that Fernan Lake has a propensity toward blue-green algae blooms. Falter also concludes that the eastern shallows of Fernan Lake have characteristics making this area quite susceptible to the establishment of the invasive Eurasian watermilfoil.

APPENDIX D
FERNAN LAKE AREA GEOTECHNICAL HAZARD STUDY
DESCRIPTION OF GEOTECHNICAL TERRIAN UNITS

GTU 1 - Landslide Hazard and Made Ground
Terrain Unit 1 generally lies along the steep north and south slopes of Fernan Lake, the side slopes of lake tributaries, and the side slopes of French Gulch. It is made up of colluvium, residuum, and talus deposits along with debris flow and solifluction deposits. Colluvium is composed of angular pebble and cobble gravel in a sandy silt matrix. Residuum is composed of clayey to silty sandy saprolite that grades with depth into bedrock. These materials along with debris flow and solifluction deposits occur on the steep north facing slopes on the south and east sides of Fernan Lake, and within the upper reaches of French Gulch.

The relatively steep slopes on the north side of the lake are composed of basalt talus and landslide deposits that are derived from the overlying Columbia River basalt (see Figure 1). These deposits are poorly sorted angular basalt cobbles and boulders mixed with silt and clay. It is hard to distinguish between landslide deposits and talus; however, this geologic unit is on a steep slope, is subject to landsliding and is therefore classified as a landslide hazard. The landslide hazard is pronounced near the contact between the basalt and the underlying weathered metasedimentary rocks.

All of these materials cover bedrock and can range in thickness from a few feet up to about 40 feet. Rock crops out where colluvium and talus have been removed by gravity and where bedrock forms steep cliffs. Folded and fractured metasedimentary rocks are exposed (Figure 2) along Fernan Lake Road (mapped as the Pritchard Formation by Lewis et. al. (2002). Rock falls may occur, causing potential hazards to structures below and above; appropriate setbacks should be required.

Man-made deposits occur on the western margin of Fernan Lake Village. Man-made deposits include disturbed, transported and emplaced materials generally derived from a local source. A large component of the man-made ground deposits at the western edge of Fernan Lake Village consist of engineered highway embankment fills placed by the Idaho Transportation Department. Man-made deposits are hazardous because they can be composed of non-compacted or loose, highly compressible and weak materials. All man-made deposits should be considered hazardous, unless the deposits were engineered and inspected during construction.

Solifluction is the process of slow flowage from higher to lower ground of masses of saturated material. Talus or scree is accumulations of fragments of broken rock at the base of a cliff. Colluvium is a general term applied to loose and incoherent deposits, usually at the foot of a slope or cliff and brought there chiefly by gravity.
Slope- Slopes range from 10% to near vertical. The flat and gently sloping areas are generally small and on ridge tops and should be studied for access road alignment and slope stability since roads will cross areas with steep natural slopes.

Groundwater- Ground water is estimated to be deep and probably controlled by the bedrock. However, there are isolated near surface ground water sources controlled by geology. This may be true on the north side of the lake where basalt provides water to the overlying colluvium. This source of water may be the cause of landsliding in this area.

Erosion- The fine grain portion of this soil is erosion prone.
Soil- The soil deposits colluvium that is poorly sorted gravel with silt and clay matrix and talus. The soil can be thin or thick and overlie bedrock.

Landslide Potential- HIGH- The colluvium is subject to landsliding. Natural landslides generally occur toward the top of the steep hillsides. Construction directly on talus and solifluction slopes should be avoided.

Earthwork- Depth of excavation is limited by the presence of weathered and intact bedrock. The colluvial soil can be excavated with large earthmoving equipment. Compacted fills using colluvium are difficult to construct because of the particle size range and the fine soil. Moisture conditioning is essential for compaction of reworked colluvial soils.

Roadways- These soils will provide an adequate foundation for roads. Cuts and fills will be required on the steep hillsides. Cut and fill slopes should not exceed 2H: 1V, unless by recommendation of a Geotechnical/geological Engineer.

Foundations- Foundations should bear on undisturbed soil, bedrock or engineered fill. Setbacks from the crests and toes of steep slopes should be required. The existing landslide, talus and solifluction deposits should be avoided.

Septic Systems- Septic or wastewater systems should be located below development and where the effluents will not surface or cause slope instability. Near-surface bedrock and the steep slopes may cause effluent to surface. Stock, effluent lagoons or other water storage ponds should be avoided.

Recommended Site Specific Studies- Most of the area in this unit is steeper than 20% and should require a Soil Engineering and Engineering Geology Report before development is approved. All of the steep slopes should be classed as Special Areas of Concern because of the potential for landslide hazard. The Soil Engineering and Engineering Geology Report should specifically address landslide potential from the proposed development, including cuts and fills, location of building and location of septic or other wastewater disposal systems. The location of existing landslides is not well marked on geology maps, so landslides should be located in the field and appropriate setbacks for site improvements established. Any debris or solifluction chutes should be identified. Road cut and fill slopes should be specified. An Engineering Hydrology Report should be required and should include surface water disposal and stormwater management. Site development should be designed by a Civil Engineer and a Geotechnical or Geological Engineer licensed in Idaho.

GTU 2- Lacustrine Sediments and Alluvium

This unit includes the silt, sand, and organic soil deposits on the northeast and southeast sides of Fernan Lake (Figures 3 and 4). These deposits are in bays in the Lake's high water zone and were made by streams, such a Fernan Creek and other unnamed creeks draining into Fernan Lake. The deposits grade upstream into alluvium. The soils are deep and poorly drained, and may contain seams of organic plant and woody material.

Slope- Slopes are flat (0-2%).

Groundwater- Groundwater elevation will be associated with Fernan Lake and the streams that formed the deposits. Generally expect groundwater to be near the ground surface.

Erosion- Erosion potential is high if exposed in cuts or excavations.

Soil- The soil deposits consist of silt and sand interbedded with alluvium and organic seams. Soil grades upstream into alluvium. The soil layers are saturated, soft and poorly drained. The soil deposits are compressible and possess a low strength.

Landslide Potential- None. However, excavations into these soils could cause slope failure in the sides of the excavation. Setbacks from landslides existing in adjacent Terrain Unit 1 should be required.

Earthwork- Earthwork will be difficult because of the high groundwater. Excavations will require dewatering and bracing.

Roadways- These sediments have poor road support capabilities, and high potential for settlement or failure of roadway embankment fills. A high potential for frost heave exists for this Unit. A thick crushed rock base is generally required for pavement support together with appropriate surfacing and good surface drainage. Fill slopes should not exceed 2H: 1V.

Foundations- Foundation support capabilities of this soil are poor. The soft sediments combined with organic seams create a potential for large total and differential settlement. Poor bearing capacity may result in complete loss of support when loaded. Large fills on the soft soil will be subject to foundation failure. Developments should include adequate surface and foundation drainage. Basements should be avoided. Driven or drilled piling will be necessary to support heavy loads or embankments.

Septic Systems- Septic or wastewater systems in native soil are not generally feasible due to shallow groundwater.

Recommended Site Specific Studies- These soils are variable and subject to large total and differential settlement and loss of bearing capacity when loaded. For this reason, structures or thick roadway embankments should be avoided. Consideration should be given to avoid development on this Unit because of the poor soils, high groundwater and potential for flooding. A Soil Engineering and Engineering Geology Report should be required and should specifically address foundation support potential for the proposed development including cuts and fills, location of building. The Unit is not suitable for septic or wastewater disposal systems. Site development should be undertaken with the assistance of a civil engineer and a geotechnical or geological engineer licensed in Idaho.

GTU 3 - Fluvial Gravels, Undivided Channel Gravels and Relict Alluvium

This unit includes fluvial gravels deposited by the last Lake Missoula floods and colluvium derived from the underlying bedrock. The soil will vary from sandy gravel to sandy silt. Some soil types in this Unit consist of clayey to silty sands. In some cases, the sandy silts and clayey sands may be poorly drained. Thickness will range from a few feet to several tens of feet.

Slope- The slopes in this unit vary from flat (0-10%) to sloping (10-20%).

Groundwater- The water table may be at or near the ground surface depending upon the relationship of the site to drainage channels and soil permeability. The position of the water table will vary seasonally depending on precipitation, irrigation and infiltration. Development may change or affect the position of the water table.

Erosion- The soils in this unit have relatively high permeability so this unit tends to support infiltration rather than runoff. However, fine-grain soil will erode in cut and fill slopes.

Soils- The soil includes flood deposits and alluvium and can vary in grain size from clay to cobbles.

Landslide Potential- Natural slopes are relatively flat and stable. Setbacks from landslides existing in adjacent Terrain Units should be required.

Earthwork- Excavation within this Unit will be relatively easy. However, it may be difficult to keep side slopes open and stable in excavations below the water table. Excavated soil will be good structural fill if organic matter is removed and if at the optimum water content.

Roadways- This unit, except for pockets of silt and clay will support roadways. Some frost heaving may occur because of high ground water and fine grain soil.

Foundations- The sand and gravel will provide good support for foundations, except with a high water table.

Septic Systems- Near surface water tables and will limit the use of septic systems. The use of septic systems is site specific.

Recommended Site Specific Studies- Engineering Hydrology Report should be required, particularly if septic systems are planned. A Soil Engineering and Engineering Geology Report should be required if the site is near the boundary of Terrain Unit 1.

GTU 4 - Basalt Bedrock

This Terrain Unit is composed of basalt scoured by the Missoula floods. It forms rimrock above Terrain Unit 1. Soil deposits up to 15 feet thick composed of sandy clay may cover the basalt surface. Figure 7 shows a typical outcrop of weathered basalt. Basalt outcrops can also be seen at the crest of the steep slopes just south of Fernan Hill Road.

Slope- The slope is flat (0-10%) for the most part, but there are some local areas that are sloping (10-20%). Margins of the basalt may be cliff-like.

Groundwater- Groundwater will be deep. However, local perched water tables will exist in the soil cover.

Erosion- Little potential, if undisturbed. However, fine-grain soil overburden will erode in cut and fill slopes.

Landslide Potential- Natural slopes are relatively flat and stable. Landslide potential is low for flat slopes. Setbacks from landslides existing in adjacent Terrain Units should be required.

Earthwork- Difficulty of excavation is variable and depends on the depth of weathered cobbly soil overlying bedrock. Cut slopes will expose stony soil that tends to slough. Basalt bedrock will probably require blasting for deep cuts.

Roadways- This Unit, less fine grained soil components, will make excellent sub-grade for roads.

Foundations- This Unit will generally provide adequate support for light to heavy foundation loads.

Septic Systems- Permeability is poor and presence of cobbles and shallow rock makes siting septic systems difficult. Location of septic systems is site specific.

Site Specific Studies- Site specific studies needed for septic systems. A Soil Engineering and Engineering Geology Report should be required if the site is near the boundary of Terrain Unit 1.

Photographs of Terrain Units

Figure 4. Photo Showing Typical GTU 1 Terrain – Fernan Hill Terrace Area

Figure 5. Photo Showing Typical GTU 1 Terrain – South Shore Fernan Lake

Figure 6. Air Photo of Typical GTU 2 surrounded by GTU 1. – Mouth of Fernan Creek

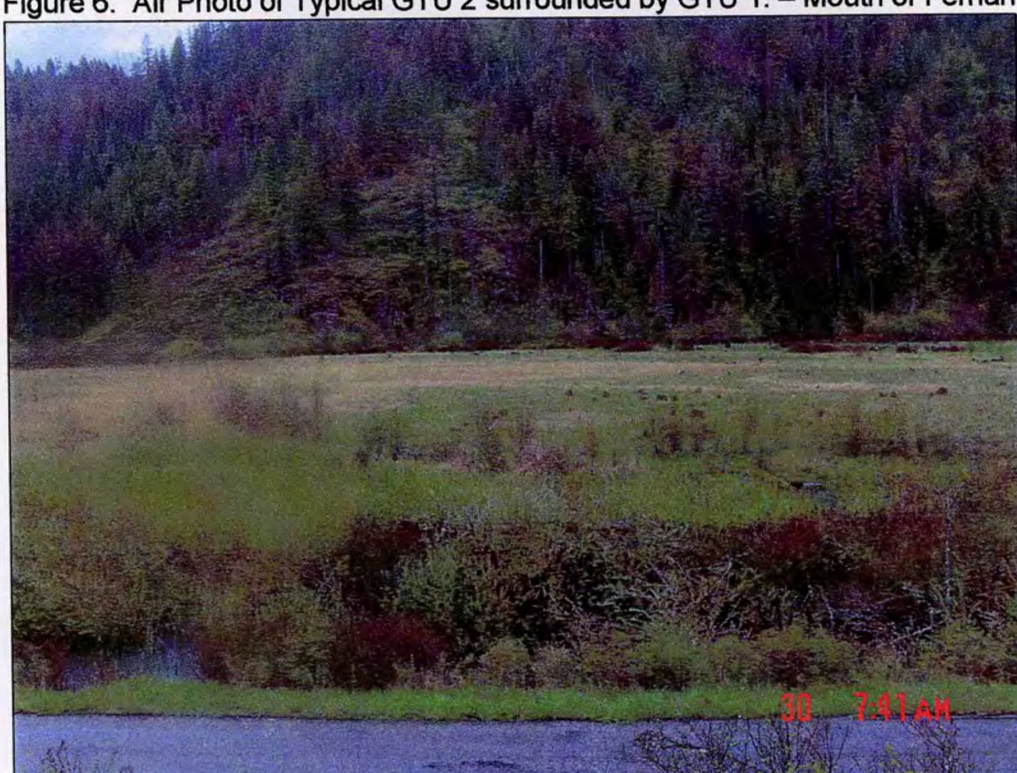


Figure 7. Photo showing Typical GTU 2 Conditions (foreground). – Fernan Creek Area

Figure 8. Photo showing Typical GTU 3 Conditions – Armstrong Park Area

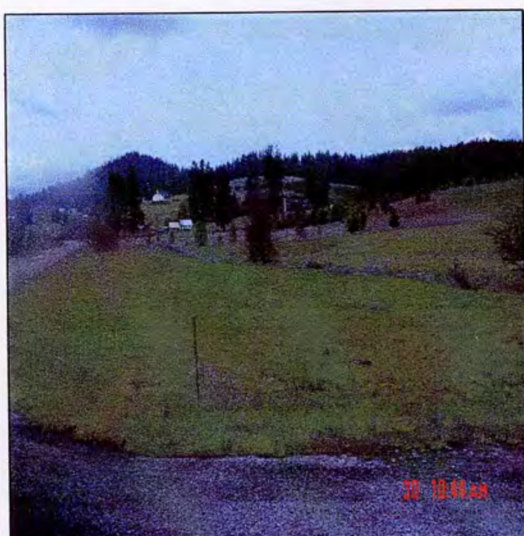


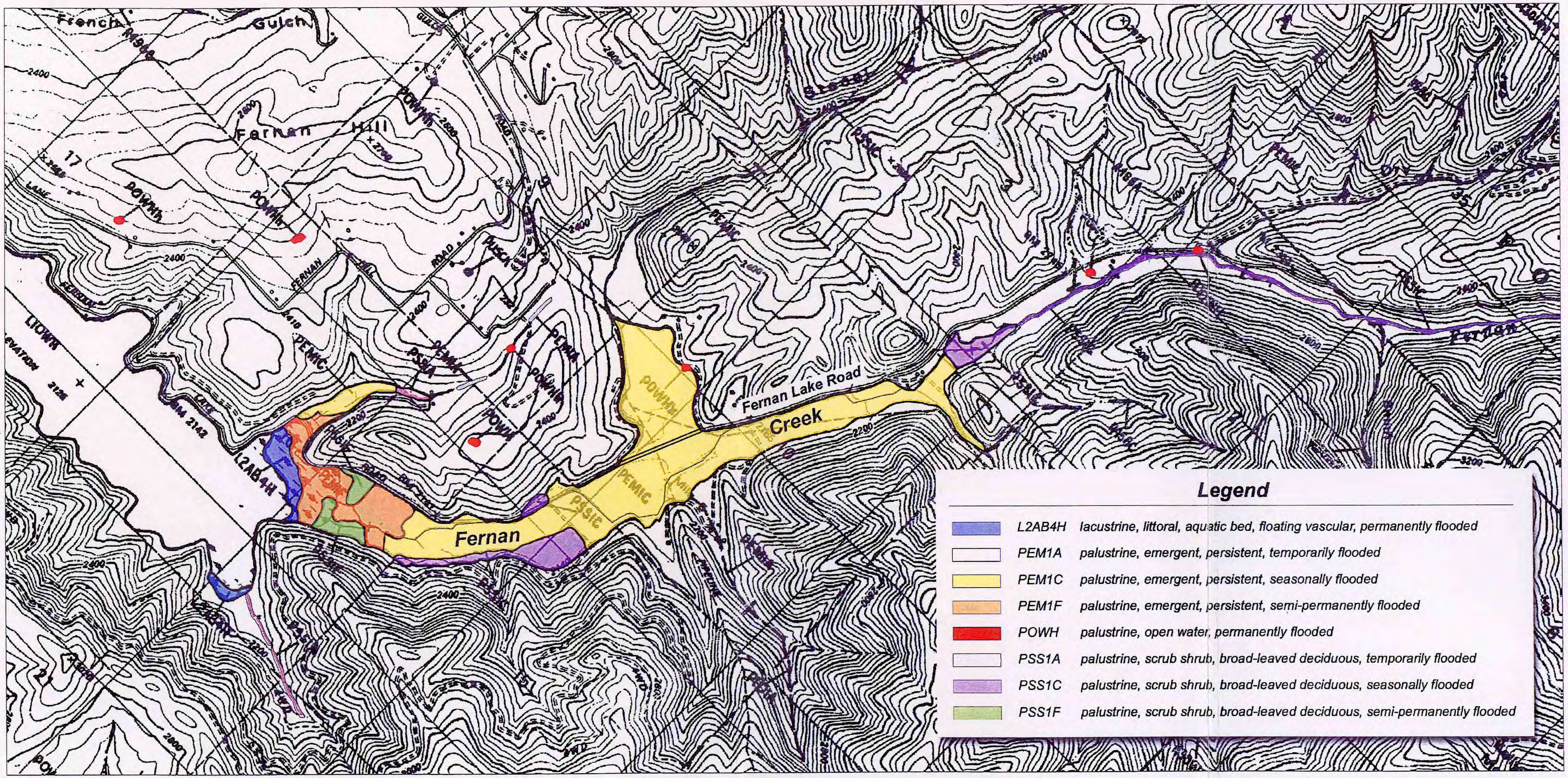
Figure 9. Photo showing Typical GTU 3 Conditions – French Gulch Area
Figure 10. Photo showing Typical GTU 4 Conditions – Fernan Hill Road Area

GIS ANALYSIS COVERAGES

15 GIS coverage's where used:

2 - USGS 10 meter surface digital elevation models,
(Coeur d'Alene & Fernan Lake 1:24,000 Quadrangles)

- ✓ Kootenai County 911 Roads
- ✓ Kootenai City Boundary's
- ✓ 20 ft contours (derived from digital elevation model)
- ✓ Slope analysis grid, derived from digital elevation model
- ✓ Fernan Lake 25 ft buffer zone
- ✓ Kootenai Comprehensive plan
- ✓ Idaho Geological Survey Geology Classification
- ✓ James Brown / Idaho Geological Survey technical report
- ✓ Strata GTU classification
- ✓ Kootenai Soils (NRCS)
- ✓ Kootenai addressable structures
- ✓ Kootenai Hydro (lakes and rivers)
- ✓ Kootenai Streams
- ✓ Kootenai Hillside, derived from digital elevation model



Source: FWS, 1987

Fig. 3. National Wetlands Inventory map for the Fernan Lake Road project corridor.

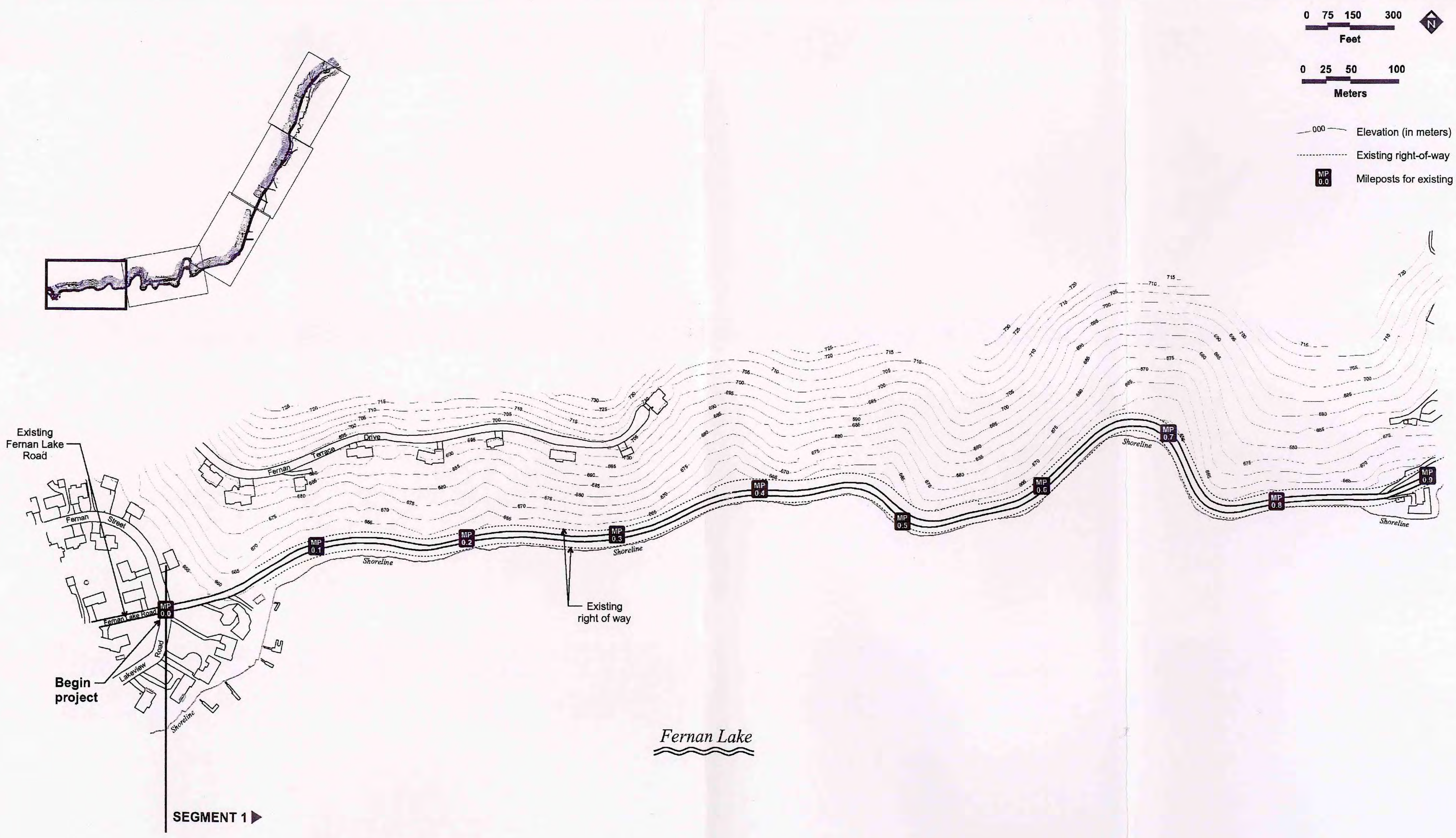


Fig. 5a.
Delineated wetlands in the project corridor between MP 0.0 and MP 0.9 (none in this section).

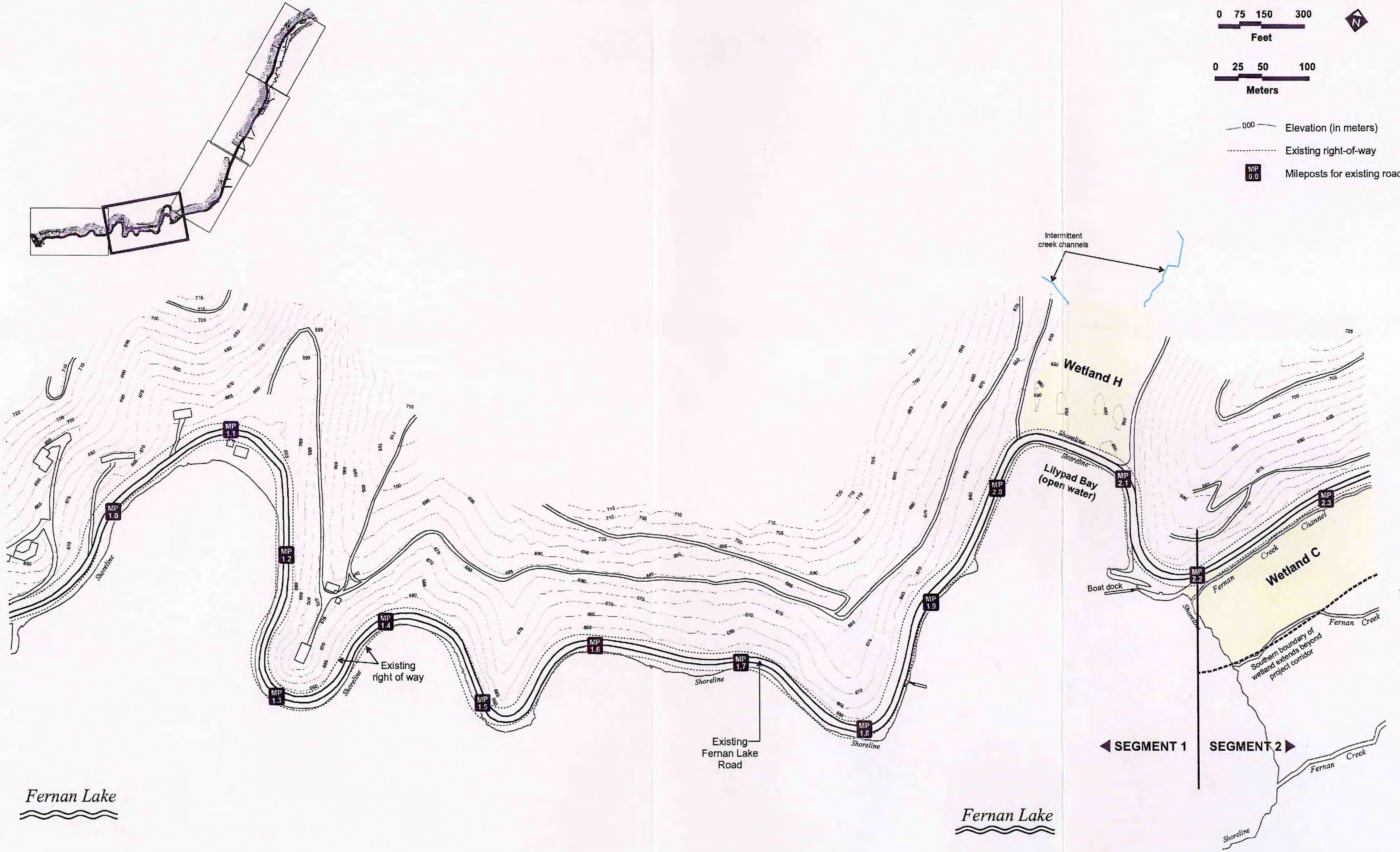


Fig. 5b.
Delineated wetlands in the project corridor between MP 0.9 and MP 2.3 (Wetland H and part of Wetland C).

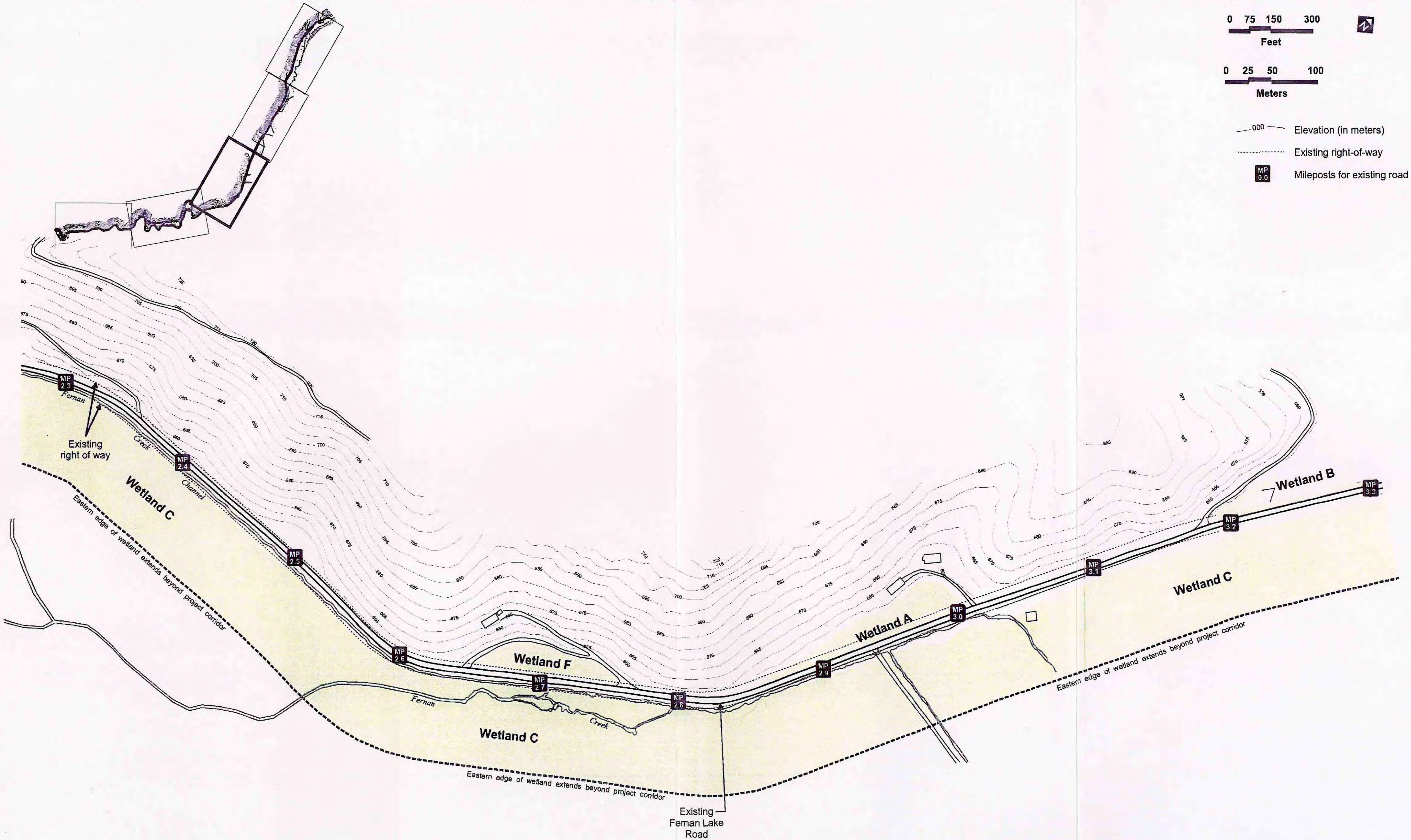


Fig. 5c.
Delineated wetlands in the project corridor between MP 2.3 And MP 3.3 (Wetlands A, B, and F, and part of Wetland C).

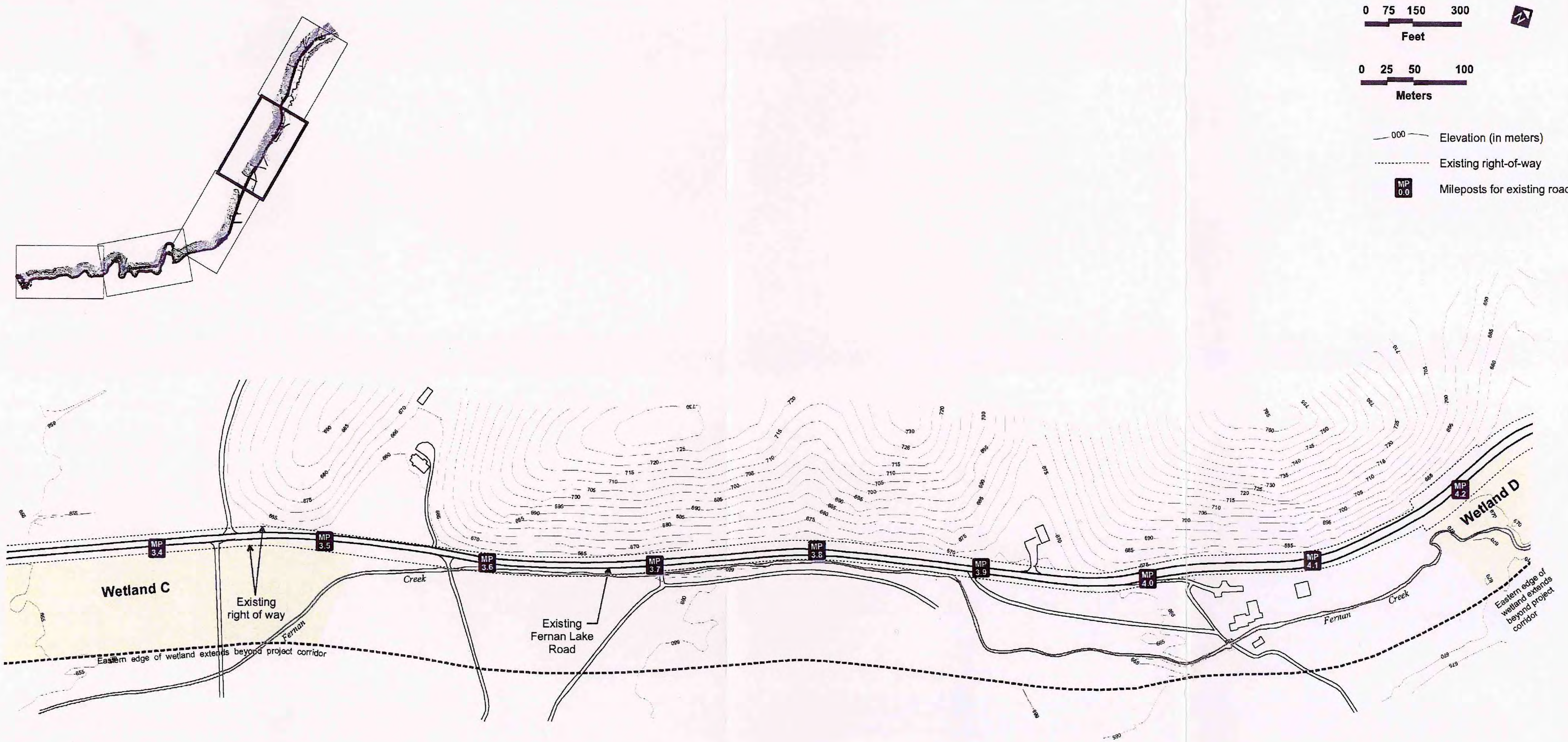


Fig. 5d.
Delineated wetlands in the project corridor between MP 3.3 and MP 4.2 (parts of Wetlands C and D).

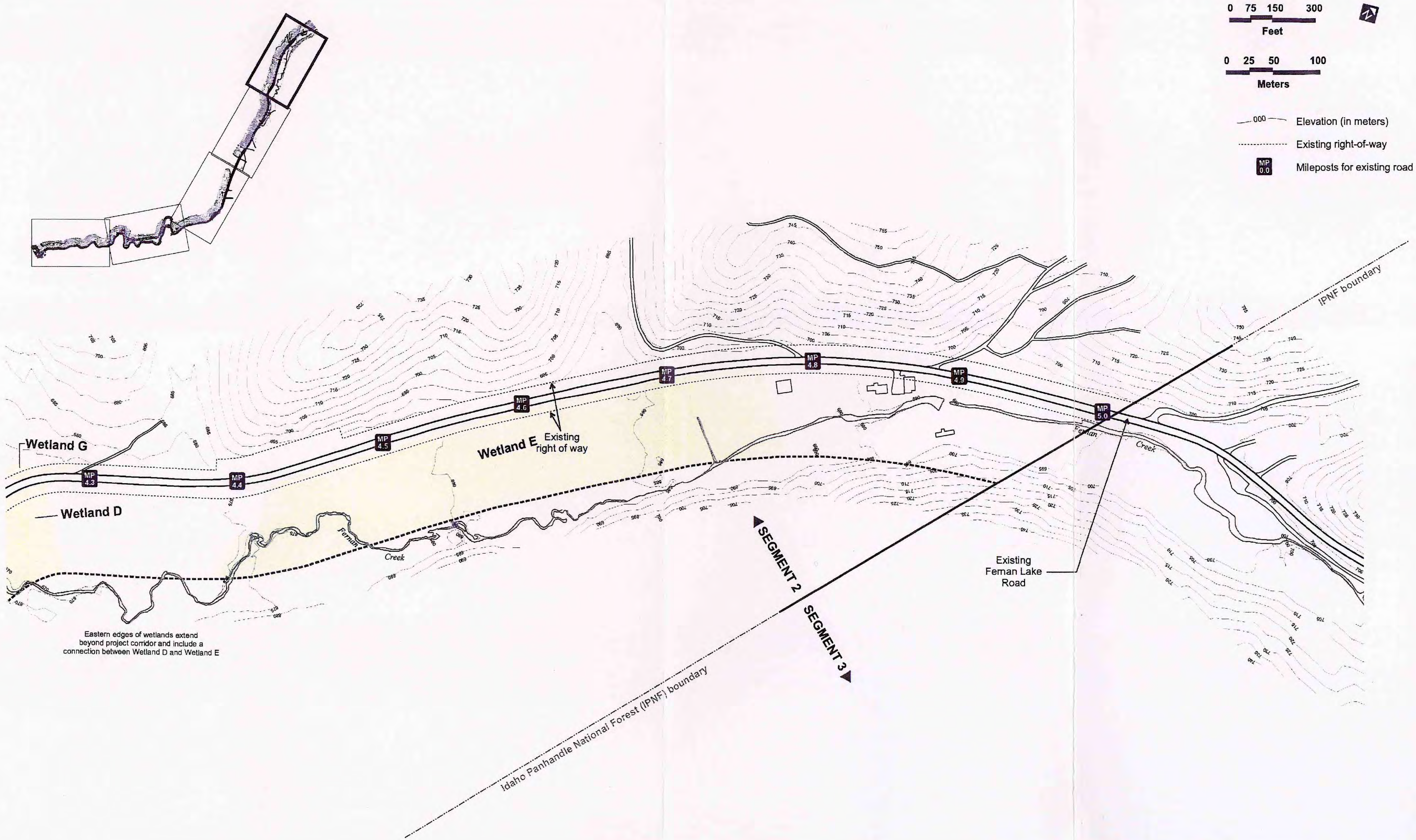


Fig. 5e.
Delineated wetlands in the project corridor between MP 4.2 and MP 5.0 (Wetlands E and G and part of Wetland D).

CITATIONS

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