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PPL MONTANA, LLC

PPLM-2301-1861

Magalie R. Salas
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

Re: Filing of Mystic Lake Project 2301 Proposed Study Plan per the
Integrated Licensing Process

November 1, 2004

Dear Secretary Salas:

PPL Montana filed a Notice of Intent (NOI) and Pre-Application Document (PAD) for relicensing of the Mystic Lake Project (FERC No. 2301) with the Commission on July 1, 2004 per the Commission's Integrated Licensing Process (ILP) rules. PPL Montana herein files a proposed study plan for the Mystic Lake Project with the Commission per the Mystic ILP schedule. A table summary of the 18 studies considered within the Mystic Project ILP proposed study plan appears below.

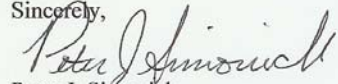
The Mystic Lake study plan has been developed in consultation with state (MDEQ, MFWP and MTSHPO) and federal (USFS) agencies, Tribes (Eastern Shoshone, Crow, Northern Arapaho and Shoshone-Bannock), Stillwater and Carbon Counties, American Whitewater, and other interested public and private stakeholders. A copy of this filing letter and Mystic study plan will be posted on PPL Montana's Mystic Lake Project website at www.mysticlakeproject.com by November 2, 2004.

PPL Montana has scheduled a meeting with FERC, agencies and other interested stakeholders for December 1 and 2, 2004 at the Sheraton Hotel in Billings Montana to discuss the Mystic Project proposed study plan. An agenda for this meeting will be posted on PPL Montana's website www.mysticlakeproject.com by November 15, 2004. PPL Montana will continue to consult with Mystic stakeholders on proposed study plan issues in preparation for this meeting.

Mystic Project Study No.	Study Description
1	Archaeological Resource Inventory- Area of Potential Effect- Mystic Lake, West Rosebud Lake, and Plant Operating Area
2	Inventory and Evaluation of Plant Operating Facilities
3	Jurisdiction of West Rosebud Road
4	Reliability of Transmission Lines and Feasibility of Eliminating Redundant Line
5	West Rosebud Creek Bypass Reach Habitat and Fish Population Evaluation
6	Hydrologic Characterization of the West Rosebud Creek Bypass Reach Between Mystic Lake Dam and the Powerhouse
7	Water temperature monitoring in the Mystic Lake Project Area
8	Mystic Lake Spill Hydrology
9	Aerial Survey of Riparian Corridor
10	Shoreline Erosion Inventory at Mystic Lake
11	Sensitive Plant Survey in the Mystic Lake Hydroelectric Project Area
12	Flow Restoration Action Plan for Flow-line or Penstock Shutoff
13	Mystic Hydroelectric Project Whitewater Flow Study
14	Mystic Hydroelectric Project Recreation Use Counts
15	Mystic Hydroelectric Project Water Quality Studies
16	Biological Assessment of Federally Listed Species
17	Biological Evaluation for Forest Service Sensitive Species
18	Evaluation of the Current Fish Population and Habitat in West Rosebud Creek Downstream from Emerald Lake

Thank you for your consideration of this proposed study plan.

Sincerely,



Peter J. Simonich,
Manager Hydro Generation

Cc: PPL Montana will send Mystic stakeholders an email with directions to access the Mystic proposed study plan at website www.mysticlakeproject.com

Mystic Lake Hydroelectric Project
FERC Project No. 2301
Proposed Study Plan



Prepared by:
PPL Montana
45 Basin Creek Road
Butte, Montana 59701

With assistance by:
GEI Consultants, Inc.
American Lands
Legacy Consulting

November 1, 2004

Mystic Project Study Request No. 1

Title of Proposed Study: Archaeological Resource Inventory- Area of Potential Effect-
Mystic Lake, West Rosebud Lake, and Plant Operating Area

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Refer to criteria, #1 and #6, adapted from FERC Regulations 18 CFR 5.9 (b), and Appendix I as discussed below.

2) A schedule for conducting the study.

The study plan is scheduled for the 2005 summer field season. The schedule for submitting an initial study report, reviewing the study, and decisions to continue and/or amend the study plan is provided in the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com).

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Refer to the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com) that outlines the timeline for pre-filing milestones and the process for communications and information sharing.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

Not Applicable.

****Criteria adapted from FERC Regulations 18 CFR 5.9 (b) and 18 CFR 5.11(4)(d)****

1) Describe goals and objectives of proposed study and the information to be obtained.

An archaeological inventory of the Area of Potential Effect (APE) is needed in order for the Federal Energy Regulatory Commission (FERC) to be in compliance with Section 106 of the National Historic Preservation Act, as amended (NHPA), and other applicable statutory and regulatory requirements for Cultural Resource Management (CRM). The Northern Region of the USFS also has a Programmatic Agreement (PA) with the Montana State Historic Preservation Officer (SHPO) that requires a Class III, intensive archaeological inventory within the APE on projects of this scope. The archaeological inventory is needed in the following APE:

- **Mystic Lake:** archaeological inventory of the Fluctuation Zone¹ (FZ) and in the Backshore Zone (BZ) from the maximum water elevation to 150 feet above that elevation, except in areas of the shoreline which are armored with rock or are rock cliffs.
- **West Rosebud Lake:** archaeological inventory of the Fluctuation Zone (FZ) and in the Backshore Zone (BZ) from the maximum water elevation to 150 feet above that elevation, except in areas of the shoreline which are armored with rock or are rock cliffs.
- **Mystic Lake Plant Operating Area:** archaeological inventory of the operating facilities area, as defined by the project boundary.

2) If applicable, explain any relevant resource management goals for agencies or Tribes with jurisdiction over the resource to be studied.

The goal is to identify archaeological properties located within the APE, which may be affected by operation of the Project, or by Project-Associated Actions, which may be undertaken after issuance of a new license.

3) If applicant is not an agency, explain any relevant public interest in regard to the proposed study.

PPL Montana is submitting this study request in order to assist FERC in meeting its responsibilities for CRM in the relicensing of the Project.

The public interest includes providing access for the use and enjoyment of public lands, waters, and other natural resources that are managed by public resource agencies. The public's interest also includes benefits from renewable energy produced by the Mystic Lake hydroelectric project.

¹ Defined as the zone between the maximum high-water and maximum draw down elevations at both Mystic and West Rosebud lakes.

4) Describe existing information on subject of proposed study and the need for additional information.

With the exception of limited inventory that identified several archaeological properties in the FZ of Mystic Lake; no systematic inventory of the Mystic Lake Fluctuation Zone, or adjacent lands has been undertaken. Therefore, such an inventory is needed in order to determine what archaeological properties are located in the APE, which could be affected by Project operations or Project-Associated Actions.

In 1977 an archaeological inventory was undertaken at West Rosebud Lake;² The West Rosebud Lake Site (24ST651) was excavated in 1978 in order to mitigate the impacts to it associated with raising the level of the lake. That work revealed significant cultural deposits and information on the campsite that suggest a tie to Shoshone groups. Current observations indicate that since the raising of the West Rosebud Lake level, erosion has occurred along portions of the shoreline. Consequently, an inventory at West Rosebud Lake would be undertaken. The purpose of this inventory would be to determine if archaeological properties not identified in the 1977 inventory have been exposed by erosion occurring subsequent to the 1978 raise of the West Rosebud Lake level.

No inventory of lands encompassing the Mystic Plant Operating Facilities has been undertaken. Such an inventory is needed in order to determine if archaeological properties are located in this area. Some of these could be historic archaeological properties, associated with the original construction of the Mystic Project.

The purposes of these inventories would be to:

- (a) determine if previously unrecorded archaeological properties exist in the inventory areas;
- (b) update existing information on those archaeological properties previously identified in the inventory areas, and
- (c) gather sufficient data for and complete evaluations of the eligibility of all archaeological properties in the inventory areas for listing in the National Register of Historic Places (NRHP).

Inventories and evaluations of NRHP eligibility would be undertaken in the manner as set out in the archaeological inventory and evaluation portions of the document entitled: *“MYSTIC HYDROELECTRIC PROJECT RELICENSING-CULTURAL RESOURCE STUDY PLAN”*, and are summarized in Appendix I hereinafter.

² This inventory was undertaken in advance of raising the level of West Rosebud Lake to the current operating elevation.

5) Explain any connection between project operation and effects (direct, indirect, and/or cumulative) on the resource to be studied and how study results will help identify potential project impacts and assist in development of License conditions.

The impacts of project operations on archaeological properties are currently unknown. However, it is reasonable to assume that if such properties are located in areas subject to erosion on Mystic or West Rosebud Lake, that erosion impacts are related to some degree at least on the operation of the Project. Also, impacts to archeological properties could occur in future operation of the Project, through proposals for land-disturbing activities within the APE, proposed by the Licensee (Project-Associated Actions). The proposed inventories will identify archaeological properties in the APE and the NRHP status of those properties. The impacts of Project operations can then be determined and plans developed to address those impacts. Such plans would be then included in the overall *Historic Properties Management Plan* for the Project. Implementation of that plan would become a license condition.

6) Explain how proposed study methods (including data collection and analysis techniques, study schedule and duration) is consistent with accepted scientific practices or considers, as appropriate, relevant Tribal values and knowledge.

The proposed inventories meet the needs as set out in FERC requirements for completing CRM in the relicensing process. Additional details on the methods for inventory and NRHP-evaluation are included in Appendix I. The inventory strategies are required under the USFS Region One Programmatic Agreement with the Montana State Historic Preservation Officer (SHPO).

7) Describe level of effort and anticipated cost and why alternative studies would not be sufficient to meet stated information needs.

The level-of-effort for these inventories is detailed in Appendix I. Estimated work load would be the inventory and recordation of sites within an approximate area of 250 acres (Mystic Lake highwater line at 18,000ft x 150ft = 62 acres + 31.45acres FZ = 94 acres; West Rosebud = 21 acres; Plant Facilities = 133 acres). Current rates for archaeological inventory range from \$8.80 to \$32.00 per acre. No alternative studies are feasible, since it is necessary to identify and evaluate archaeological properties in the APE so that known or potential impacts of Project operation to NRHP-eligible properties can then be assessed and plans drawn to address any such impacts.

The CNF has offered to provide access to agency documentation of the area, including previous inventory reports, original maps, and artifact collections. PPL Montana will sponsor the actual inventory and evaluation studies.

APPENDIX I

MYSTIC HYDROELECTRIC PROJECT RELICENSING CULTURAL RESOURCE STUDY PLAN SUMMARY – ARCHAEOLOGICAL RESOURCES

OVERVIEW

The document entitled “*MYSTIC HYDROELECTRIC PROJECT RELICENSING-CULTURAL RESOURCE STUDY PLAN*”, developed in consultation with parties to the relicensing of the Project, details all of the proposed studies for CRM. The following summarizes proposed archaeological studies from that plan.

SCOPING

This will include a review of all previously identified archaeological properties in the Fluctuation Zone (FZ) and/or Backshore Zone (BZ), as regards the location, nature and other data on these properties, thereby indicating the potential for additional, undiscovered properties in areas of the Area of Potential Effect (APE) for Mystic and West Rosebud lakes and the Plant Operating Area, which are included in the proposed inventory areas. This would be completed as a thorough file and records search, including searches of records on file with Custer National Forest; the Montana State Historic Preservation Office; the State Archaeological Site File Records (University of Montana, Missoula), and general studies in the area of the Project which could provide information for the development of context statements and NRHP Registration Requirements for any properties which may be identified in on-site resource inventories.

MYSTIC LAKE-INVENTORY AREA

A pedestrian inventory would be undertaken in the FZ of Mystic Lake. Field inventory would also include shoreline areas to determine which areas may be currently eroding, or potentially subject to such erosion in the future. The archaeological resource inventory would be extended into the BZ, for a distance of 150 feet above the full-reservoir contour of Mystic Lake, except where areas of the shoreline which are armored with rock or are rock cliffs.

WEST ROSEBUD LAKE-INVENTORY AREA

A pedestrian inventory would be undertaken in the FZ of West Rosebud Lake Mystic Lake. Field inventory would also include an evaluation of shoreline areas to determine which areas may be currently eroding, or potentially subject to such erosion in the future. The would be extended into the BZ, for a distance of 150 feet above the full-reservoir contour of West Rosebud Lake, except where areas of the shoreline which are armored with rock or are rock cliffs.

PLANT OPERATING AREA

A pedestrian inventory of the Plant Operating Area would be undertaken. Any identified properties would be recorded using appropriate recording forms and their locations identified in relation to specific operating facilities and/or any historical records of original plant construction as may be identified.

METHODS

All artifacts and cultural materials and features of cultural origins would be recorded. Only temporally or functionally diagnostic artifacts or other cultural materials would be collected, so as to conserve them from potential uncontrolled collection by others. Pedestrian transect intervals would normally not be spaced at intervals greater than 30 meters. Exceptions would include areas of steep or precipitous slopes, and/or broad expanses of exposed bedrock, which, based on field examination and evaluation were determined to warrant no or less extensive inventory effort. The different levels of inventory employed within various portions of inventory areas would be documented both in the field notes and in subsequent reporting and in the form of maps and photographs.

Data on all newly identified and or revisited Cultural Properties would be recorded on the *Custer National Forest - Heritage Resource Program Site Record* forms. Updates would be provided for any Cultural Properties already documented on these or other recording forms. A written report on all archaeological inventory and any subsequent NRHP evaluation studies would be produced.

EVALUATION OF ARCHAEOLOGICAL PROPERTIES

The process of evaluation will be to apply NRHP Context Statement(s), Property Type(s) and Registration Requirements, to the properties identified in resource inventory. Those properties, which either meet or exceed the Registration Requirements for the Property Type, will be evaluated as eligible for NRHP listing. If in the course of evaluation of the NRHP-eligibility of any PAP or HAP, any disagreements on such evaluations arise among PPL Montana, CNF, FERC and/or the SHPO, then PPL Montana will seek the opinion of the Keeper of the NRHP for resolution of any NRHP-eligibility questions and the opinion of the Keeper will guide resolution of the disagreement.

Mystic Project Study Request No. 2

Title of Proposed Study: Inventory and Evaluation of Plant Operating Facilities

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Refer to criteria, #1 and #6, adapted from FERC Regulations 18 CFR 5.9 (b), and Appendix I as discussed below.

2) A schedule for conducting the study.

The study plan is scheduled for the 2005 summer field season. The schedule for submitting an initial study report, reviewing the study, and decisions to continue and/or amend the study plan is provided in the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com).

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Refer to the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com) that outlines the timeline for pre-filing milestones and the process for communications and information sharing.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

Not Applicable.

****Criteria adapted from FERC Regulations 18 CFR 5.9 (b) and 18 CFR 5.11(4)(d)****

1) Describe goals and objectives of proposed study and the information to be obtained.

In order to be in compliance with the National Historic Preservation Act, as amended (NHPA), an inventory and evaluation of all Plant Operating Facilities (POF), for listing in the National Register of Historic Places (NRHP) needs to be conducted. This is necessary since future Project operations could have impacts on any POF identified as eligible for NRHP listing.

2) If applicable, explain any relevant resource management goals for agencies or Tribes with jurisdiction over the resource to be studied.

The goal is to identify historic POF that could be impacted by future Project operations in the form of alterations to buildings and structures. This is consistent with goals for Cultural Resource Management (CRM) identified in the Custer National Forest (CNF) Management Plan.

3) If applicant is not an agency, explain any relevant public interest in regard to the proposed study.

PPL Montana is submitting this study request in order to assist FERC in meeting its responsibilities for NHPA in the relicensing of the Project.

The public interest includes providing access for the use and enjoyment of public lands, waters, and other natural resources that are managed by public resource agencies. The public's interest also includes benefits from renewable energy produced by the Mystic Lake hydroelectric project.

4) Describe existing information on subject of proposed study and the need for additional information.

Consultation among the CNF, PPL Montana and the SHPO for the Transmission Lines and Hoist House undertakings provided for completion of the inventory of all POF at the Mystic Lake Hydroelectric facility until the FERC relicensing. These studies would fulfill commitments to complete such an inventory in that process.

5) Explain any connection between project operation and effects (direct, indirect or cumulative) on the resource to be studied and how study results will help identify potential project impacts and assist in development of License conditions.

The potential impacts of project operations on historic POF are currently unknown. The inventory of POF will identify those of an historically significant nature and the specific

historic architectural and engineering values ascribable to such facilities. This will permit later identification of potential impacts that could occur to historic POF in future Project operations and the methods to address those potential impacts. In turn, this will permit development of a management plan for historic POF, to be included in the *Historic Properties Management Plan* for the Project. Implementation of that plan would become a license condition.

6) Explain how proposed study methods (including data collection and analysis techniques, study schedule and duration) is consistent with accepted scientific practices or considers, as appropriate, relevant Tribal values and knowledge.

The study methodology will conform to applicable NRHP guidance on this type of study. Additional details on this study are included in the document entitled as “*MYSTIC HYDROELECTRIC PROJECT RELICENSING-CULTURAL RESOURCE STUDY PLAN*,” and are summarized in Appendix I hereinafter.

7) Describe level of effort and anticipated cost and why alternative studies would not be sufficient to meet stated information needs.

There are no alternative studies of the facility. No inventory or evaluation of any POF, other than the two associated electric transmission lines has been completed to-date. FERC guidance on CRM in relicensing requires the inventory and evaluation of POF. The estimated cost of the study is \$8,000.00.

CNF will provide access to Forest documentation of the area, including previous inventory reports, original maps, and artifact collections. PPL Montana will sponsor the actual inventory.

APPENDIX I

MYSTIC HYDROELECTRIC PROJECT RELICENSING CULTURAL RESOURCE STUDY PLAN SUMMARY – HISTORIC PLANT OPERATING FACILITIES

OVERVIEW

The document entitled “*MYSTIC HYDROELECTRIC PROJECT RELICENSING-CULTURAL RESOURCE STUDY PLAN*”, developed in consultation with parties to the relicensing of the Project, details all of the proposed studies for CRM. The following summarizes the details of that plan, as relates to proposed studies for identification and evaluation of historic Plant Operating Facilities (POF). These features include various buildings and structures on the Project.

STUDY SUMMARY

PPL-Montana will sponsor an inventory and National Register of Historic Places (NRHP) evaluation of those POF, which have not been inventoried and evaluated to-date. The inventory would include all POF facilities of substantial size and scale, including, but not necessarily limited to the dams, powerhouse, weirs, employee housing facilities and other support facilities. The electric transmission lines associated with the Project have already been inventoried and evaluated and an inventory has been conducted for archaeological properties in the transmission line rights-of-way. The Custer National Forest (CNF) and the Montana State Historic Preservation Officer (SHPO) have concluded that the POF are eligible for listing in the NRHP.

Inventory and evaluation of POF would be made utilizing the format adopted in 1990 by Montana Power Company, for Plant Operating Facilities on the Missouri-Madison Hydroelectric Project. A focus of that format is the place of specific POF in relation to larger contexts of the history of hydroelectric development in Montana, based on the NRHP Criteria. That format provides for the development of specific statements of historical, contextual significance and measurable NRHP Registration Requirements for historic hydroelectric operating facilities. The specific historic contexts and NRHP evaluation standards would be adapted to the context of the Mystic Project Operating Facilities. The Registration Requirements will specify the physical and associative characteristics and qualities of integrity that an individual property must possess to be eligible for NRHP listing and/or that specific elements must possess in order to be a contributing element of a larger property. Under that format, not all types of seven types of integrity must be fully present, in order for a property to be eligible for NRHP listing, or to be contributing to a larger property. The Registration Requirements specify which of the types of integrity must be represented and by what physical and associative characteristics they must be represented.³

Use of this format allows for specification of the individual units (buildings and structures) within a complex of POF that may be both of significance and have sufficient integrity of design, materials, and association, such that they may individually be NRHP-

³ NRHP Bulletin 16B

eligible properties or that constitute a contributing element of a larger property. It permits the specification of those engineering and design values, which constitute the historical importance of specific units of a given property. In turn, this allows for focused management of those specific units and the specific values they represent, in developing the management criteria for historic building and structures as part of the *Historic Properties Management Plan* for the Project. Implementation of that plan is made a license condition. If in the course of evaluation of the NRHP-eligibility of any POF, should any disagreements on such evaluations arise among PPL Montana, CNF, FERC and/or the SHPO; then PPL Montana will seek the opinion of the Keeper of the NRHP for resolution of any NRHP-eligibility questions and the opinion of the Keeper will guide resolution of the disagreement.

Mystic Project Study Request No. 3

Title of Proposed Study: Jurisdiction of West Rosebud Road

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Refer to criteria, #1 and #6, adapted from FERC Regulations 18 CFR 5.9 (b), as discussed below.

2) A schedule for conducting the study.

The study plan is scheduled for the 2005 field season. The schedule for submitting an initial study report, reviewing the study, and decisions to continue and/or amend the study plan is provided in the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com).

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Refer to the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com) that outlines the timeline for pre-filing milestones and the process for communications and information sharing.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

Not Applicable.

****Criteria adapted from FERC Regulations 18 CFR 5.9 (b) and 18 CFR 5.11(4)(d)****

1) Describe goals and objectives of proposed study and the information to be obtained.

The goal is to determine legal jurisdiction regarding access for West Rosebud Road on non-FS lands.

2) If applicable, explain any relevant resource management goals for agencies or Tribes with jurisdiction over the resource to be studied.

Custer National Forest Management Plan criteria for legal access include arterial and collector routes to National Forest System lands and key access to National Forest System lands. Access may be ensured either by acquisition of an easement by the USDA Forest Service or cooperation/coordination with appropriate county and declaration of county road. Adequate legal access to areas authorized is a criterion for issuance of a special use authorization.

3) If applicant is not an agency, explain any relevant public interest in regard to the proposed study.

The public interest includes providing access for the use and enjoyment of public lands, waters, and other natural resources that are managed by public resource agencies. The public's interest also includes benefits from renewable energy produced by the Mystic Lake hydroelectric project.

4) Describe existing information on subject of proposed study and the need for additional information.

Forest Development Road #2072 is the only physical access to the Mystic Lake Hydroelectric Project. It appears that the road is a county road to the Custer National Forest boundary. There are private lands located immediately within the Forest boundary for which USDA Forest Service records do not show a legal access easement. Legal research is needed to determine the jurisdiction of: 1) the road outside the Forest boundary; 2) the road crossing private lands immediately within the Forest boundary. See attached map and legal description.

5) Explain any connection between project operation and effects (direct, indirect or cumulative) on the resource to be studied and how study results will help identify potential project impacts and assist in development of License conditions.

Adequate legal access is a requirement in order to ensure travel to and from the project. If adequate legal access does not exist, the use of the only road to the project could be in jeopardy. Research of county records and/or acquisition of title insurance will show the jurisdiction of the access road. If the entire road is either under USDA Forest Service or

County/State jurisdiction, no further action will be needed. If there are segment(s) without public road jurisdiction, efforts must be made to acquire public access across them as soon as possible. See attached map.

6) Explain how proposed study methods (including data collection and analysis techniques, study schedule and duration) is consistent with accepted scientific practices or considers, as appropriate, relevant Tribal values and knowledge.

In this case, accepted scientific practices will actually be accepted legal practices as defined by the Department of Justice in “Title Standards 2001” which says:

“Title ownership of land or interest in land is determined by an examination of documents in public land records, by a physical inspection of the property and by a review of other supplemental or supporting documents. Such title evidence is almost always universally prepared and reviewed in the private sector when land is purchased or mortgages to determine that there are no adverse or unacceptable encumbrances or “clouds” on the title. The United States government, acting through its various departments and agencies, follows the same practice when it acquires land or interests in land for the same reason, but also because it is required to do so by a statute originally enacted in 1841, now codified at 40 USC 255. This status conditions an agency’s authority to acquire land on the prior approval of the sufficiency of the title by the Attorney General or his/her delegee.”

7) Describe level of effort and anticipated cost and why alternative studies would not be sufficient to meet stated information needs.

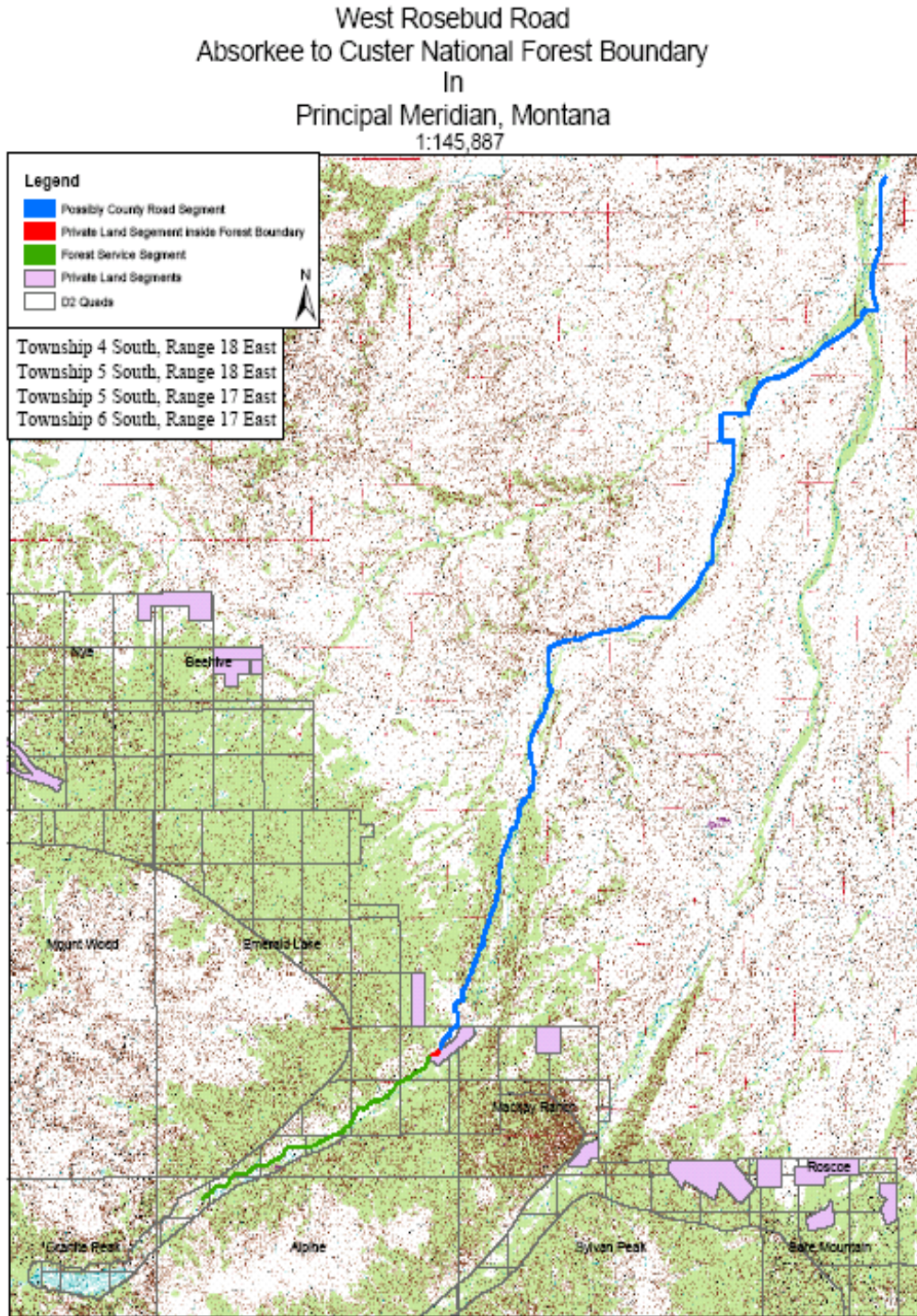
A search of Stillwater County records should be made to determine the legal jurisdiction of the road from State Highway 78 to the Mystic Lake Hydroelectric Project. It is anticipated that the roads from State Highway 78 to the Forest boundary, Highways 419 and 475, will be found to be county roads as declared by the County Commissioners. From the Forest boundary to the project, road segments crossing National Forest System lands are currently under USDA Forest Service jurisdiction. However, jurisdiction for the segment of private land inside the Forest boundary is unknown; see attached map.

The search for jurisdiction needs to be conducted by a qualified contractor or title company following standard legal procedures to verify/determine jurisdiction of the road segments and obtain, for project files, supporting documentation and/or title insurance.

Cost depends on the volume of documents and records to be searched including all public records such as deeds, easements, county commissioners’ minutes and official declarations, and county road logs. A records search by a qualified contractor/title company is anticipated to take 1 week (40 hours @ \$100/hr plus travel expenses and document copy costs) for an approximate cost of \$5,000. A follow-up study would be required should initial efforts determine other county(s) or additional records need to be searched.

Reference:

Title Standards 2001 – A Guide for Preparation of Title Evidence in Land Acquisition by the United States of America” (March 23, 2001).



Mystic Project Study Request No. 4

Title of Proposed Study: Reliability of Transmission Lines and Feasibility of Eliminating Redundant Line

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Refer to criteria, #1 and #6, adapted from FERC Regulations 18 CFR 5.9 (b), as discussed below.

2) A schedule for conducting the study.

The study plan is scheduled for the 2005 summer field season. The schedule for submitting an initial study report, reviewing the study, and decisions to continue and/or amend the study plan is provided in the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com).

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Refer to the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com) that outlines the timeline for pre-filing milestones and the process for communications and information sharing.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

Not Applicable.

****Criteria adapted from FERC Regulations 18 CFR 5.9 (b) and 18 CFR 5.11(4)(d)****

1) Describe goals and objectives of proposed study and the information to be obtained.

The goal is to have the fewest number of improvements, eliminate redundant structures where possible, have a net gain in resource protection and environmental quality and improve the visual quality within the project area.

The project currently uses two 50 kV transmission lines to transmit power from the power house northeast approximately 5.2 miles across NFS lands to a substation near the Forest boundary. PPL Montana has indicated that both lines are needed for safe and reliable project operation. PPL Montana also noted that line inspections include visual checks for burning poles, trees, or cross arms. The USDA Forest Service expressed concerns regarding the reliability and safety of the current transmission lines.

The objective of this study is to analyze the reliability and safety of the existing transmission lines and consider the potential to eliminate redundancy through the removal of one of the lines or, if necessary, replace both lines with a single line built to current industry standards. The study should provide definitive conclusions as to whether opting for a single line is a reasonable alternative to the existing transmission lines in terms of cost, aesthetic value, environmental and cultural resource impacts, and functionality. The study will review specific requirements for redundancy at the Mystic Lake facility. Recognizing that Mystic Lake is located in a remote area with specific requirements for supplying stable grid voltages and peaking capability, the study will review other similar facilities and make comparisons to determine whether or not they utilize similar levels of redundancy to enhance reliability.

2) If applicable, explain any relevant resource management goals for agencies or Tribes with jurisdiction over the resource to be studied.

The USDA Forest Service has a duty to minimize the risk of wildfire by ensuring that facilities constructed and operated on National Forest System lands meet accepted construction standards and that maintenance is conducted as needed to provide safe and reliable service.

In addition, USDA Forest Service Manual 2703 provides key policy direction applicable to management of authorizations on National Forest System lands:

- Limit the area of NFS lands to no greater than is needed for the purpose authorized.
- Do not grant an authorization primarily to afford the applicant a lower cost or less restrictive location as compared to other reasonable alternatives.

Custer National Forest Management Plan (CNFMP) stipulates in regard to Power Lines that:

- All new or replacement power or telephone transmission or distribution lines will be underground except where prohibited by technical circumstances.
- Technically required overhead power lines will be routed to minimize visual impacts.
- They will be designed to minimize risk of raptor electrocution.

Removal of one redundant 50 kV line or replacement of both lines with a single line could meet the intent of CNFMP to minimize visual impact and raptor electrocution.

3) If applicant is not an agency, explain any relevant public interest in regard to the proposed study.

The public interest includes providing access for the use and enjoyment of public lands, waters, and other natural resources that are managed by public resource agencies. The public's interest also includes benefits from renewable energy produced by the Mystic Lake hydroelectric project.

4) Describe existing information on subject of proposed study and the need for additional information.

PPL Montana has two 50 KV power transmission lines which leave the hydro plant and run approximately 5.2 miles northeast to the Forest boundary. Beyond the boundary, the lines run across non-NFS lands to PPL's Line Creek Substation. The north line is referenced as the "A" line or Mystic-Columbus line and the south line is the "B" lines or the Mystic-Red Lodge line. The Forest has issued a special use permit to PPL Montana for the 5.19 miles of lines on NFS lands valid until 12/31/2021.

Additional information needed to complete this study include:

- Examples of other hydropower projects where the need for redundant lines has been demonstrated to provide for reliability
- A report of past failures and line faults associated with the two lines over the term of the existing license including the cause of the failure, duration of the line trip, causal agent (wind, lightning, defective equipment, trees, animal damage or contact, etc), collateral impacts such as downed lines, fires, or other damage, and the remedy for the problem.
- Cost estimates for the various alternatives, including redesigning one transmission line to carry the other line, redesigning a new line to replace both lines, cost estimates to mitigate historic properties (A line), cost of any demolition and reconstruction, modification, or alteration of the existing lines.
- If, in replacing two lines with a modern line, or in making other modifications, the need arose to go outside the existing right of way, any new land disturbances outside the existing right of way would require an archeological survey.

5) Explain any connection between project operation and effects (direct, indirect or cumulative) on the resource to be studied and how study results will help identify potential project impacts and assist in development of License conditions.

PPL Montana provided rationale and justification for the two parallel 50KV power transmission lines by way of a GEI Consultants Memo dated August 26, 2004. The USDA Forest Service contends that a feasibility study to address reducing the need for two lines to one line is needed to complete the justification. PPL Montana asserts the need for sufficient reliability to guarantee the ability to maintain continuous transmission. Given that PPL Montana should be able to maintain reliability on the level currently achievable with two redundant lines, the study should focus on options that will not compromise this current capability. Accepting this, the study should address options available for maintaining the existing level of reliability via a new single line, or modifications to one of the two existing lines that would facilitate removal of the other line. The cause and effect relationship between resources of concern including visual quality, preservation of historic places, protection from fire hazard, and raptor electrocution hazard vs. operational concerns such as reliability, ability to sustain continuous transmission, and cost control to a reasonable extent will be weighed.

The study will assist Licensee conditions by assessing the cost-benefit of various alternatives to identify preferred transmission line improvements over the life of the license.

6) Explain how proposed study methods (including data collection and analysis techniques, study schedule and duration) is consistent with accepted scientific practices or considers, as appropriate, relevant Tribal values and knowledge.

The USFS contends that the current accepted practice throughout the power generation industry is one dedicated set of transmission lines from the point of generation to the point of distribution.

7) Describe level of effort and anticipated cost and why alternative studies would not be sufficient to meet stated information needs.

The feasibility study requested would be performed by PPL Montana and would display the cost benefit of maintaining two power transmission lines over the period of the license vs. installation and maintenance of one power transmission line capable of addressing the maintenance and reliability concerns cited for retaining two lines. Anticipated costs to develop the information for the study are unknown. It is estimated that the feasibility studies, review of existing transmission line configurations at other facilities, cost estimates for the various alternatives, and formal reporting of the findings could cost \$25,000 - \$50,000.

Mystic Lake Study Request No. 5

Title of Proposed Study: West Rosebud Creek Bypass Reach Habitat and Fish Population Evaluation

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Not Applicable.

2) A schedule for conducting the study.

Not Applicable.

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Not Applicable.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

**2004 West Rosebud Creek Bypass Reach
Habitat and Fish Population Evaluation**

**Preliminary Results
Response to U.S. Forest Service study request No. 5**

November 1, 2004

This study was conducted in response to the USFS Study Request No. 5 titled Evaluation of Current Instream Flows and Biological Indicators for the West Rosebud Creek Bypass Reach.

Abstract:

Habitat sampling in accordance with fish surveys were made in the summer/fall of 2004 in the West Rosebud Creek bypass reach. Evaluation of instream habitat at varying flows indicated that sufficient habitat is available for the trout population residing in this reach of stream during the low flows that occur early fall through winter. Cross-sectional data visually indicates that pools are sufficiently deep at flows down to 2.0 cfs in the upstream and middle sections, while habitat was also sufficient at 3.6 cfs, the lowest flow observed at the downstream site to maintain fish populations during the fall and winter months. Longitudinal surveys indicate that, at the lowest flows observed, pool depths are above the residual pool depths at each site. It was also observed that sufficient depths were present in the transition zones between pools for fish movement between habitat units. Fish sampling indicated that the bypass reach has an extremely healthy population of rainbow trout in all sites as well as the occurrence brown trout in the downstream section. Due to the fact that the current instream flow regulations have been in place for over 20 years and the fish population is healthy, and with the current information presented from the 2004 field season, we believe that no other instream flow studies need to be pursued to evaluate the suitability of current instream flows in relation to fish habitat and populations within the West Rosebud Creek bypass reach.

Introduction:

The Mystic Project interagency fisheries, aquatic habitats, and water quality resource work group identified the current instream flows for the West Rosebud Creek bypass reach (channel) as a potential issue. Specifically, the issue is focused on whether current instream flows for the bypass channel are sufficient during the fall and winter months to maintain suitable habitat for the aquatic species residing within the stream. The existing license for the Mystic Project calls for a minimum flow in the bypass reach of 3 cfs from September 1 to May 31 and 10 cfs from June 1 to August 31. The license order establishing these minimum flows was issued by FERC on January 19, 1981.

PPL Montana asked for and listened to comments made by the U.S. Forest Service (USFS) to assess what data would be sufficient to evaluate the suitable habitat in regards to the rainbow trout population within the bypass reach. The goal of this study was to evaluate the quality of fish habitat available during the fall and winter seasons under the current flow regime.

In conjunction with the physical habitat evaluation, fish populations were sampled during 2004 in four sites, which is viewed as the best indicator as to how well the current instream flow requirements have worked for over the past twenty years. Although macroinvertebrate sampling also occurred within the bypass reach in the summer of 2004 those results are not yet available, therefore they will not be presented within this preliminary report.

In response to comments received by the USFS (10/18/2004), PPL Montana has agreed to additional habitat sampling in the West Rosebud Creek bypass reach during November of

2004. PPL Montana's senior fisheries biologist Brent Mabbott and Custer National Forest fisheries biologist Darren Watschke will lead a team of fisheries professionals to further evaluate habitat within the bypass reach using a modified R1/R4 habitat inventory methodology. The sampling will consist of breaking the reaches of the bypass reach into habitat units (pools and riffles) and measuring the lengths, widths, and average and maximum depths within these habitat units. This will also allow for pool to riffle ratios to be quantified as well as metrics such as pools/distance and riffles/distance throughout the bypass reach. Discharge will not be measured at the individual habitat units, rather will be obtained from the upper weir, just upstream of the Mystic Lake Powerhouse. Results of this work will be included into this preliminary study and will be distributed to all participants of the Mystic Lake fisheries and water quality resource groups.

The following sections describe data that have already been collected as of October 2004.

Methods:

Instream Habitat Evaluation

Because the physical characteristics of the bypass channel vary longitudinally, sampling occurred at the three physically distinct reaches to capture the variation in fish habitat within the entire bypass reach. One study section in each of the three stream segments were used, one in the upper steep habitat, one in the middle flatter section, and one just above the upper weir located near the powerhouse. The lower study section is not representative of the high gradient bedrock habitat that is characteristic of the majority of the downstream areas of the bypass channel. This study site was selected because the high gradient bedrock areas are very difficult to sample. We included this study site because this is the only area within the bypass channel that contains brown trout. Therefore the area just above the weir was chosen as the most downstream site for habitat sampling. Although only three sites were chosen for habitat evaluation, a fourth site was included in the fish population survey methodology. That site is representative of the steep bedrock area that is characteristic of the lower bypass channel.

A reference benchmark location was established at each of the three sites. Longitudinal profile surveys were conducted at each site on August 5 and September 28, 2004. Longitudinal profiles were taken through the thalweg to characterize all obvious habitat types and the breaks in habitat types and to better characterize the residual pool depths within each site.

Six monumented cross-section surveys were collected within each site on August 5, 2004. Cross sections were taken at the middle of a pool and the pool tail out area, thus two transects per pool were taken. Cross-sectional data consisted of the depth of the stream across the cross section and cross-sectional length. All cross-sections were tied longitudinally and by elevation to each sites benchmark.

To evaluate how the fall in water elevation with decreasing flows influences instream habitat, waters edge elevations at each of the six previously measured cross-sections were measured and tied back to the benchmarks on August 31 and September 28, 2004.

Evaluating how the surface water elevation changes allowed PPL Montana to graphically represent the quantity of instream habitat available during each independent flow.

Stream Discharge Measurements

Flow was measured on August 5, 2004 at the upper weir, just upstream of the Mystic Powerhouse. During both the August 31 and September 28, 2004 studies, flow was measured at each site within the most adequate section of the stream that all parties present felt best-represented laminar flow. Stream discharge was measured using a pygmy current meter with rotating cups. Methods used were similar to that described in Harrelson et al. 1994.

Photo Tour

Fixed photograph stations were established at each of the three sites to allow visual comparison of the available habitat within each site at different flows. Photographs were taken from the established benchmarks and captured the same habitats through all three flows. The “photo tour” visually depicting the three sections at differing flow is included as a supplement to this preliminary report (can be sent upon request by mail on CD-ROM) due to the excessive file size and the inability of some parties to electronically receive it via email.

Fish Sampling:

Four sections within the West Rosebud Creek bypass reach were sampled with a backpack electrofishing unit on August 3 and 4, 2004. Three of the sites were the same as for the habitat evaluation (upstream, middle, and downstream sites), while one additional site was also electrofished. The additional site that was not used in the habitat survey was sampled for fish on August 4 in the same manner as the upstream and downstream sites (one pass electrofishing). This section was located between the downstream and middle site, in a just reach just upstream of known natural fish barriers, therefore this site was named “barrier falls”. Global Positioning Satellite positions were taken at each site and are listed below in Table 1.

Table 1. Location of all Habitat and Fish Sampling sites

Site	GPS Positions	
	North	West
Upstream	45.23145	109.75158
Middle	45.23591	109.74664
Barrier Falls	45.23904	109.73724
Downstream	45.24306	109.73258

During all fish sampling, regional fish biologist Jim Olsen of the Montana Fish Wildlife and Parks (MFWP) was present. Due to high flow conditions (38.2 and 37.3 cfs) in the bypass reach on August 3 and 4, the efficiency of capture was low, therefore only one pass was made at the downstream and upstream sites. Two electrofishing passes were made at the middle site, one on August 3 and one on August 4. All fish captured were

tagged by an adipose fin clip, which facilitated future mark-recapture population estimates. All fish were measured to total length (in).

Another electrofishing pass was made in the middle site on September 1, 2004 when discharge was recorded at approximately 6.2 cfs at the upper weir. This sampling was used by MFWP to calculate a population estimate using mark recapture methods. This method is standard for MFWP monitoring reaches and is based on the proportion of marked fish from the August 3 and 4 sampling and the proportion recaptured on September 1. All fish captured on September 1 were measured to total length (in) and weighed (lbs).

Results:

Instream Habitat Evaluation

Longitudinal surveys of the upstream high gradient site indicate that residual pool depths (defined as depth of water at zero flow) for the deepest pools are approximately 2.0 ft in depth. Residual pool depth for medium sized pools are over 1.5 ft at the low flow of 2.0 cfs that occurred on September 28, 2004 (Figure 1). Pools remained deeper than actual residual pool depth for all pools during the 2.0 cfs flow in September. The maximum depth recorded for the longitudinal survey on September 28 at a flow of 2.0 cfs was 2.55 ft (Table 2). Transitions between pools in this high gradient reach had a minimum depth of 0.3 ft (See Table 2).

The depth of cross sections in the upstream site varied with varying flows as well as between transects (Figures 2, 3, and 4). Transect #1 in Pool #2 retained a depth of 2.12 ft in the thalweg during the flow of 2.0 cfs in September, while the maximum depth of Transect #2 of the same pool retained 0.61 ft of water. The depth of the deepest pools in the upstream site decreased on average by 0.53 ft from a flow of 10.4 cfs to the low flow of 2.0 cfs (Table 3).

Longitudinal surveys of the middle site indicate that residual pool depths of approximately 2.0 ft are present within this reach (Figure 5). The actual depth of all pools was greater than the residual pool depths during the low flow of 2.1 cfs measured in September. The maximum depth recorded for the longitudinal survey on September 28 at a flow of 2.1 cfs was 2.56 ft (See Table 2). Transitions between pools in this reach had a minimum depth of 0.30 ft (See Table 2).

**Table 2. Longitudinal profile data for West Rosebud Creek Bypass Reach
September 28, 2004.**

Longitudinal Profiles for all three sites on September 28, 2004					
Upstream Site		Middle Site		Downstream Site (upper weir)	
2.0 cfs		2.1 cfs		3.6 cfs	
Distance (ft)	Depth (ft)	Distance (ft)	Depth (ft)	Distance (ft)	Depth (ft)
12	0.80	7	1.40	17	0.52
16	0.70	11	1.35	20.5	2.60
18	0.70	15.5	1.40	26	2.25
22	0.90	21	1.08	34	1.61
23	1.00	26	1.35	42	1.86
25	0.40	27.5	0.30	50	1.38
27	1.10	30	0.84	56	1.14
30	0.80	32	1.60	64	1.73
34	0.90	36	1.78	71	1.38
38.5	0.70	41	1.36	74	0.98
44	1.70	44	0.74	76	1.58
48.5	1.40	47	1.40	80	1.05
52	1.55	53	2.10	83	1.20
56	0.50	61	2.29	85.5	1.15
59	0.70	66	2.56	88.5	1.05
62	1.00	77	1.84	91	2.20
66	0.50	84	1.30	94	2.25
70	0.30	91	0.72	97.5	1.50
72	1.55	96	0.70	100	0.90
75	0.35	98	1.08	103	1.80
79.5	0.90	104	1.32	105	1.85
81	1.65	110.5	0.98	108	1.38
84	1.50	116	1.42	112	1.20
87	2.05	120	1.30	116	1.60
90	2.20	124	1.28	117	0.60
96	2.55	130	1.71	Max	2.60
100	0.50	138	1.35	Min	0.52
103	0.30	143	1.43		
105	1.65	148	1.40		
107	0.35	151	0.65		
108.5	1.05	153	1.15		
115	1.60	157.5	1.10		
118	1.85	161	1.09		
123	1.50	164.5	1.40		
127	0.70	168	1.64		
131	0.50	171	0.95		
137	0.75	177	1.00		
139.5	1.40	181.5	0.55		
143	1.20	186.5	0.70		
145	1.20	188.5	0.72		
148	1.00	195	1.35		
Max	2.55	203	1.45		
Min	0.30	213	1.40		
		221	0.90		
		Max	2.56		
		Min	0.30		

Cross sections in the middle site indicate that at the low flow of 2.1 cfs the center of all pools contained depths in excess of 1.0 ft. (Figures 6, 7, and 8). Water elevation changed at all transects in the middle site less than 1.0 ft from flows of 11.7cfs to 2.1 cfs. The

depth of the deepest pools in all transects in the middle site decreased on average by 0.46 ft from a flow of 11.7 to 2.1 cfs (See Table 3).

Longitudinal surveys of the downstream site indicate residual pool depths range from just over 1.0 ft to approximately 0.5 ft (Figure 9). The depth of all pools was greater than the residual pool depths at the 3.6 cfs during September. The maximum depth recorded for the longitudinal survey on September 28 at a flow of 3.6 cfs was 2.60 ft (See Table 2). Transitions between pools in this high gradient reach had a minimum depth of 0.30 ft (See Table 2).

Table 3. Cross sectional data for West Rosebud Creek Bypass Reach at three differing flows.

Upstream Site				Middle Site				Downstream Site			
Pool	Transect	Flow (cfs)	Max Pool Depth (ft)	Pool	Transect	Flow (cfs)	Max Pool Depth (ft)	Pool	Transect	Flow (cfs)	Max Pool Depth (ft)
1	1	32.3	1.90	1	1	32.3	2.05	1	1	37.2	2.55
		10.4	1.30			11.7	1.8			14.1	2.15
		2.0	0.95			2.1	1.29			3.6	1.47
	2	32.3	1.70		2	32.3	1.95		2	37.2	2.75
		10.4	1.28			11.7	1.59			14.1	2.23
		2.0	NA			2.1	1.15			3.6	1.57
2	1	32.3	3.10	2	1	32.3	3.15	2	1	37.2	2.2
		10.4	2.73			11.7	2.68			14.1	1.01
		2.0	2.12			2.1	2.34			3.6	0.72
	2	32.3	1.85		2	32.3	2.05		2	37.2	1.65
		10.4	1.20			11.7	1.81			14.1	0.67
		2.0	0.61			2.1	1.22			3.6	0.44
3	1	32.3	2.65	3	1	32.3	2.3	3	1	37.2	3.6
		10.4	1.60			11.7	1.87			14.1	1.18
		2.0	0.88			2.1	1.39			3.6	0.9
	2	32.3	2.15		2	32.3	1.65		2	37.2	2.2
		10.4	1.45			11.7	1.27			14.1	1.06
		2.0	1.07			2.1	0.85			3.6	0.55

Cross-sectional surveys of the downstream site indicate that the middle of pools maintained depths ranging from 1.57 ft to approximately 0.7 ft (Figures 10, 11, and 12). Less than a 1.0 ft decrease in elevation was observed at all transects from the August 31 flow of 14.1 cfs to the September 28 flow of 3.6 cfs. The depth of the deepest pools in all transects in the downstream site decreased on average by 0.44 ft from a flow of 14.1 to 3.6 cfs (See Table 3).

Photo Tour

Three photographs were taken at each site during all three of the habitat surveys. The photo tour is not included in this preliminary report due to the difficulty of emailing a file

of this size. The photo tour has been sent to the members of the Mystic Lake fisheries resource group.

Fish Sampling

Rainbow trout were the only species of fish captured at the upstream and middle sites, while rainbow trout and brown trout were the only species captured at the downstream site. A population estimate based on mark recapture methods (Partial Log-Likelihood) was made for the middle section of the West Rosebud Creek bypass reach by MFWP. A total population of 4,883 rainbow trout per mile was estimated. Although the reach was actually only 528 ft, MFWP standardizes all estimates to one mile to allow comparisons between stream sections. No recapture efforts were made for the upstream and downstream sites. Using the initial one pass data gathered on August 3, 2004 allows comparison of the catch-per-unit-effort (CPUE) data of the three sites and make some extrapolations based on these number as to how the upstream and downstream sites may compare to the middle site. Extrapolated numbers on CPUE are shown in Table 4 below. Although we understand that these numbers are not statistically rigorous, comparisons of CPUE data is a common technique for managers to monitor trends and compare individual sites between one another. These data are only to be used as a comparative tool that allows us to compare all four sites within the West Rosebud Creek bypass reach. The 4,883-fish/mile mark-recapture estimate is the highest density of trout that MFWP has for all monitored streams in its Region 5 (Jim Olsen, MFWP Region 5 fish biologist, Personal Communication September 28, 2004).

Table 4. CPUE for all trout captured during electrofishing sampling and extrapolated population density numbers. *denotes mark-recapture estimate computed by MFWP.

West Rosebud Creek Bypass Reach Electrofishing Statistics for August 3 & 4, 2004						
Site	Minutes Shocked	# Rainbow Trout Captured	CPUE (Fish/Min)	Population Estimate (fish/mile)	Extrapolated Estimates (fish/mile)	Extrapolated Estimates (fish/100m)
Upstream	75	86	1.15	NA	5789	360
Middle	60	58	0.97	4883*	NA	303
Downstream of Barrier Falls	31	43	1.39	NA	7007	435
Above Upper Weir	31	24	0.77	NA	3876	241

Length frequency histograms for all three sites sampled on August 3, 2004 are shown in Figure 13. Missing bins in these graphs are likely a relic of the poor efficiency that was found during electrofishing on this date. The middle site and upstream site are very representative of what would likely be found in a healthy system, while the downstream site was very difficult to electrofish on this date and notes were made that many fish escaped due to the nature of the channel and the flow of over 37 cfs. These figures show that a wide size range of fish were captured, including some fish that were likely young-of-the-year. These data indicate that several age classes of rainbow trout are present. The presence of multiple age classes of fish is likely due to fish naturally reproducing and rearing in the bypass reach.

The length-weight relationship for rainbow trout captured on September 1, 2004 in the middle section is shown in Figure 14. This relationship is relatively typical for rainbow trout in small high mountain streams.

Discussion:

Winter conditions have been recognized as limiting trout populations in streams, and over winter mortality has been identified as a factor determining trout production (Chisholm et al. 1987). While many researchers have studied the over wintering behavior and habitat needs of stream salmonids in general, a limited number of studies have taken place in a similar environment to the West Rosebud Creek bypass reach. Although it is known to be an important factor in the production of trout, Muhlfeld et al. (2001) states "...few studies have quantified the habitat use and movements of stream-dwelling resident salmonids during fall and winter in northern Rocky Mountain streams."

Some researchers have concluded that salmonids preferentially select the deepest pools within a reach during the winter months (Chisholm et al. 1987; Young 1998; Muhlfeld et al. 2001), however this is not the only finding. For example, Brown and Mackay (1995) concluded that water temperature is more likely a more important winter habitat parameter for trout than depth in an Alberta stream.

It has been well recognized that substrate is an important habitat feature selected by trout during winter conditions (Bjornn 1971; Young 1998; Muhlfeld et al. 2001). While Chisholm et al. (1987) observed brook trout in lower gradient stream reaches selecting deep pools in the winter, they also found that brook trout inhabiting high gradient reaches actually selected shallower water with gravel-rubble-boulder substrates. Additionally, Bjornn (1971) found subyearling trout in Idaho more often chose to stay in a reach to over winter as long as suitable substrate providing adequate interstices was available. Conversely, if interstices were not available, trout tended to migrate. Young (1998) concluded that the small size (7.3 to 9.5 inches (185-242 mm) total length) of adult Colorado River cutthroat trout (*O. clarki pleuriticus*) in a high mountain stream may have enabled them to use widely available interstitial spaces beneath rubble and boulders for cover during the late fall, whereas populations consisting of larger fish may need to move long distances to find deep pools suitable for their individual sizes. It may also be important to note that less than one-third of all pools in Young's (1998) study reaches were deeper than 1.64 ft (50 cm) with the deepest being 2.36 ft (72 cm). These conclusions are particularly relevant to the West Rosebud bypass reach since it is a high gradient reach with gravel-rubble-boulder and bedrock substrates.

Movement of resident salmonids from late fall to winter varies with the system and species, and most likely with the availability of habitat (Bjornn 1971; Young 1998; Muhlfeld et al. 2001). Muhlfeld et al. (2001) found that redband trout (*O. mykiss gairdneri*) in a small tributary to the Kootenai River in northwest Montana displayed both sedentary and mobile behaviors during the winter months. Specifically, they observed 57% (13) of their radio tagged rainbow trout did not change habitat location (sedentary)

and 43% (10) rainbow trout migrated a mean total length per fish of 439 ft (134 m). Additionally, Young (1998) did not observe a change in location of Colorado River cutthroat trout from early July to late October in a high elevation (8,595 ft above mean sea level) stream in south-central Wyoming. These studies highlight the relatively sedentary nature of trout living in harsh climates in small streams over winter.

The data reported in this report give visual and quantifiable estimates of the available habitat within the West Rosebud Creek bypass reach during three varying flows. The cross sectional and longitudinal profiles measured at flows of 2.0 cfs, 2.1 cfs, and 3.6 cfs in the upstream, middle, and downstream sites respectively, give a clear picture of the available water within these representative reaches during fall and winter months.

Cross sectional data at the lowest flows observed as well as longitudinal profiles show that pools within each of the three reaches are still prevalent. Longitudinal profiles of all three sites reveal that maximum depths of 2.55, 2.56, and 2.60 ft for the upstream, middle, and downstream sites respectively (See Table 3). Although the individual cross sections show shallower pools, that is most likely a due to the cross sections being established at high flows and not bisecting the pools in the deepest spot. Nonetheless, cross sectional data still show the maximum depth of pools in each reach at the lowest flow being 2.12, 2.34, and 1.57 ft for the upper, middle, and lower reaches respectively.

Young (1998) studied Colorado cutthroat trout in a high elevation stream found the deepest pool in his study stream was 2.36 ft, which is shallower than the maximum depths found in the bypass channel at low flows. Additionally, only one-third of the Colorado stream's pools were deeper than 1.64 ft. The West Rosebud Creek bypass reach contains pools in each reach that exceed 1.64 ft in depth (Table 3). Young's (1998) study stream was dominated by cobble and boulders, which is also similar to the substrate types found within the bypass reach. These similarities may allow us to speculate that fish behavior in the bypass reach may be similar to that observed by Young (1998). We believe that due to the small size of individual fish within the bypass reach, in conjunction with the substrate type, elevation, and water temperatures during the fall and winter months, that rainbow trout have adequate habitat to seek shelter between interstices and survive the harsh winter environment. In addition, small rainbow trout are unlikely to migrate long distances within the bypass reach during the fall and winter months. However, we believe that sufficient depths are available at low flows to allow these small fish to navigate freely between habitat units.

Others (Marotz et al. 1988) have recommended minimum flows in Montana streams for winter months that are well below the perceived minimum flows needed to allow salmonids to effectively migrate. Marotz et al. (1988) used the known migration timing of salmonids present in a system to recommend increasing flows in the spring and summer months to allow for migration. While Marotz et al. (1998) used the period of April 1 to June 30 to set minimum flows at a level believed to allow fish migration, the streams in his report are at a much lower elevation (tributaries to the Kootenai River, Montana) than that of the bypass channel. The high elevation of the bypass channel would delay migration behavior due to cold water temperatures, thus the minimum flow

of 10 cfs for the period of June 1 to August 1 should allow adequate stream flows for rainbow trout migration during their pre-spawning migration activities. In addition, known natural barriers already occur in numerous places throughout the bypass reach, thus limiting the distance rainbow trout can navigate to spawning locations.

The best evidence for the conclusion that an adequate amount of quality habitat is being provided through the winter for the rainbow trout population(s) in the bypass reach is the current abundance of trout found within all four electrofishing reaches. In addition to high densities of fish, data indicate that the population(s) include many age classes, lending further evidence to survival through a variety of years with differing environmental conditions.

Most instream flow models are used to predict the amount of water that is needed to produce some level of desired fish density. The current instream flow regulations for the bypass reach have been in place for over 20 years. The best indicator of how well instream flows are maintaining fish habitat is to evaluate the fish population. Our data indicate that the fish population of the bypass reach is currently healthy, therefore fish habitat has been sufficient.

Conclusion:

PPL Montana feels sufficient data have been or will be collected in 2004 to answer the questions addressed in the U.S. Forest Service's Proposed Study Plan No. 5 "Evaluation of Current Instream Flows and Biological Indicators for the West Rosebud Creek Bypass Reach", which stated:

"The Mystic Project interagency fisheries, aquatic habitats, and water quality resource work group identified the issue of whether current minimum instream flows for the bypass channel are sufficient during the fall and winter months to maintain suitable habitat for the aquatic species residing within the stream. The goal of the proposed study is to evaluate the quality of fish habitat available during the fall and winter seasons under the current flow regime. In conjunction with the physical habitat evaluation, fish populations will be sampled to determine how the fishery is responding to the current flow regimes."

PPL Montana received comments on the preliminary draft of this report from the USFS that brought up issues pertaining to recreation, riparian, and hydrologic resources in the bypass reach. Information contained in the Pre-Application Document (PAD) specifically shows the minimal amount of angling that occurs on West Rosebud Creek between the dam and the powerhouse. Recreation in the bypass reach is primarily hiking, which is unaffected by instream flows. Riparian conditions in the bypass reach will be addressed in Study No. 9 (this document). Hydrological resources of the bypass reach have been addressed in the PAD, and will be further addressed in Study No. 8 (this document). Therefore, all the concerns for instream flows in the bypass reach have been

addressed through studies done in 2004 or will be addressed through other studies to be conducted in 2005 and no further instream flow studies are proposed.

References:

- Bjornn, T. C. 1971. Trout and salmon movements in two Idaho streams as related to temperature, food, stream flow, cover, and population density. *Transactions of the American Fisheries Society* 100:423-438.
- Brown, S. R. and W. C. Mackay. 1995. Fall and winter movements of and habitat use by cutthroat trout in the Ram River, Alberta. *Transactions of the American Fisheries Society* 124:873-885.
- Chisholm, I. M., W. A. Hubert, and T. A. Wesche. 1987. Winter stream conditions and use of habitat by brook trout in high-elevation Wyoming Streams. *Transactions of the American Society* 116:176-184.
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- Marotz, B., B. Hansen, S. Tralles, and F. Holm. 1988. Instream flows needed for successful migration, spawning, and rearing of rainbow and westslope cutthroat trout in selected tributaries of the Kootenai River. BPA Report DOE/BP-23666-2.
- Muhlfeld C. C., D. H. Bennett, and B. Marotz. 2001. Fall and Winter habitat use and movement by Columbia River redband trout in a small stream in Montana. *North American Journal of Fisheries Management* 21:170-177.
- Young, M. K. 1998. Absence of autumnal changes in habitat use and location of adult Colorado River cutthroat trout in a small stream. *Transactions of the American Fisheries Society* 127:147-151.

Figures:
Upstream Section Longitudinal Survey

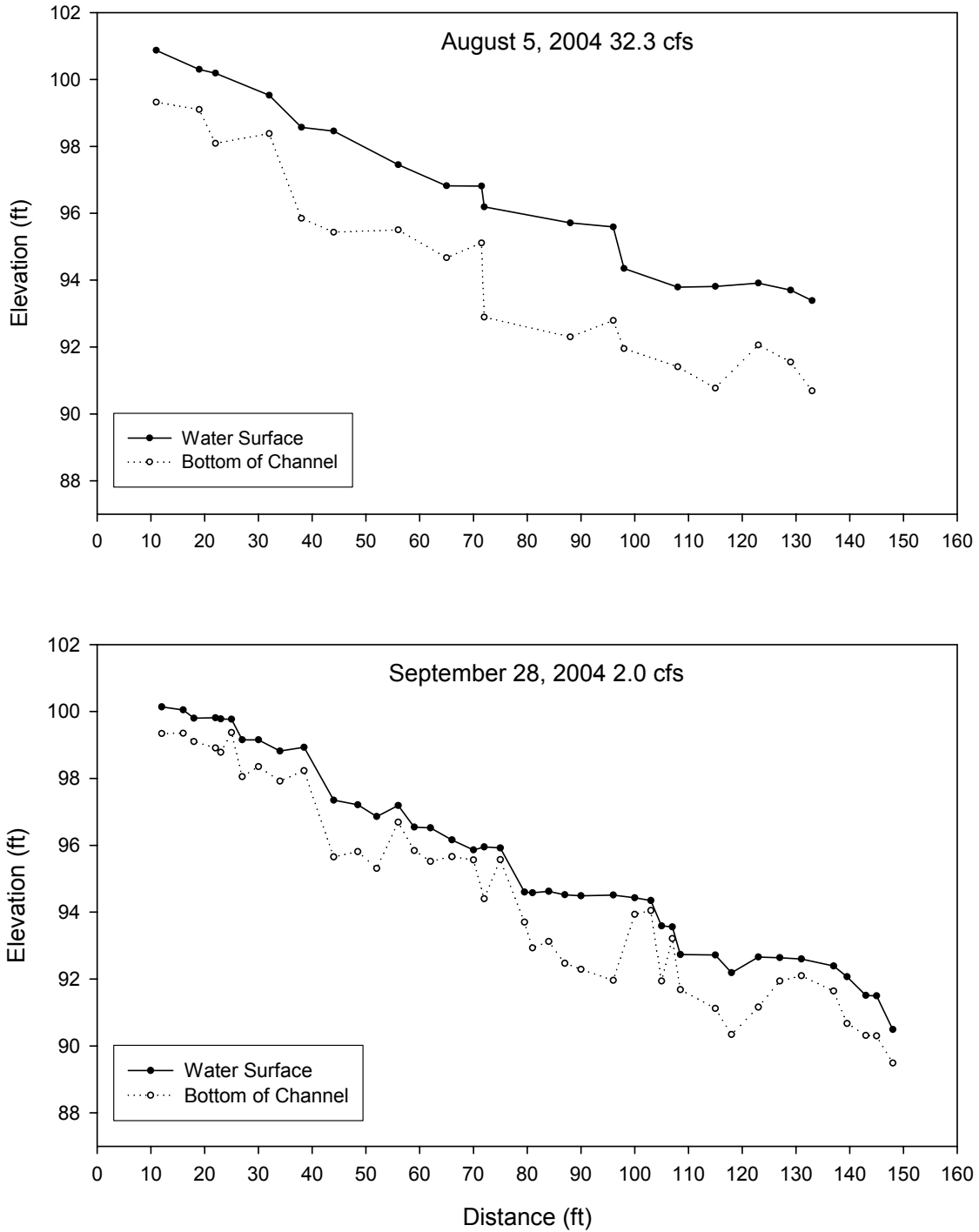


Figure 1. Longitudinal surveys of the upstream section. Note that longitudinal distances were taken at independent times within the same reach. Distances along the x-axis are not exactly the same position along the actual stream profile.

Upstream Site
Pool #1

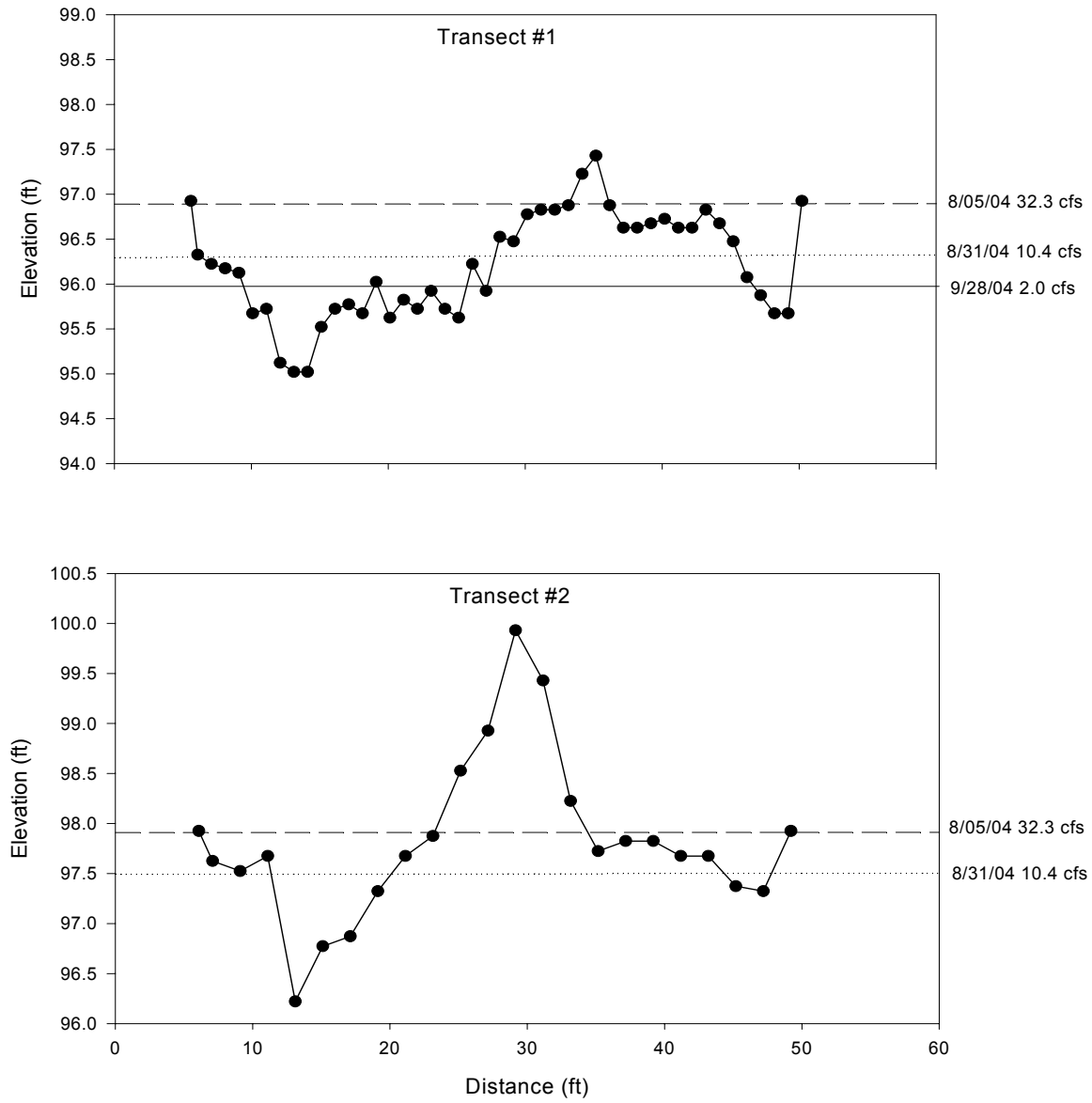


Figure 2. Cross-sectional surveys of the middle and pool tail of pool #1 in the upstream site.

Upstream Site
Pool #2

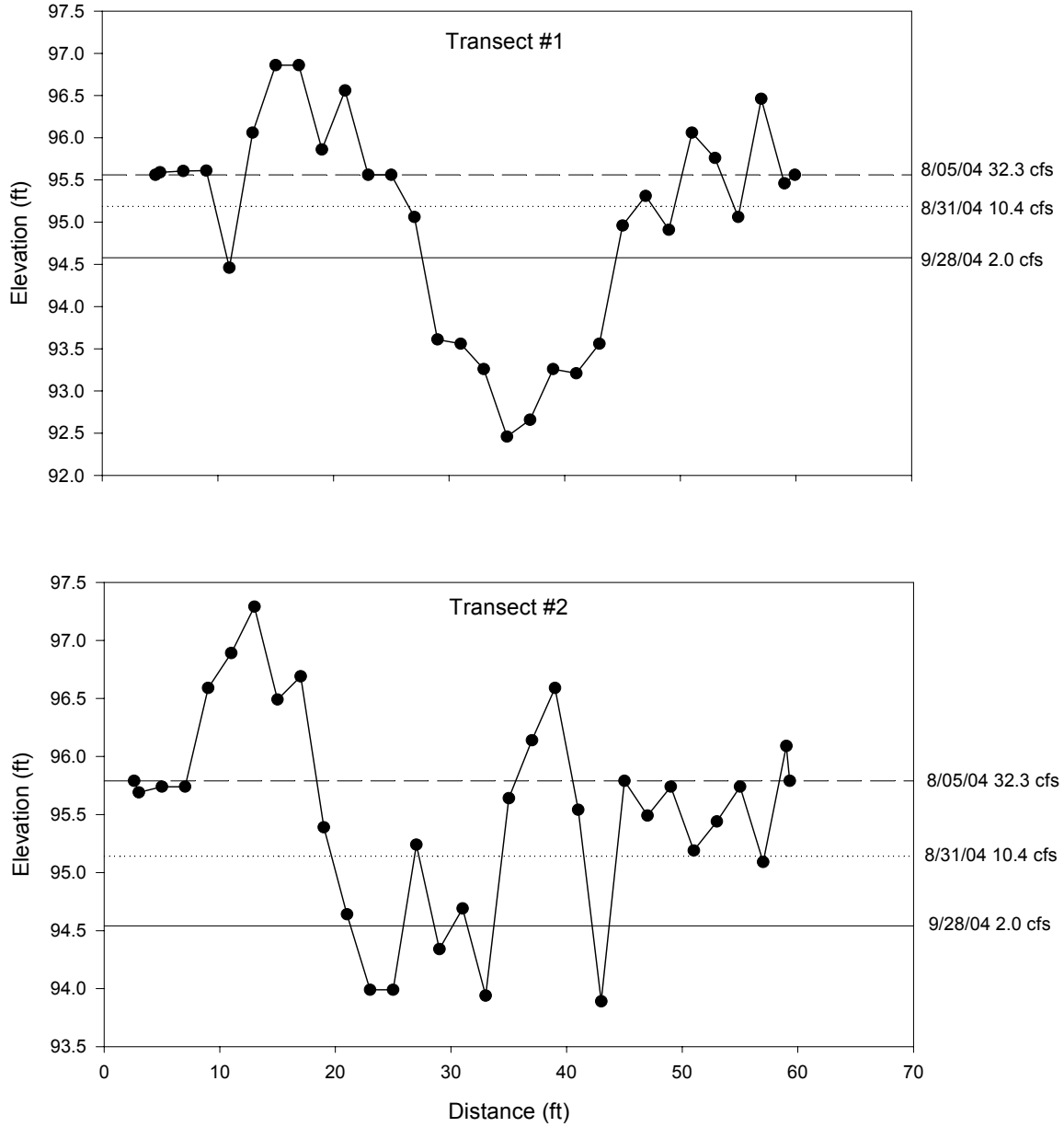


Figure 3. Cross-sectional surveys of the middle and pool tail of pool #2 in the upstream site.

Upstream Site
Pool #3

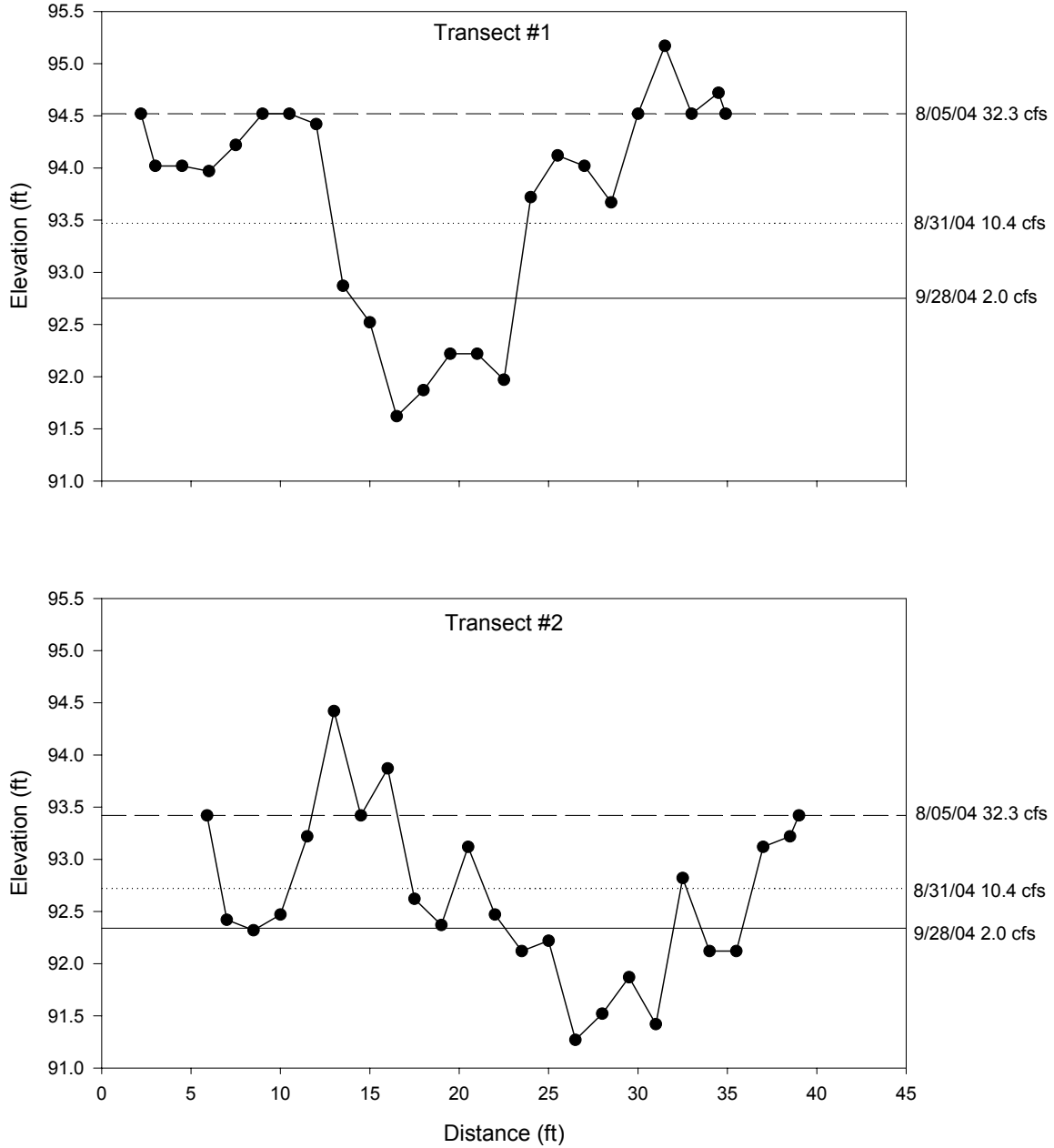


Figure 4. Cross-sectional surveys of the middle and pool tail of pool #3 in the upstream site.

Middle Site Longitudinal Survey

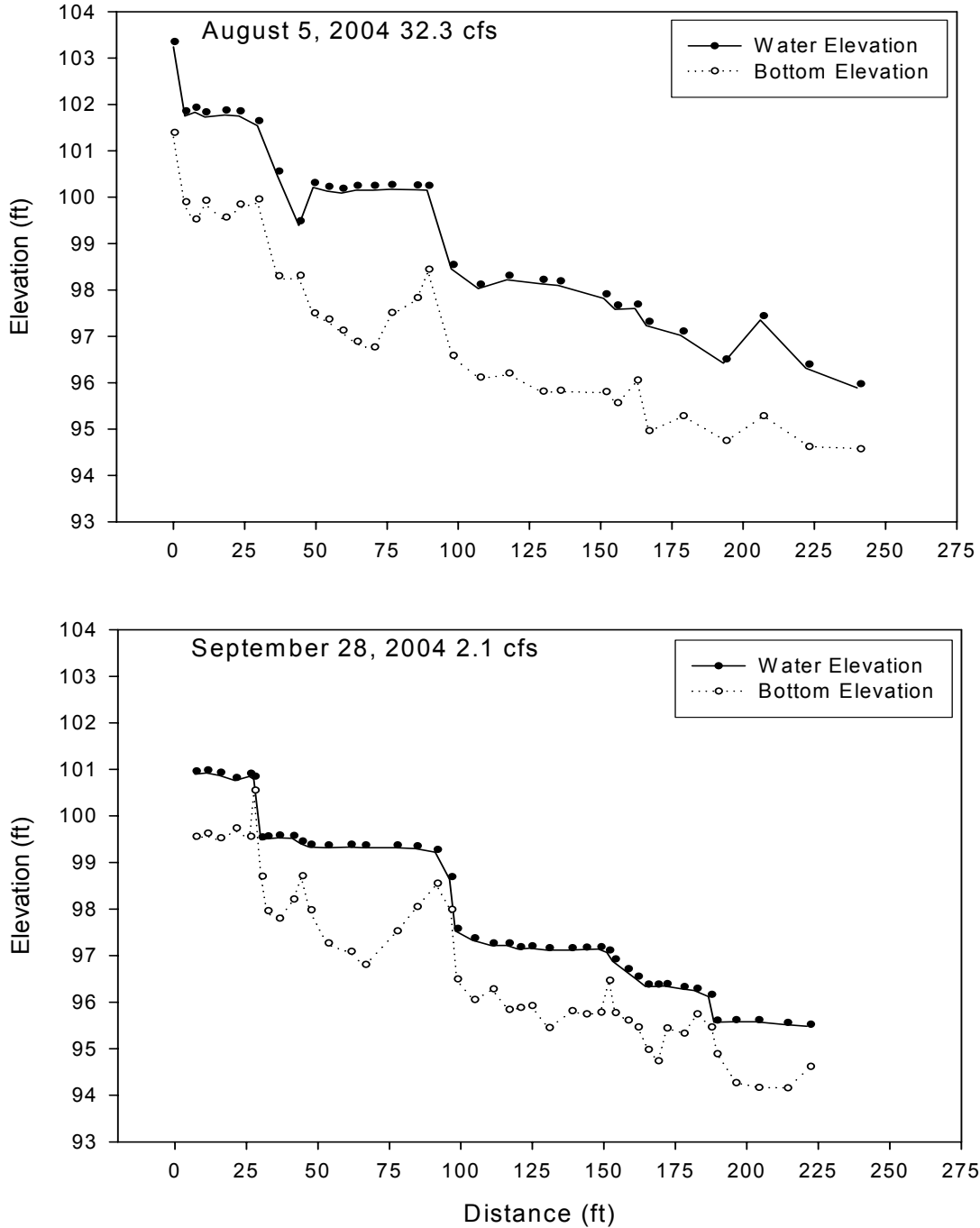


Figure 5. Longitudinal surveys of the middle section. Note that longitudinal distances were taken at independent times within the same reach. Distances along the x-axis are not exactly the same position along the actual stream profile.

Middle Site
Pool #1

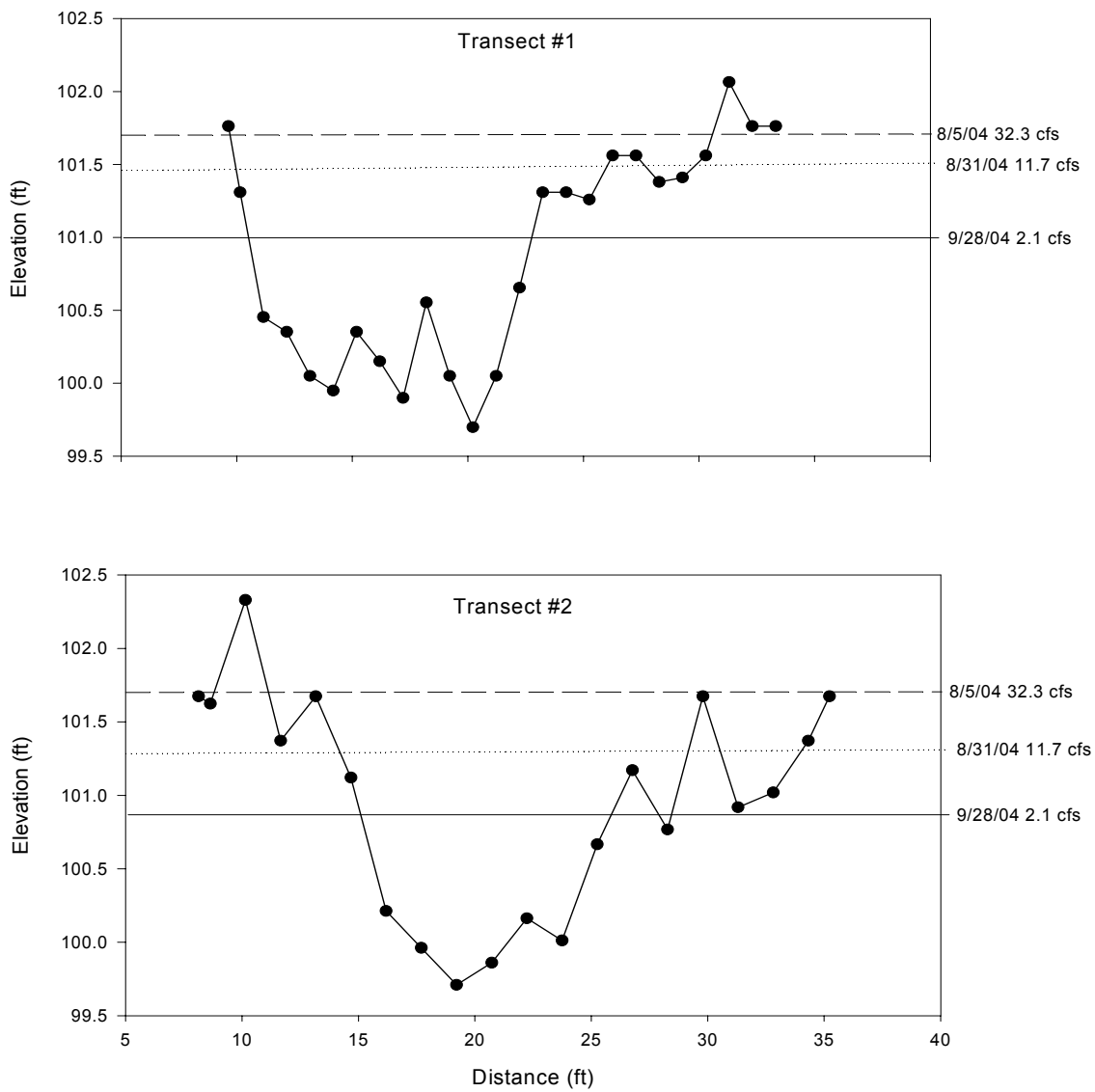


Figure 6. Cross-sectional surveys of the middle and pool tail of pool #1 in the middle site.

Middle Site
Pool #2

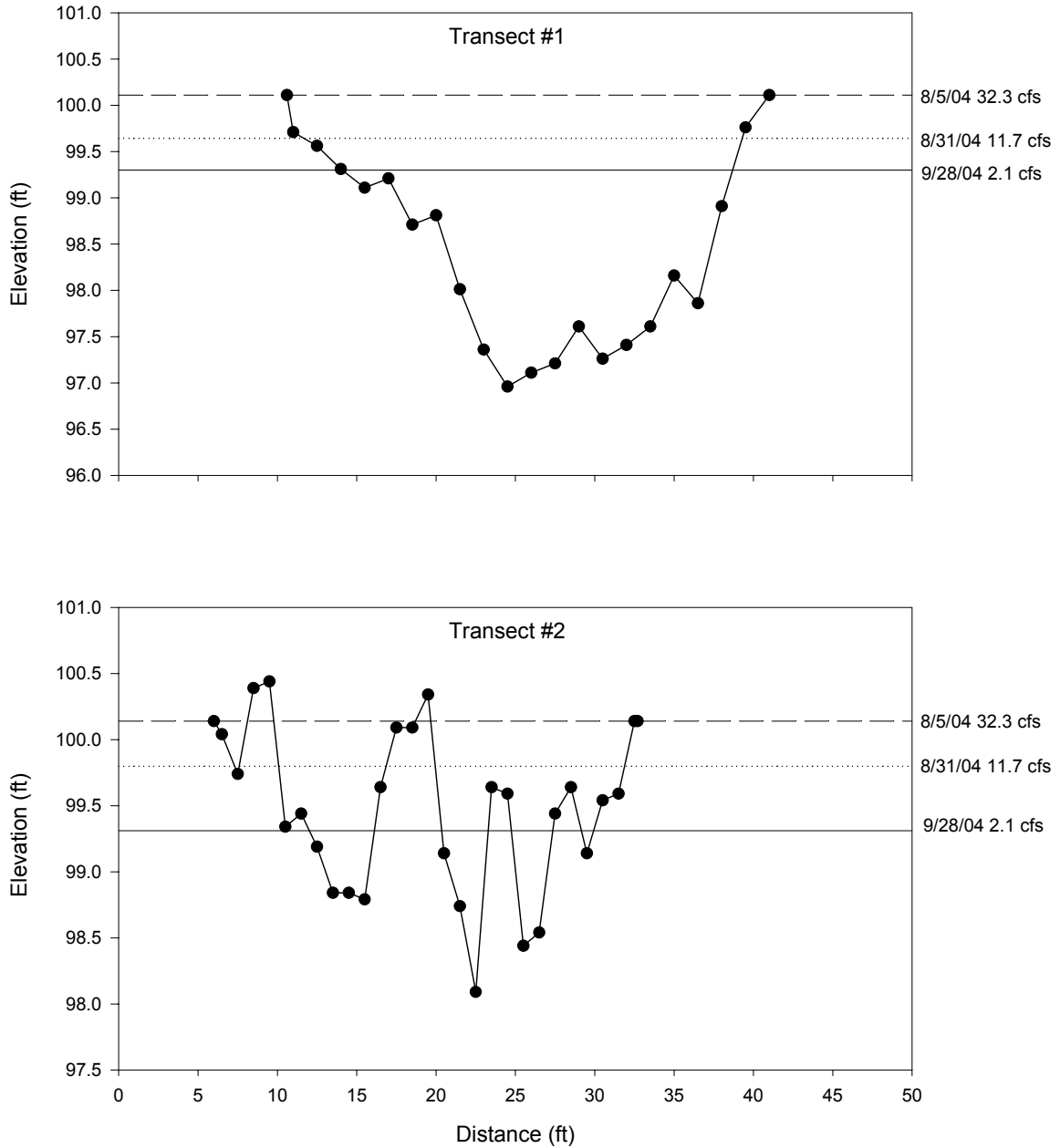


Figure 7. Cross-sectional surveys of the middle and pool tail of pool #2 in the middle site.

Middle Site
Pool #3

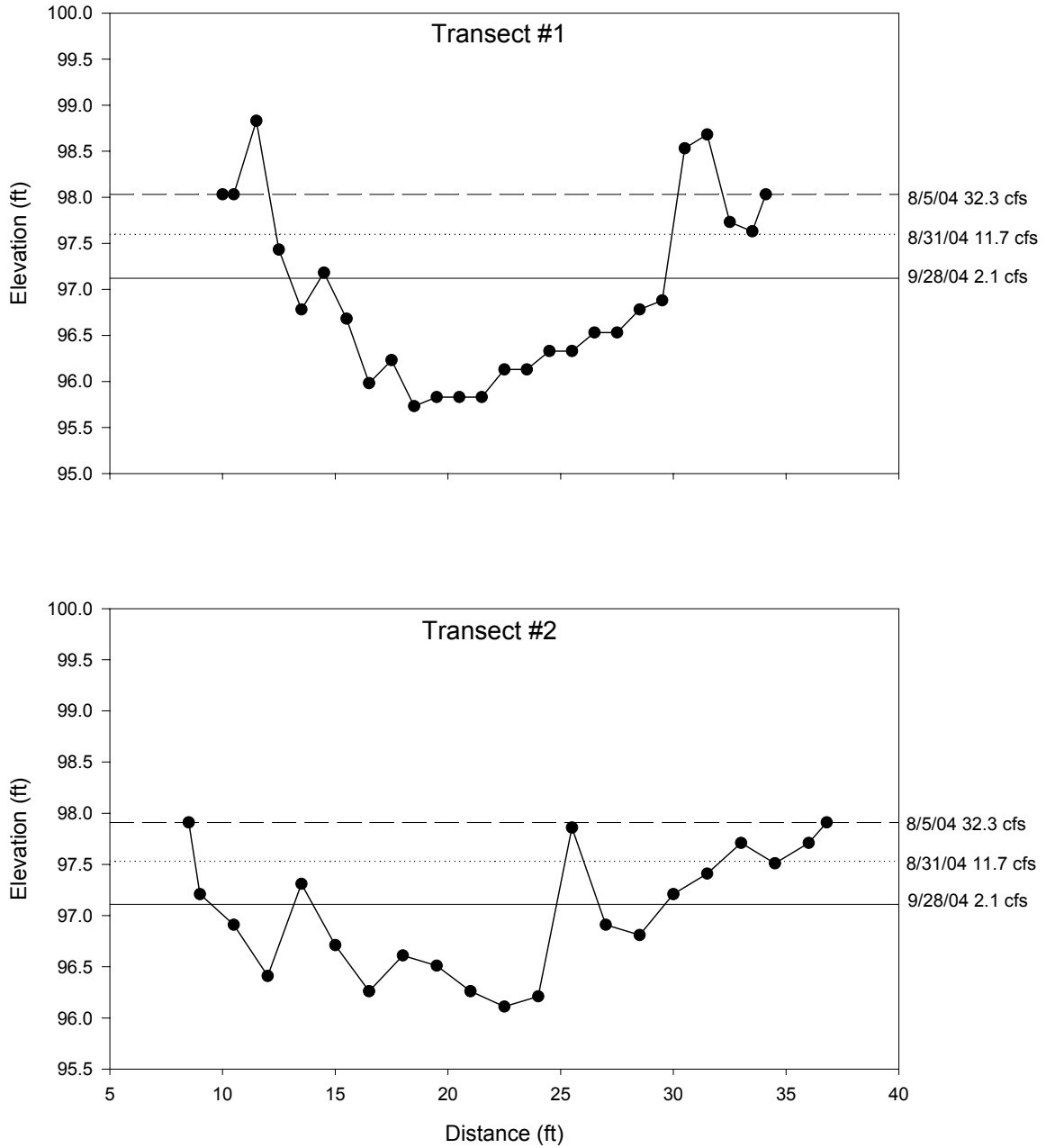


Figure 8. Cross-sectional surveys of the middle and pool tail of pool #3 in the middle site.

Downstream Site Longitudinal Survey

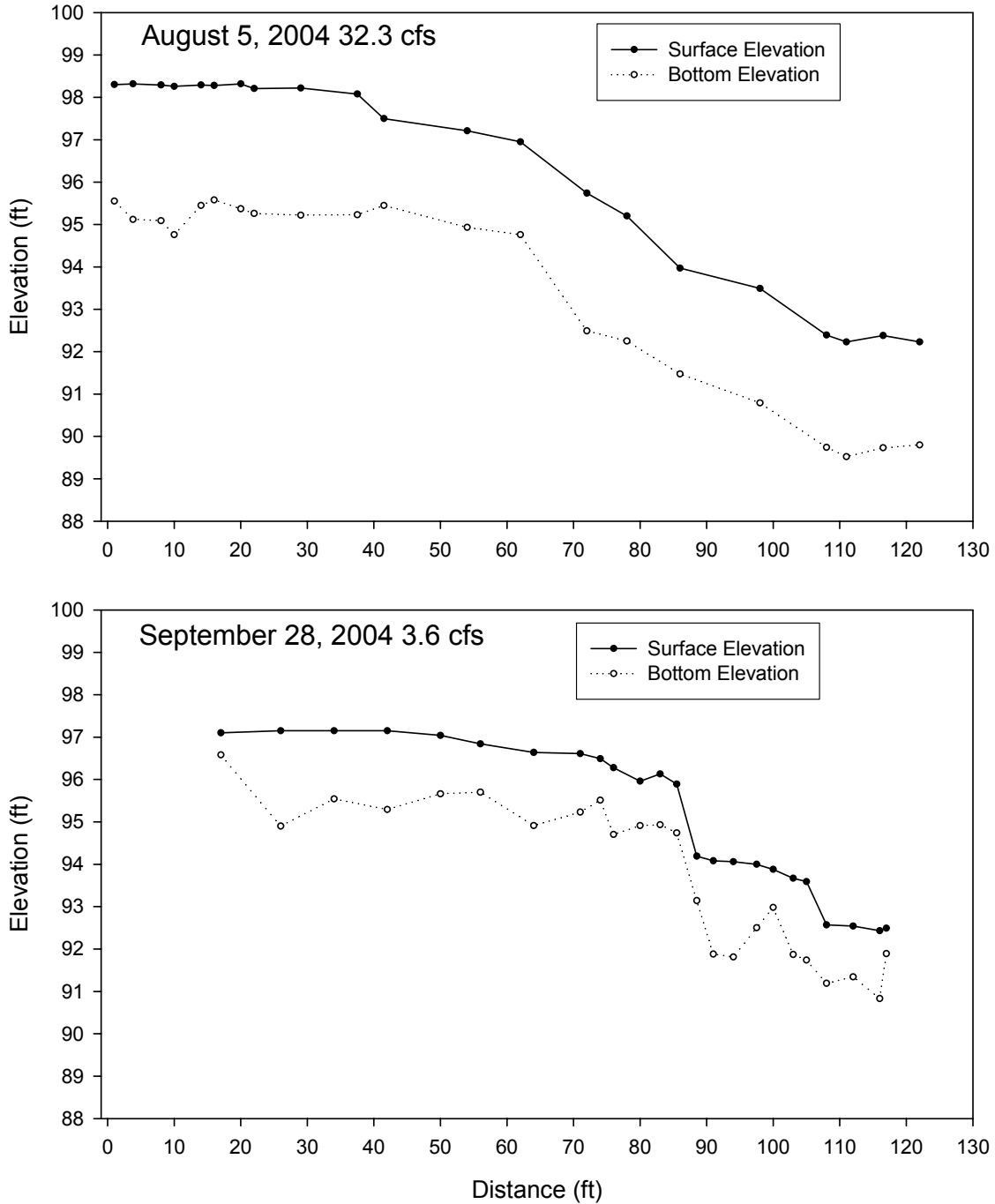


Figure 9. Longitudinal surveys of the downstream section. Note that longitudinal distances were taken at independent times within the same reach. Distances along the x-axis are not exactly the same position along the actual stream profile.

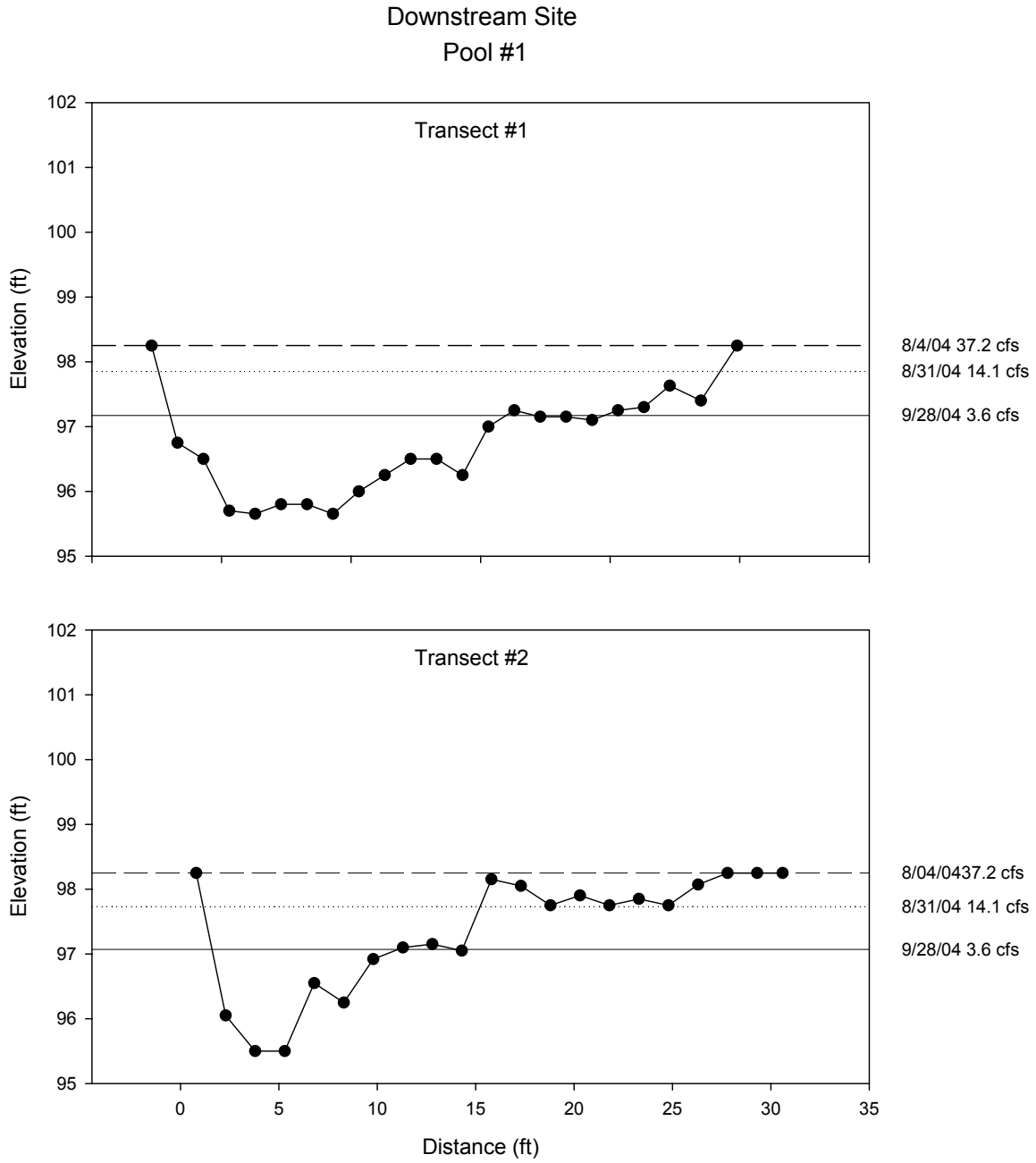


Figure 10. Cross-sectional surveys of the middle and pool tail of pool #1 in the downstream site.

Downstream Site
Pool #2

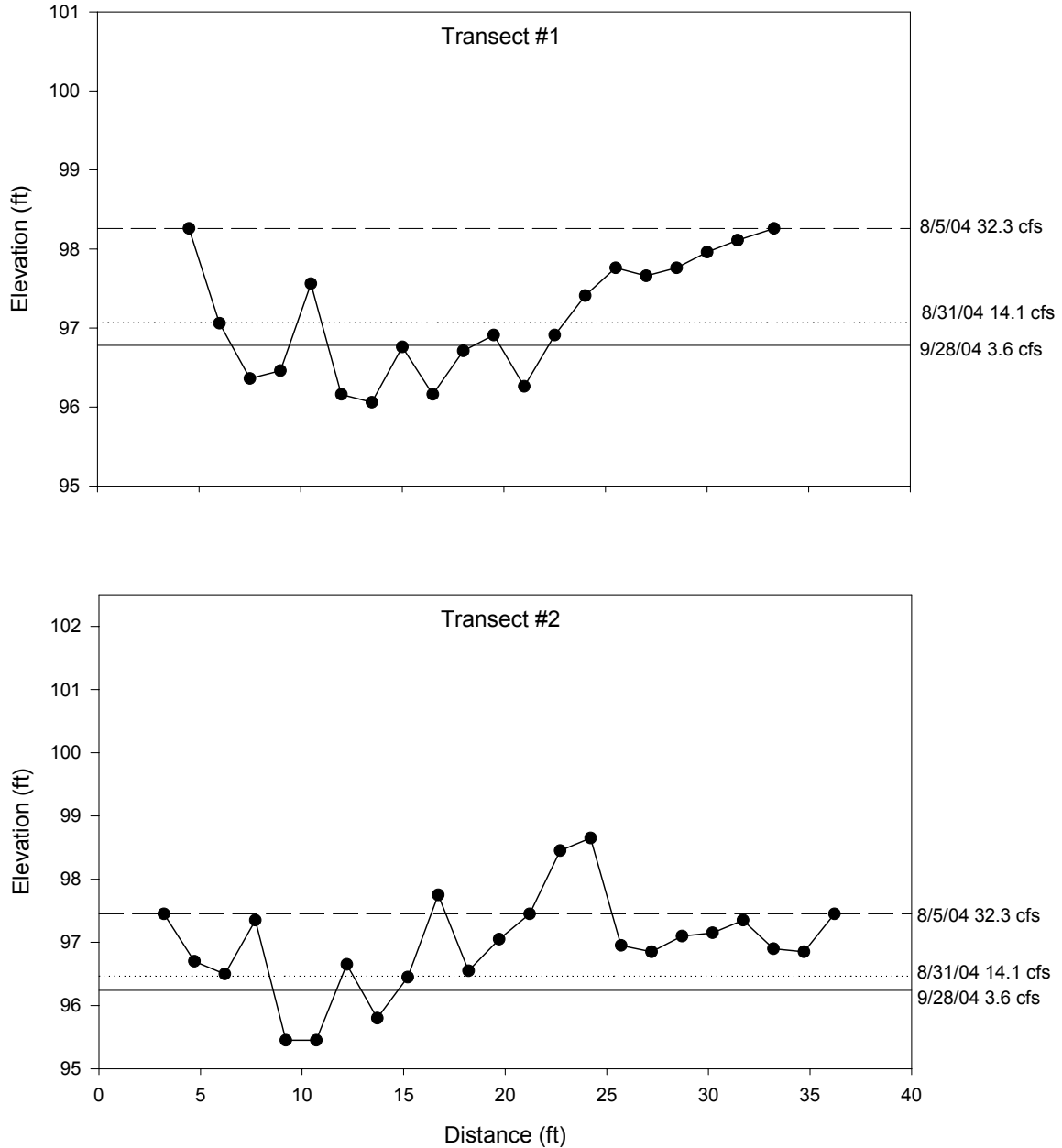


Figure 11. Cross-sectional surveys of the middle and pool tail of pool #2 in the downstream site.

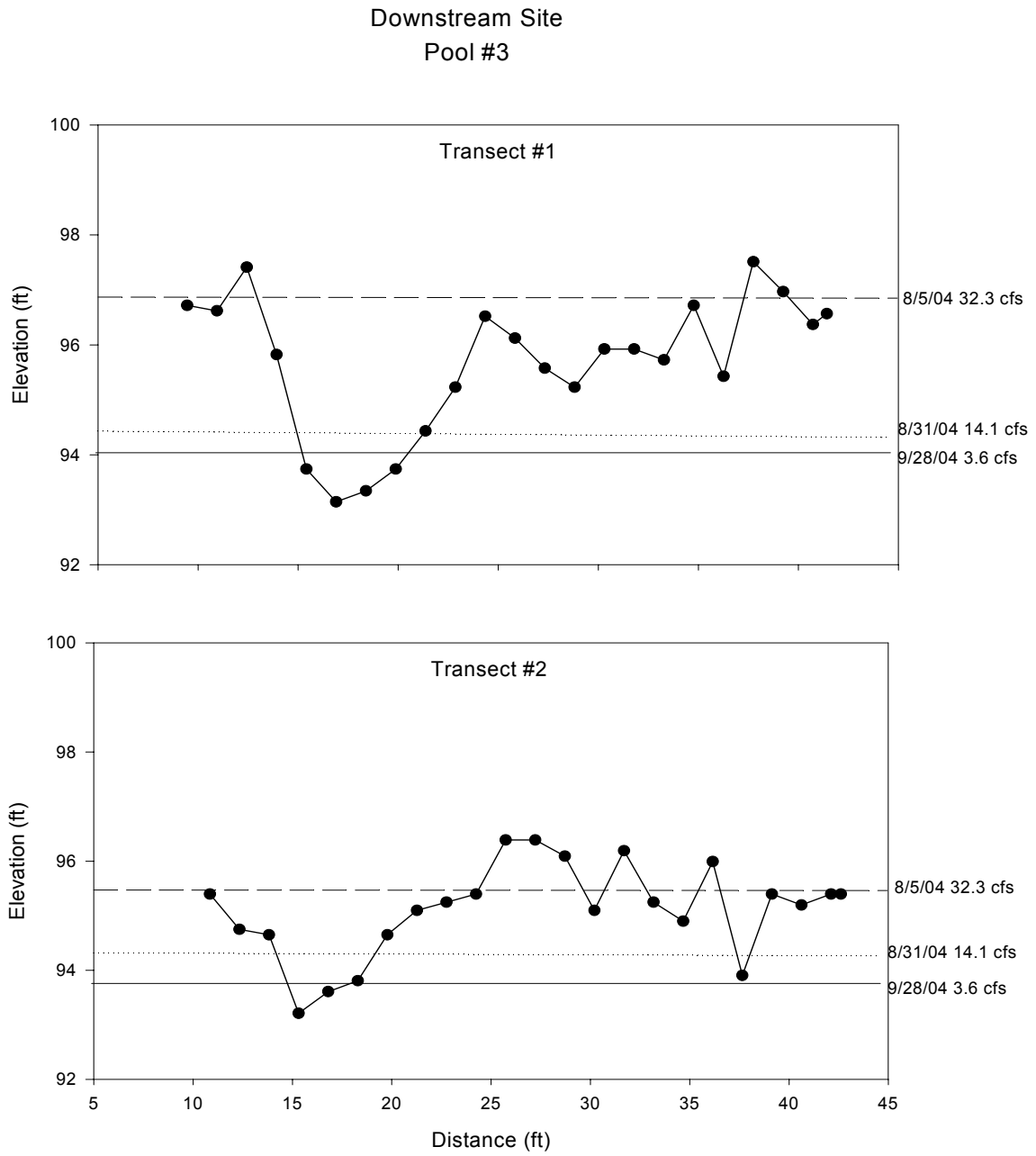


Figure 12. Cross-sectional surveys of the middle and pool tail of pool #3 in the downstream site.

West Rosebud Creek Bypass Reach
August 3 & 4, 2004 Length Frequency Histograms

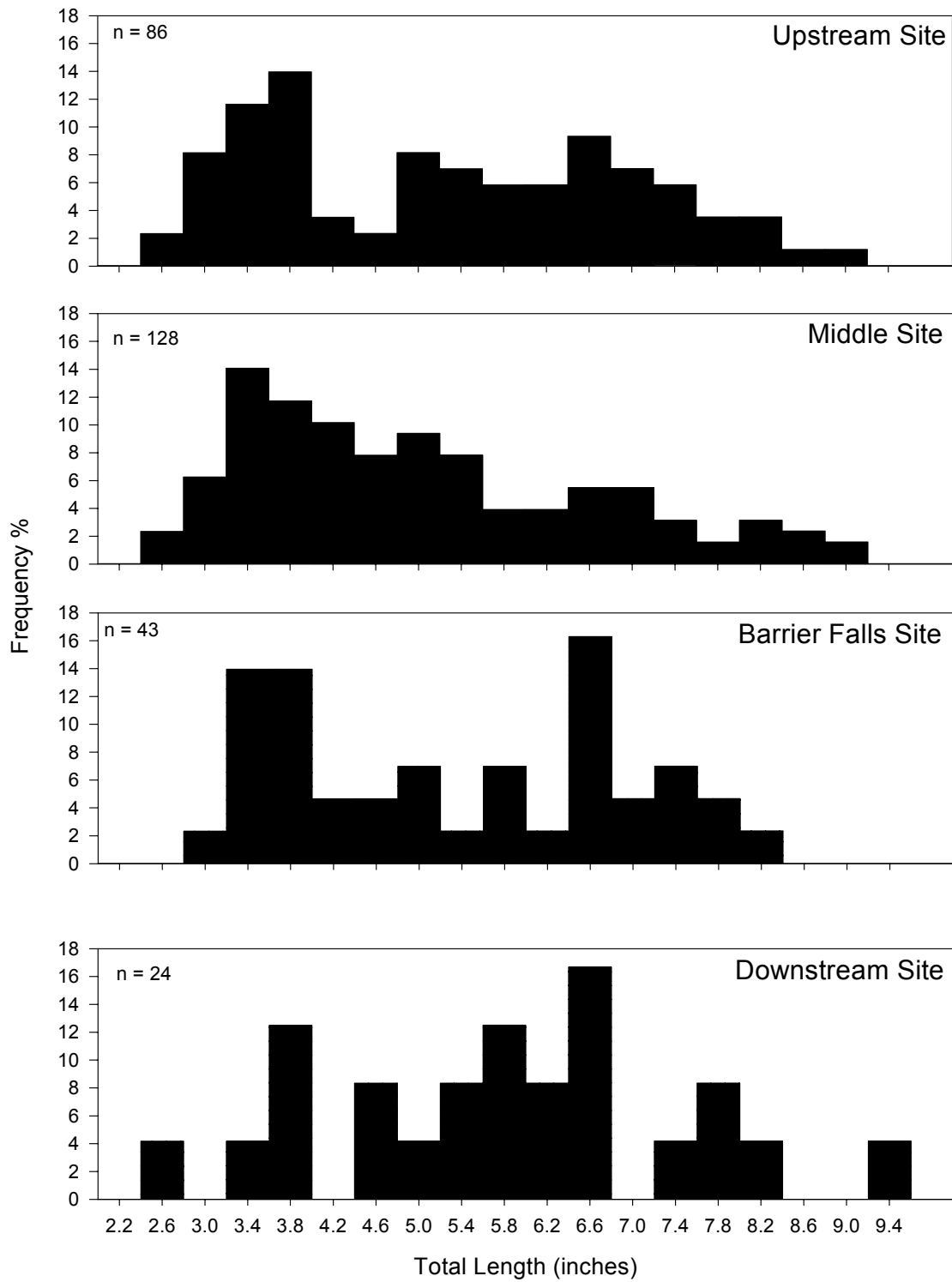


Figure 13. Length frequency histogram for all trout captured during the August 3 & 4, 2004 electrofishing sampling effort.

Middle Site
West Rosebud Creek Bypass Reach
September 1, 2004 Length-Weight Relationship
Rainbow Trout (5 inches and larger)

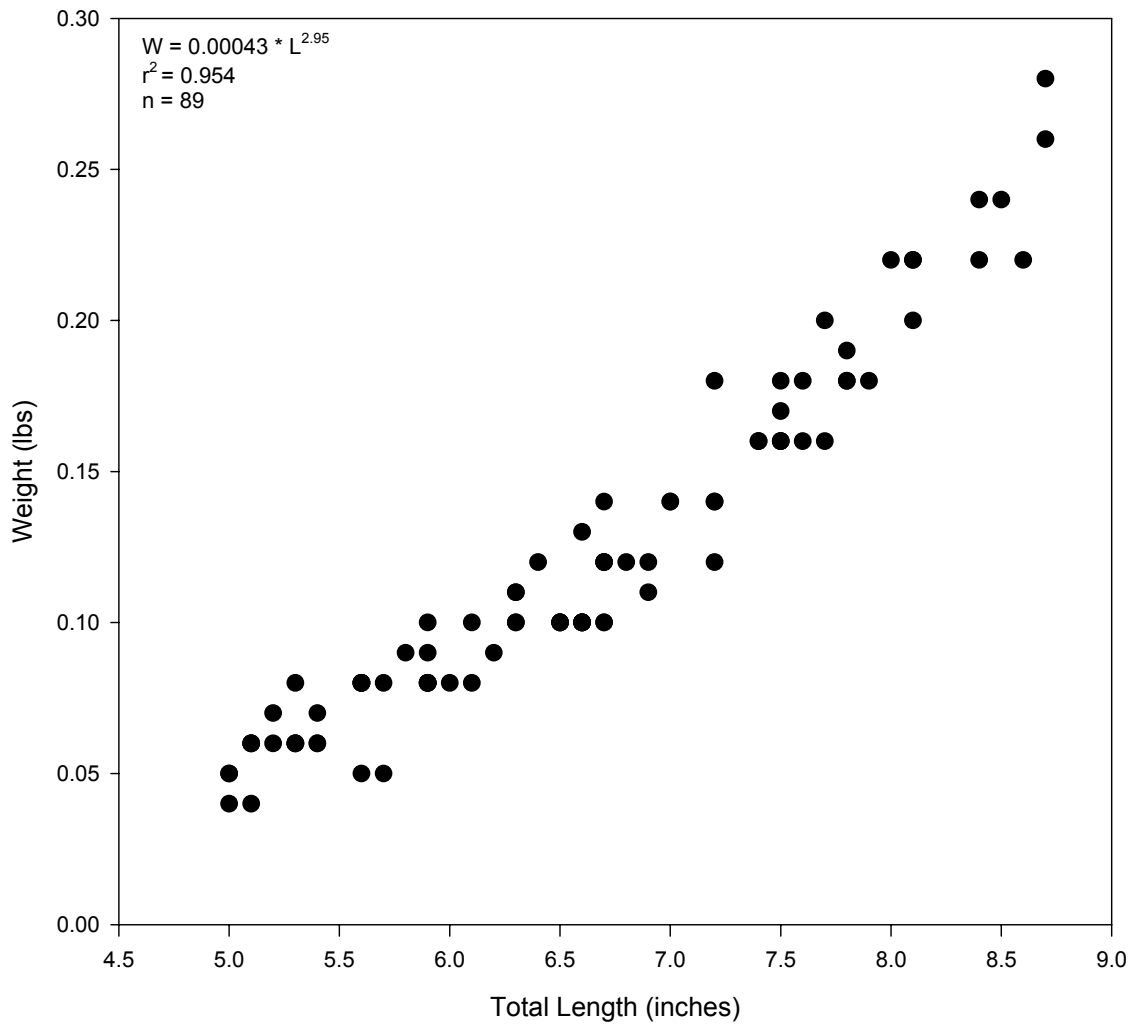


Figure 14. Length-weight relationship for rainbow trout sampled in the middle section on September 28, 2004.

Mystic Project Study Request No. 6

Title of Proposed Study: Hydrologic Characterization of the West Rosebud Creek Bypass Reach Between Mystic Lake Dam and the Powerhouse

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Refer to criteria, #1 and #6, adapted from FERC Regulations 18 CFR 5.9 (b), as discussed below.

2) A schedule for conducting the study.

The study plan is scheduled for the 2005 summer field season. The schedule for submitting an initial study report, reviewing the study, and decisions to continue and/or amend the study plan is provided in the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com).

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Refer to the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com) that outlines the timeline for pre-filing milestones and the process for communications and information sharing.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

Not Applicable.

Criteria adapted from FERC Regulations 18 CFR 5.9 (b) and 18 CFR 5.11(4)(d)

1) Describe goals and objectives of proposed study and the information to be obtained.

Goal: To provide definitive year around hydrologic characterizations of the bypass reach of West Rosebud Creek from Mystic Lake Dam to the powerhouse.

Objective: To determine the relationships between discharges released from the fish valve and total streamflow as measured at the upper weir just upstream of the powerhouse. Determination of these relationships will allow PPL Montana to determine the amount of flow release needed at the upper end of the bypass reach in order to assure that minimum flows are delivered along the entire bypass channel.

Background: Questions have arisen concerning the relationship between flows released at the uppermost end of the bypass reach at the fish valve and those measured at the upper weir (bottom end of the bypass reach). Historically, efforts have been made to maintain a consistent flow of 3 cfs in the upper bypass reach. The only location for verifying the presence of a 3 cfs flow was at the upper weir, which is at the bottom end of the bypass reach. Recent improvements in automation, data management and telemetry have made it possible to continuously monitor the pool elevation (head) of Mystic Lake while simultaneously monitoring and controlling the fish valve gate position. These improvements make it possible to continuously dispense known flow amounts very precisely from the fish valve under constantly changing conditions. By tracking the amount of flow released from the fish valve and comparing it to the amount of flow measured at the upper weir, the relationship between fish valve releases and upper weir measurements will be established. Accurate calibration of the monitoring instrumentation for the fish valve and the upper weir is an important but straightforward precursor to conducting the study.

Within the bypass reach, there are three locations where relatively accurate flow measurements are continually made; 1) From spill through the flashboard bays at Mystic Lake dam, 2) from discharge through the fish valve and 3) from flow measurements made at the upper weir. These three measurements alone are capable of quantifying the limits of the difference in bypass channel flow at the extreme upper and lower ends. Recent improvements in data archiving at the plant make the continuous collection of these data a simple task that is currently being performed automatically.

Once the measurements are taken (a task performed continuously and automatically throughout the year by the SCADA system), the characterization of flows from the top to the bottom of the bypass reach is yielded by comparing point for point the flow measured at the top of the bypass reach (fish valve or dam) to that measured at the bottom (upper weir). The difference in the flows yields the contributions from tributary influxes and other sources. The approach will yield continuous results under a wide range of hydrologic conditions throughout the year.

In addition to flow data, information is currently being collected on the status of aquatic life in the bypass reach. Specifically, the electrofishing data will provide indications of the health of fish populations currently present (under the current flow regime) in the bypass reach. During the 2004 field season MFWP has stated that the fish populations within all three sampled sections within the bypass reach seem healthy due to their abundance (see Study Request No. 5), this includes two reaches that are significantly upstream from the upper weir where the current instream flow measurements are taken. The USDA Forest Service will integrate the results of this hydrologic characterization with the habitat results from the high gradient habitat analysis to analyze flow-habitat relationships for the bypassed reach.

2) If applicable, explain any relevant resource management goals for agencies or Tribes with jurisdiction over the resource to be studied.

Management goals for riparian areas are identified in the Custer N.F. Forest Plan under Chapter II Forest Wide Management Direction and Chapter III – Management Area Direction.

Forest Plan goals for riparian areas include: “manage for water quality, provide diverse vegetation, and protect key wildlife habitat in these areas from conflicting uses” and “uses and activities that adversely impact these areas will be mitigated” (page 3).

The Forest Plan goal for watershed management is to ensure that soil productivity is maintained and that water quality is maintained at a level that meets or exceeds state water quality standards (page 4).

The Forest Plan objective for soil and water resources is: Continue to produce water that meets State water quality standards. National Forest System lands will be managed so that the soil and watershed conditions are in a desirable condition and will remain in that condition for the foreseeable future. Soil and water quality objectives are designed to assure that these resources meet State water quality objectives and BMPs (Best Management Practices) are incorporated to assure this (page 5).

Forest Plan objectives for riparian areas include recognition of their unique values, and management direction is to be designed to protect these key wildlife habitats and improve water quality: “these areas will be managed in relation to various legally mandated requirements including, but not limited to, those associated with floodplains, wetlands, water quality, dredged and fill material, endangered species, and cultural resources” (page 5).

Forest Wide Management Standards for wildlife and fisheries state: h) Management activities, including prescribed fire, will be conducted to maintain or enhance the unique value associated within woody draws and riparian zones, as well as a variety of successional vegetative stages (page 18), e) Shorelines along reservoirs and lakes that support cold or warm water fisheries will be managed to encourage the establishment of

bank vegetation, and maintenance [or] improvement of water quality (page 19).

Goals for Management Area M (Riparian) are: Manage to protect from conflicting uses in order to provide healthy, self-perpetuating plant and water communities that will have optimum diversity and density of understory and overstory vegetation (page 80).

Montana Surface Water Quality Regulations: Montana has classified all waters within the project area as B-1 waters (Administrative Rules of Montana (ARM) (17.30.611 (a))). The beneficial uses associated with this classification include: drinking, culinary and food processing purposes, after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply (ARM 17.30.623 (1)).

The Montana Water Quality Act, Nondegradation Rules, and Surface Water Quality Standards require that land management activities must not generate pollutants in excess of those that are naturally occurring, regardless of the stream's classification. "Naturally occurring means conditions or material present from runoff or percolation over which man has no control or from developed lands where all reasonable land, soil and water conservation practices have been applied" (ARM 17.30.602 (19)). "Reasonable land, soil and water conservation practices means methods, measures or practices that protect present and reasonably anticipated beneficial uses" (ARM 17.30.602 (24)) are commonly called Best Management Practices (BMPs). Best management practices are considered reasonable only if beneficial uses are protected. Project operations are expected to utilize adequate BMPs to ensure compliance with State Water Quality Laws.

3) If applicant is not an agency, explain any relevant public interest in regard to the proposed study.

The public interest includes providing access for the use and enjoyment of public lands, waters, and other natural resources that are managed by public resource agencies. The public's interest also includes benefits from renewable energy produced by the Mystic Lake hydroelectric project.

4) Describe existing information on subject of proposed study and the need for additional information.

The FERC license requires that PPL Montana provide instream flows of 10 cfs (June 1 to August 31) and 3 cfs (September 1 to May 31), with measurement and compliance determined at a weir near the power plant. This information is useful, but does not measure actual releases in the vicinity of the dam; rather, this measurement is the combined total of releases and accreted flows from ground water and/or tributary inputs. Measurement of flows at the upper weir is not sufficient to provide a complete understanding of the physical-biological relationship within the bypass reach. Within the bypass reach, there are three locations where relatively accurate flow measurements are continually made; 1) From spill through the flashboard bays at Mystic Lake dam, 2) from

discharge through the fish valve and 3) from flow measurements made at the upper weir. Additional required information includes obtaining calibration and performance data on the instrumentation used to measure the fish valve gate position and the stage at the upper weir. Performance data on the fish valve will be required. Simple tests to validate the accuracy of the pool elevation at Mystic Lake, the fish valve discharge as a function of Mystic Lake pool elevation and gate position, and the upper weir stage should be performed prior to initiating the study.

5) Explain any connection between project operation and effects (direct, indirect or cumulative) on the resource to be studied and how study results will help identify potential project impacts and assist in development of License conditions.

Project operations have reduced flows in the bypass reach of West Rosebud Creek. Discharge distributions in the bypass reach will be used in conjunction with habitat data to evaluate physical habitat within the bypass reach, and determine if current license requirements for instream flows are sufficient.

6) Explain how proposed study methods (including data collection and analysis techniques, study schedule and duration) is consistent with accepted scientific practices or considers, as appropriate, relevant Tribal values and knowledge.

With regard to the flow measurement portion of the study using instrumented valves and weirs, the methodology is a standard, straightforward approach that is in wide use throughout the world. Discharge measurements are commonly used to evaluate stream hydrology and physical habitat in fluvial systems. Although discharge measurements are commonly used to evaluate stream hydrology and physical habitat in fluvial systems, there has been considerable debate as to their utility in high gradient systems dominated by large substrate types.

7) Describe level of effort and anticipated cost and why alternative studies would not be sufficient to meet stated information needs.

The flow measurement study would require precursory evaluation of the valves, weirs, and the instrumentation used to monitor them. A series of tests would be run to confirm the calibration of the devices. Once established, they should be able to perform reliably with only regularly scheduled maintenance that is routinely performed by plant operations personnel as a part of normal plant operations.

This work would require two technicians to visit the field for a two-day period to evaluate the installations and collect the first set of measurements, and on two separate additional days for system maintenance, plus office time for data processing and report writing. Anticipated cost estimate (not including equipment):

Field: 2 technicians (4 days) @\$800/day
Travel: (4 days) @ \$150/day

Office: 1 technician (3 days) \$800/day
Total: 11 person-days plus travel = \$620

Mystic Project Study Request No. 7

Title of Proposed Study: Water Temperature Monitoring in the Mystic Lake Project Area

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Refer to criteria, #1 and #6, adapted from FERC Regulations 18 CFR 5.9 (b), as discussed below.

2) A schedule for conducting the study.

The study plan is scheduled for the 2005 summer field season. The schedule for submitting an initial study report, reviewing the study, and decisions to continue and/or amend the study plan is provided in the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com).

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Refer to the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com) that outlines the timeline for pre-filing milestones and the process for communications and information sharing.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

Not Applicable.

****Criteria adapted from FERC Regulations 18 CFR 5.9 (b) and 18 CFR 5.11(4)(d)****

1) Describe goals and objectives of proposed study and the information to be obtained.

The fisheries, aquatic habitats and water quality resource work groups identified water temperature as a potential issue for the Mystic Lake Project. Specifically, the question was asked, “Is the Mystic Project adversely affecting water temperatures in West Rosebud Creek?” The goal of the proposed study is to monitor water temperatures at a variety of locations along the length of West Rosebud Creek to determine if the Mystic Project is having an adverse effect on temperature.

2) If applicable, explain any relevant resource management goals for agencies or Tribes with jurisdiction over the resource to be studied.

Resource management goals of PPL Montana and resource agencies include a determination of whether the project is having any continuing or adverse effects on aquatic resources. One aspect of this determination is understanding the project’s impacts (if any) on water temperature.

3) If applicant is not an agency, explain any relevant public interest in regard to the proposed study.

The public interest includes providing access to the use and enjoyment of public lands and waters and natural resources that are managed on those lands and waters by public resource agencies. Public interest also includes the benefits of renewable energy from electricity developed by the project.

4) Describe existing information on subject of proposed study and the need for additional information.

The Pre-Application Document (PAD) filed by PPL Montana on July 1, 2004 describes the existing information about the Mystic Lake Project. The physical and chemical parameters of the water in the Mystic Lake Project were described in Section 3.2.3 of that document. Water temperature information was available for Mystic Lake, West Rosebud Lake, and Emerald Lake and that information is summarized in the PAD. However, water temperature data for West Rosebud Creek were not available at the time the PAD was prepared.

The data on the lakes did not indicate that the project is creating water temperature problems. However, the Resource Work Groups expressed an interest in filling the West Rosebud Creek water temperature data gap so that we can be sure that the Project is not having a detrimental impact on water temperature.

In 2004, PPL Montana deployed thermographs in a variety of locations in the West Rosebud Creek drainage. The preliminary results of the 2004 evaluation are presented in a report at the end of this study request. The conclusion of the 2004 study is that summer water temperature in the Mystic Lake Project area is in the preferred range for salmonid species. There is no indication of excessive water temperatures occurring at any location.

In 2005, thermographs will be deployed to confirm this result. The proposed study for 2005 is described below.

5) Explain any connection between project operation and effects (direct, indirect or cumulative) on the resource to be studied and how study results will help identify potential project impacts and assist in development of License conditions.

The purpose of the study is to identify if a connection exists between project operation and summer water temperatures. The study will focus on the warm months between May and September. It is assumed that if there is a temperature issue that the issue would be with high temperatures during the summer months. If the project causes an unnatural increase in summer temperatures it could potentially affect trout reproduction, feeding, and growth.

6) Explain how proposed study methods (including data collection and analysis techniques, study schedule and duration) is consistent with accepted scientific practices or considers, as appropriate, relevant Tribal values and knowledge.

During 2005 PPL Montana will monitor water temperatures throughout West Rosebud Creek from Mystic Lake to its confluence with the East Rosebud Creek. Optic Stowaway thermographs will be placed in a total of 8 locations including: Mystic Lake penstock intake, above powerhouse, below powerhouse, below West Rosebud Lake, Emerald Lake Outlet, West Rosebud Creek at Allen Grade Bridge (approx. three miles above Fiddler Creek, also known as the section 2 bridge), West Rosebud Creek above the confluence with East Rosebud Creek, and East Rosebud Creek above the confluence with West Rosebud Creek.

Thermographs will be set to collect hourly data. The thermographs will be installed around May 4 and removed around September 15. Data will be used to evaluate spatial and temporal differences in water temperature throughout the project area. Thermographs are checked for accuracy at the beginning of the year and are checked frequently on site during the data collection period as part of the QC/QA for this program.

In addition, a thermograph will be installed at the upstream end of the bypass reach, in the same area where stream habitat data are being collected. This thermograph will be installed in the fall of 2004 and retrieved in September 2005. This thermograph is being installed in response to a request by the U.S. Forest Service to gather data about fall and winter water temperatures in the bypass reach.

Optic stowaway thermographs are well-known, reliable, commonly used temperature recording devices. They will provide around the clock temperature readings during the time period they are deployed.

7) Describe level of effort and anticipated cost and why alternative studies would not be sufficient to meet stated information needs.

Thermographs will be deployed, maintained as needed, and retrieved at the end of the study, requiring 5-6 days in the field. Data will then be downloaded and analyzed and a report written. This effort will require 20 – 40 hours.

Use of the recording thermographs provides an entire season of data with minimal labor. No alternative is available that would provide this density of data with this (relatively low) level of effort.

Preliminary Results for 2004
Water Temperature in West Rosebud Creek
Draft: Not for Citation

Mystic Lake Hydroelectric Project, Montana

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November 1, 2004

Introduction

The Pre-Application Document (PAD) filed by PPL Montana on July 1, 2004 describes the existing information about the Mystic Lake Project. The physical and chemical parameters of the water in the Mystic Lake Project are described in Section 3.2.3 of that document. Water temperature information was available for Mystic Lake, West Rosebud Lake, and Emerald Lake and that information is summarized in the PAD. However, water temperature data for West Rosebud Creek was not available.

The existing data on the lakes do not indicate the project is creating water temperature problems. However, the Resource Work Groups expressed an interest in gathering water temperature data on West Rosebud Creek to verify the Project is not having a detrimental impact on water temperature.

Methods

In 2004 PPL Montana monitored water temperatures throughout West Rosebud Creek from Mystic Lake to its confluence with East Rosebud Creek. Optic Stowaway thermographs were placed in a total of 8 locations including: Mystic Lake penstock intake, above powerhouse, below powerhouse, below West Rosebud Lake, Emerald Lake Outlet, West Rosebud Creek at Allen Grade Bridge (approximately three miles above Fiddler Creek), West Rosebud Creek above the confluence with East Rosebud Creek at the Rosebud Isle Fishing Access Site, and East Rosebud Creek above the confluence with West Rosebud Creek at the 419 Bridge Crossing. Thermographs were set to collect half-hourly data. The thermographs were installed around May 7 and removed around September 28, 2004 (dates varied slightly at different sites).

Results

Water temperatures were collected in East Rosebud Creek to provide a comparison to West Rosebud Creek. The East Rosebud Creek drainage is similar to the West Rosebud Creek drainage in terms of geology, size, aspect, and the presence of lakes. However, East Rosebud Creek does not contain a hydroelectric plant. This makes comparisons to East Rosebud Creek helpful in potentially describing hydropower impacts.

The temperature of East Rosebud Creek measured at the 419 Bridge, upstream of the confluence with West Rosebud Creek, is depicted in Figure 1.

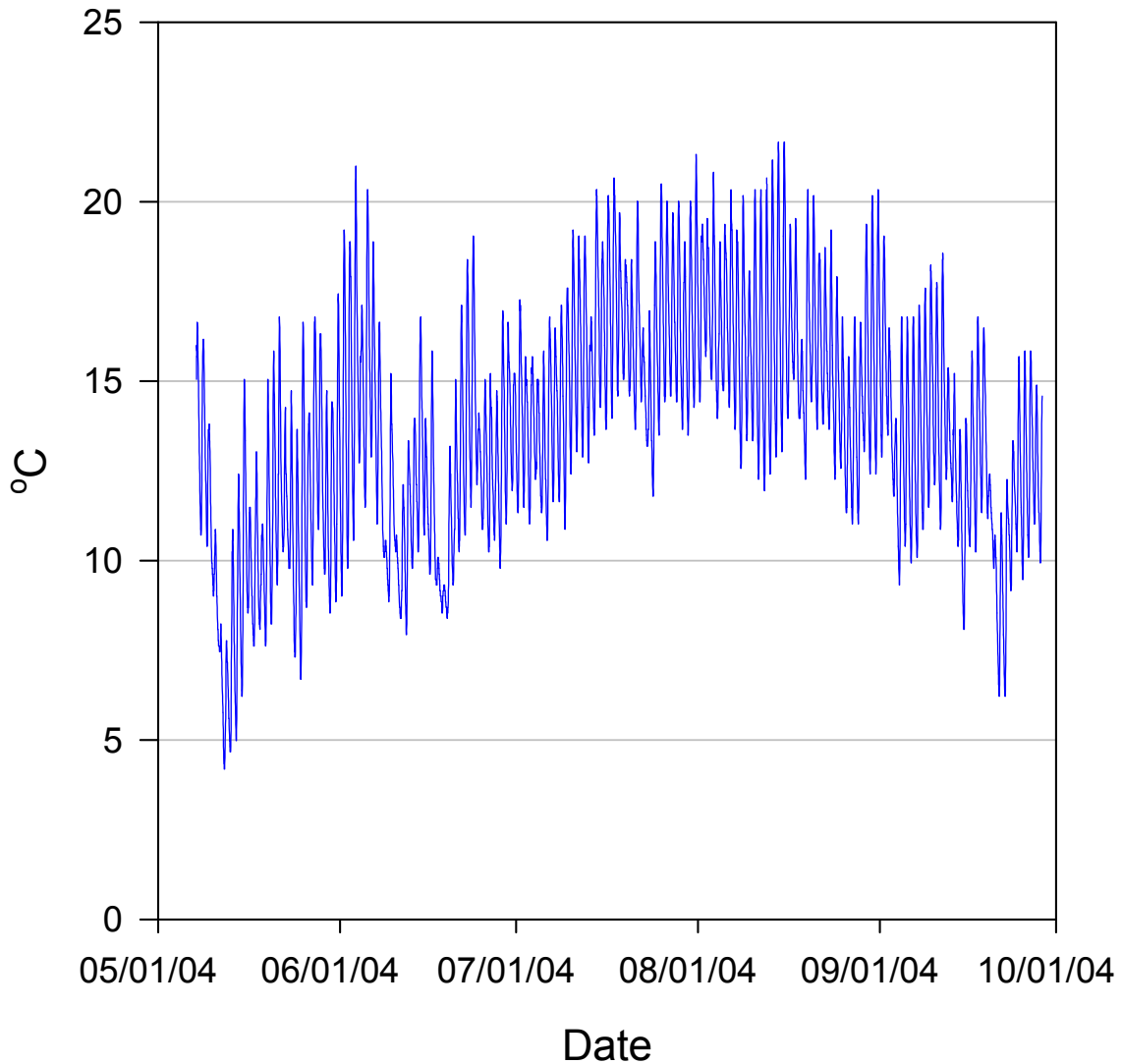


Figure 1. Temperature of East Rosebud Creek measured at the Highway 419 Bridge, just upstream of the confluence with West Rosebud Creek.

In 2004, the temperature of East Rosebud Creek gradually warmed during May, cooled off during the first half of June, and then warmed during the remainder of the summer. Peak temperatures occurred during mid-August. The warmest water temperature recorded between May 7 and September 28 was 21.66°C, which occurred on August 14 and 15. The coldest water temperature, 4.19°C, occurred on May 12. Temperatures in excess of 20°C were uncommon and short in duration.

The temperature of West Rosebud Creek is depicted in Figure 2.

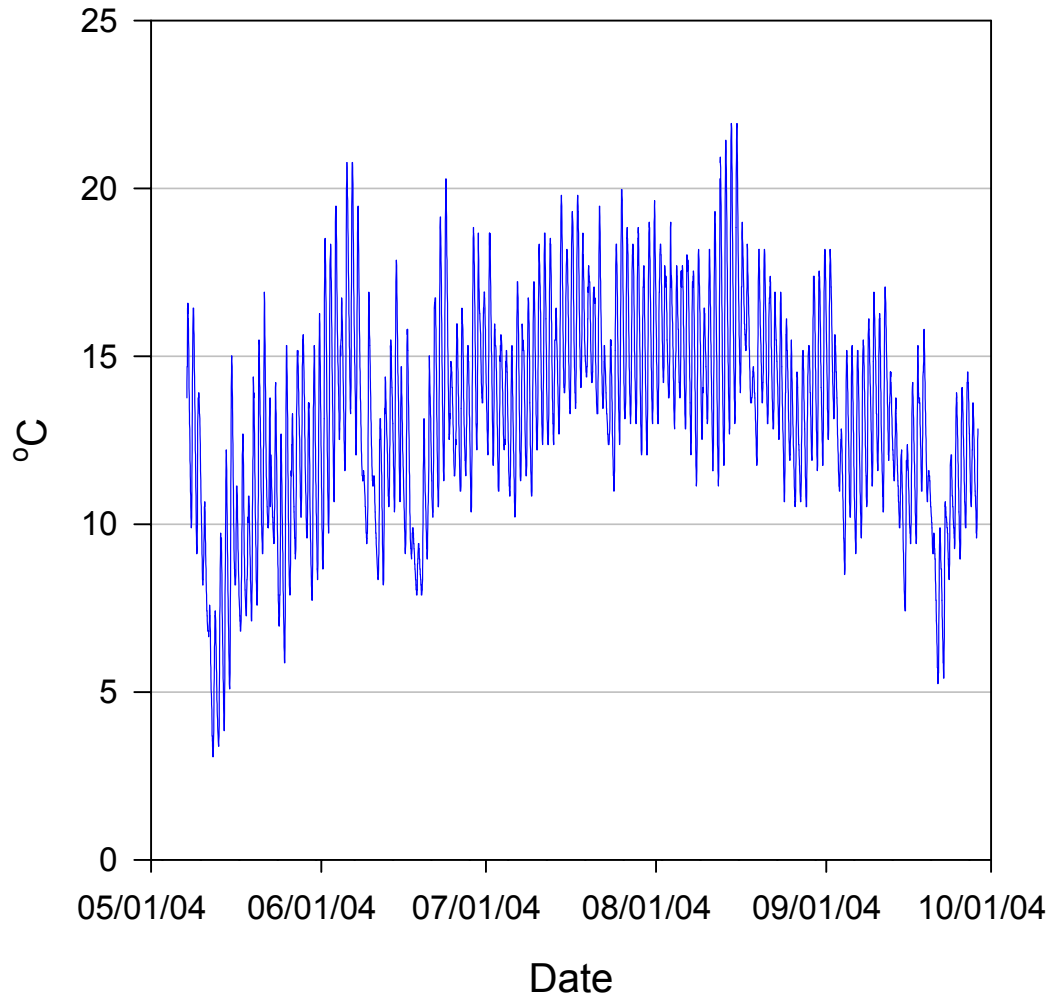


Figure 2. Water temperature of West Rosebud Creek measured at the Rosebud Isle Fishing Access Site, just upstream of the confluence with East Rosebud Creek.

In 2004, the temperature of West Rosebud Creek followed the same general seasonal pattern between May 7 and September 28 as the temperature of East Rosebud Creek. Peak water temperatures occurred on the same days for both East and West Rosebud creeks. On August 14 and 15, peak temperatures were similar at 21.66°C in East Rosebud Creek and 21.93°C in West Rosebud Creek. The coldest water temperature at this site on West Rosebud Creek during the period of record was 3.07°C, which occurred on May 12. Temperatures in excess of 20°C were uncommon and short in duration.

In order to make a direct comparison between water temperature in the two streams, the difference between their temperatures was calculated and plotted in Figure 3.

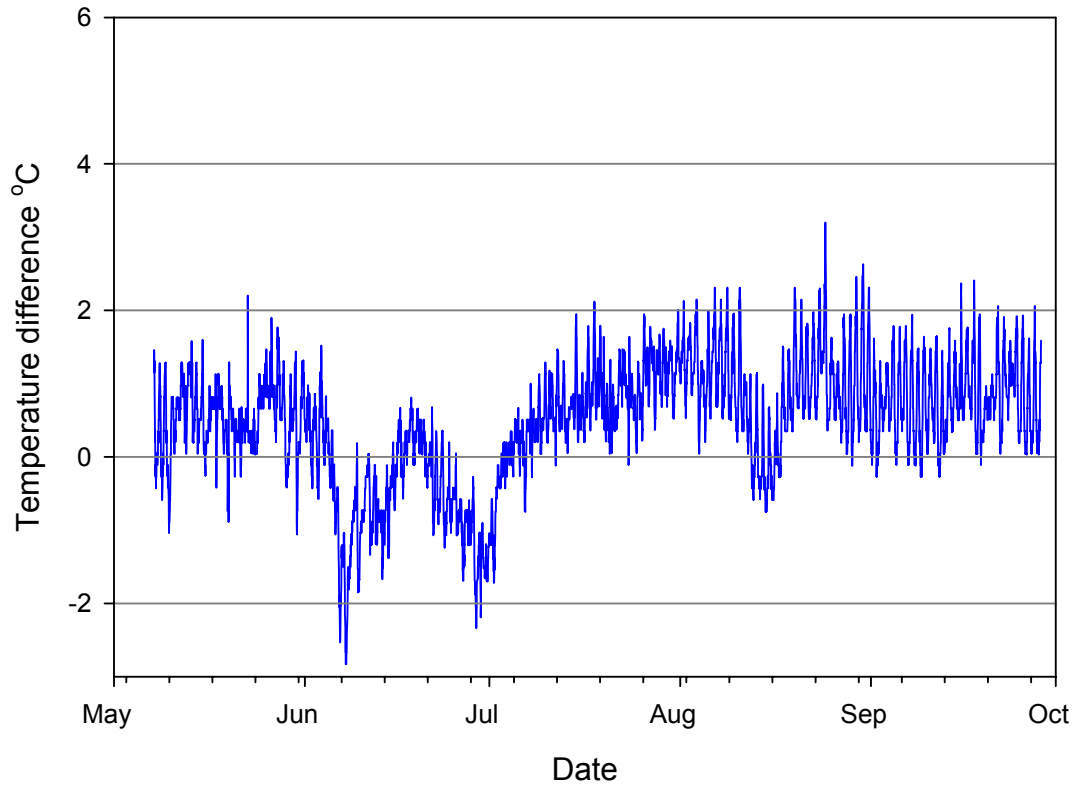


Figure 3. Water temperature difference between East Rosebud Creek (at Hwy 419 Bridge) and West Rosebud Creek (at Rosebud Isle FAS) for a given date and time. Values above zero indicate that East Rosebud Creek was warmer. Values less than zero indicate that West Rosebud Creek was warmer.

The water temperature of the two streams was very similar throughout the measurement period. During May, the two streams were generally within 1°C of each other, with East Rosebud Creek commonly about 0.5°C warmer than West Rosebud Creek. During June, West Rosebud Creek was often warmer than East Rosebud Creek by from 0 – 2°C. During the remainder of the measurement period, East Rosebud Creek was warmer than West Rosebud Creek. Only on rare occasions was the temperature difference between the two streams in excess of 2°C.

The next upstream temperature monitoring site on West Rosebud Creek was at the Allen Grade Bridge, also known as the Section 2 bridge (Figure 4). This site is approximately three miles upstream of Fiddler Creek and approximately nine miles upstream of the confluence with East Rosebud Creek.

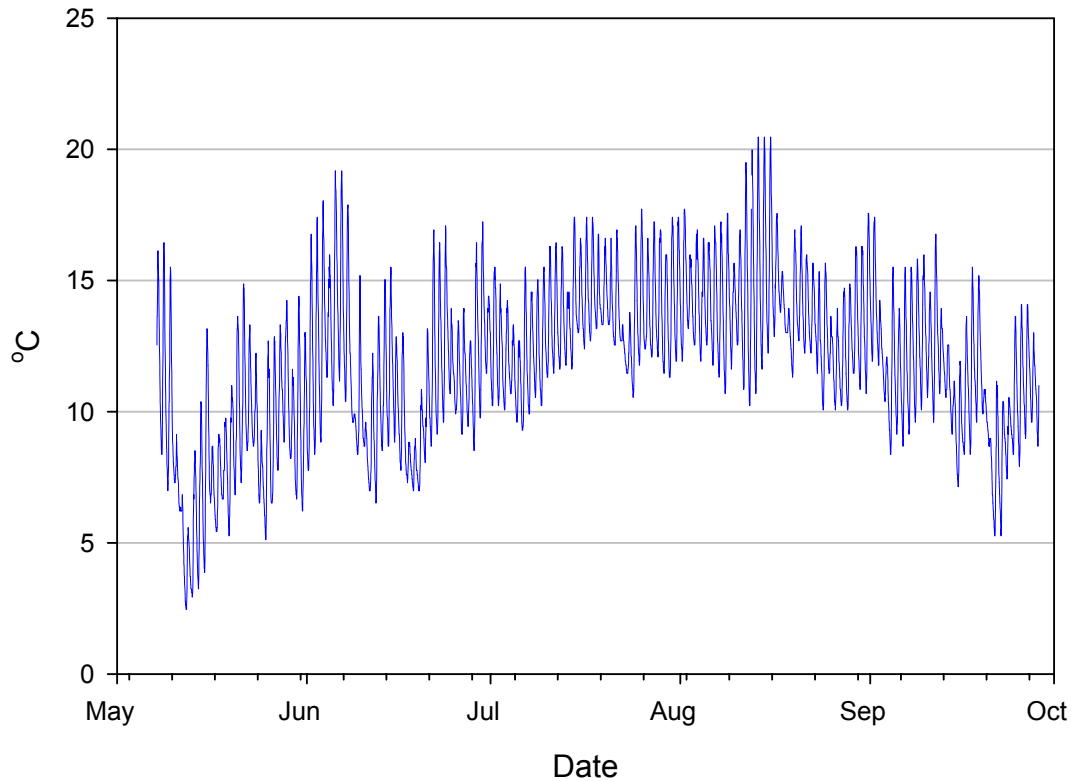


Figure 4. Water temperature of West Rosebud Creek measured at the Allen Grade Bridge (Section 2 Bridge), approximately three miles above the confluence with Fiddler Creek and approximately nine miles above the confluence with East Rosebud Creek.

In 2004, the temperature of West Rosebud Creek at the Allen Grade Bridge (also known as the Section 2 bridge) also followed the same general seasonal pattern as the temperatures measured further downstream. Peak temperatures occurred during mid-August. The warmest water temperature recorded between May 7 and September 28 was 20.47°C, which occurred on August 13, 14, and 15. The coldest water temperature was 2.46 °C, which occurred on May 12. Temperatures in excess of 20°C were very uncommon and short in duration.

In order to make a direct comparison between water temperature in the two lower measuring sites on West Rosebud Creek, the difference between their temperatures was calculated and plotted in Figure 5.

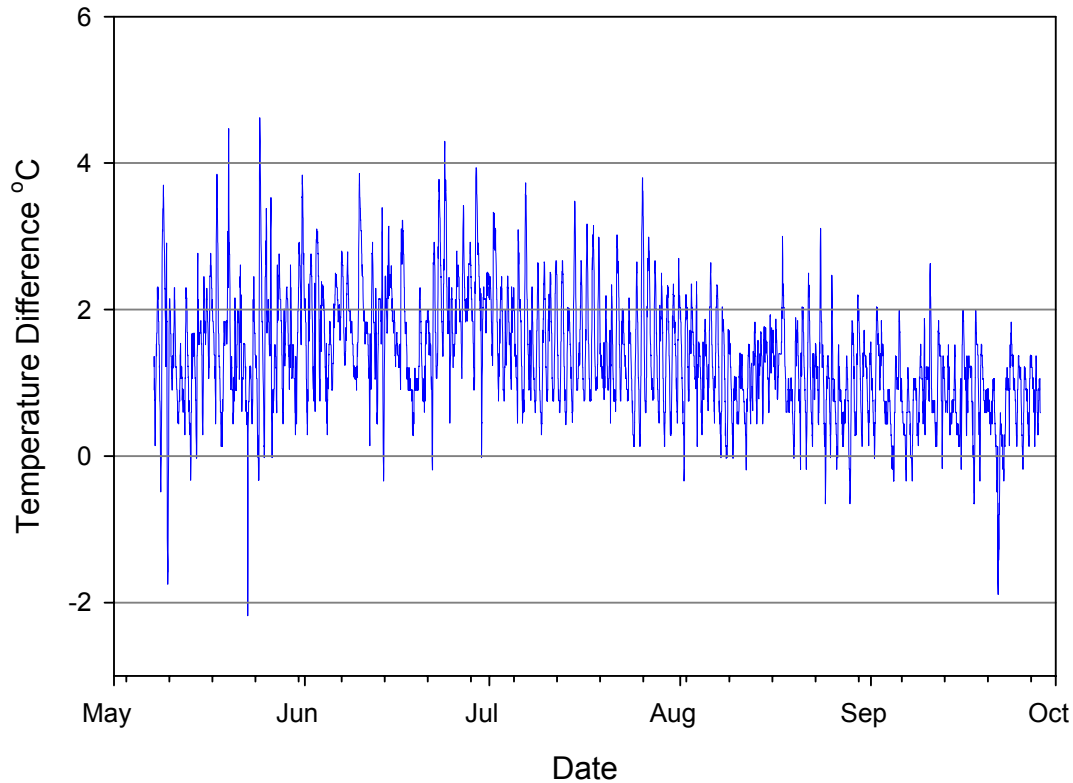


Figure 5. Water temperature difference between West Rosebud Creek at Rosebud Isle FAS and West Rosebud Creek at Allen Grade Bridge for a given date and time. Values above zero indicate that West Rosebud Creek at Rosebud Isle FAS was warmer. Values less than zero indicate that West Rosebud Creek at Allen Grade Bridge was warmer.

It is clear from Figure 5 that water temperatures in West Rosebud Creek warm as the stream moves downstream from the Allen Grade Bridge. Only on rare occasions is the water warmer at the upstream measuring site. Generally, the difference in temperature between the two sites ranges from 0 to 3°C, although there were a few events in May and June when the downstream site was warmer by > 4°C. It is not unusual or unexpected for a stream to be warmer in downstream reaches if the stream is exposed to solar radiation as it moves downstream.

The next upstream measurement site was downstream of Emerald Lake. Temperatures in West Rosebud Creek at that location are depicted in Figure 6.

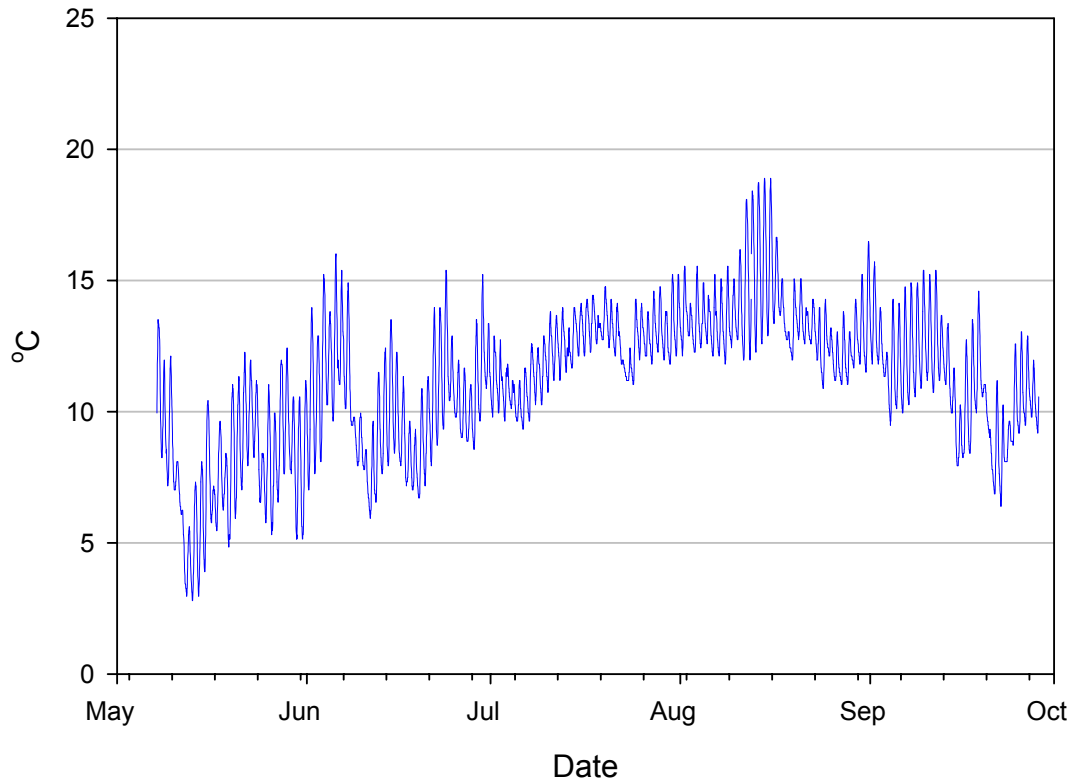


Figure 6. Water temperature measured below Emerald Lake.

Water temperature in West Rosebud Creek below Emerald Lake was clearly colder than downstream reaches of West Rosebud Creek, staying well below 20°C at all times during 2004. Maximum temperature was 18.9°C on August 18 and 19. Minimum water temperature during the measurement season (May – September) was 2.8°C on May 13.

The next upstream measurement site on West Rosebud Creek was downstream of the re-regulating dam on West Rosebud Lake. The water temperature at that site is depicted in Figure 7.

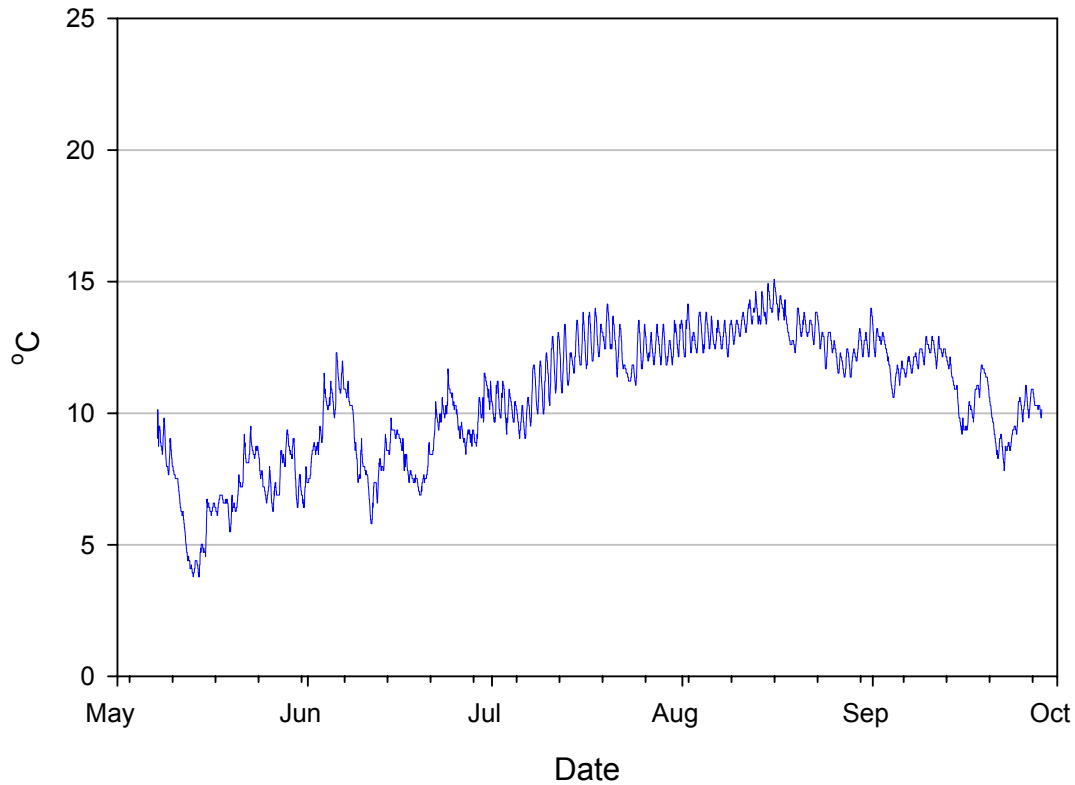


Figure 7. Water temperature of West Rosebud Creek below re-regulating dam on West Rosebud Lake.

The maximum water temperature below the re-regulating dam was 15.09°C on August 15 (Figure 7). The minimum water temperature during the period of measurement (May – September 2004) was 3.78°C on May 13 and 14. This site has noticeably colder water temperature than the site downstream of Emerald Lake, indicating that the broad surface area of Emerald Lake (a natural lake, not a part of the Mystic Hydropower project) results in warming of water temperatures. In addition, water temperature below West Rosebud Lake appears to fluctuate less over a diel cycle than in downstream areas. That is, there is less of a difference between day and night temperatures in water temperatures below West Rosebud Lake than below Emerald Lake.

The temperature difference between water exiting West Rosebud Lake and water exiting Emerald Lake is further illustrated in Figure 8.

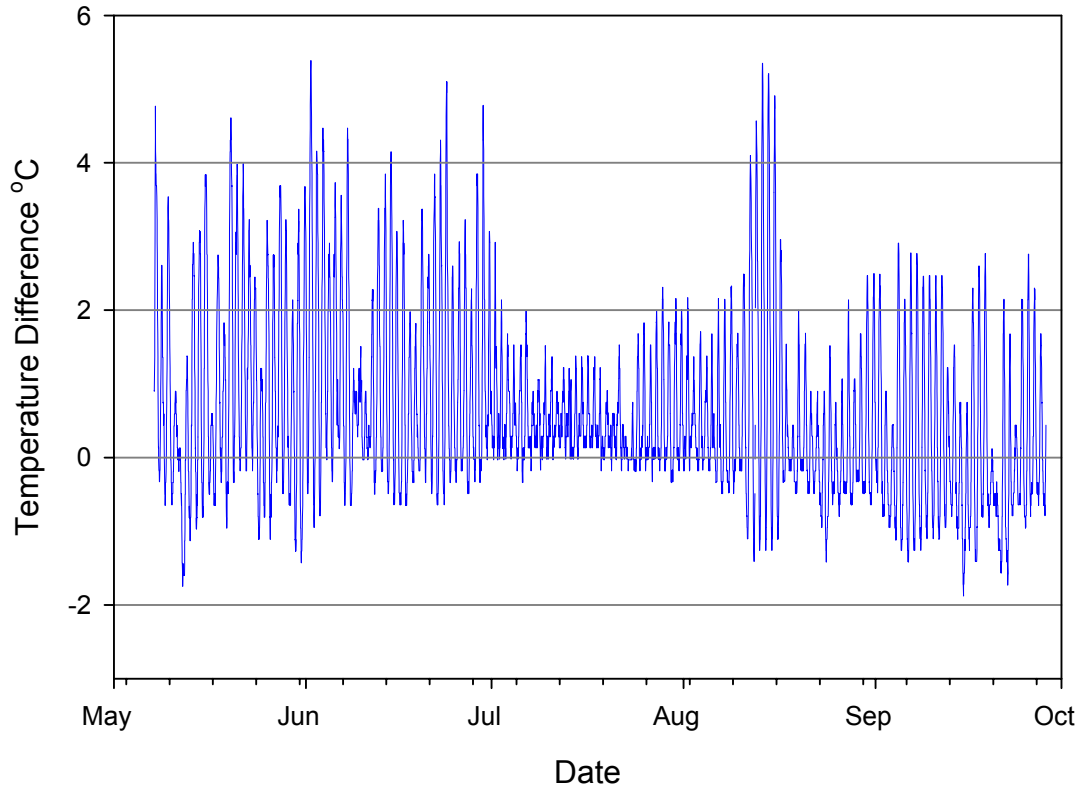


Figure 8. Water temperature exiting Emerald Lake minus water temperature exiting West Rosebud Lake. Values greater than zero indicate water exiting Emerald Lake is warmer than water exiting West Rosebud Lake.

As can be seen in Figure 8, water exiting Emerald Lake fluctuates in temperature between day and night a great deal more than water existing West Rosebud Lake. Water below Emerald Lake is generally between 0 – 5°C warmer than water below West Rosebud Lake. In the spring and fall, nighttime water temperatures can be 0 – 2°C cooler below Emerald Lake than nighttime water temperatures below West Rosebud Lake.

Water temperature measured below the powerhouse (at the lower weir) is depicted in Figure 9. Water at this site comes from a mixture of 1) water drawn from Mystic Lake and passed through the flowline and penstock and through the powerhouse, 2) spill (when Mystic Lake is at full pool), 3) water released from the “fish valve” and passed down the bypass channel, 4) tributary inflow below Mystic Lake, and 5) any groundwater inflow and seepage. As shown in Figure 9, in 2004 water temperature at this location was consistently below 15°C throughout the summer months.

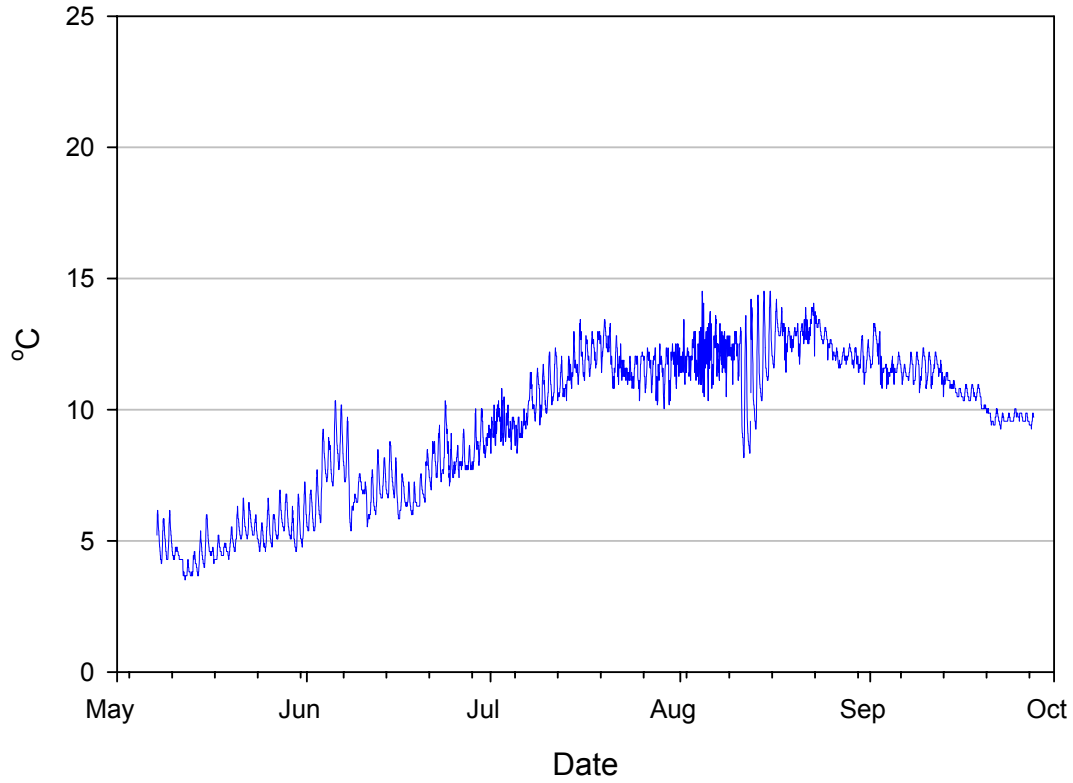


Figure 9. Water temperature in West Rosebud Lake below the powerhouse.

Figure 10 shows the difference in temperature between water exiting from West Rosebud Lake and the water exiting the powerhouse. Generally, water warms from 0 – 2°C during its pass through West Rosebud Lake, although on occasion the water warms as much as 4- 5°C.

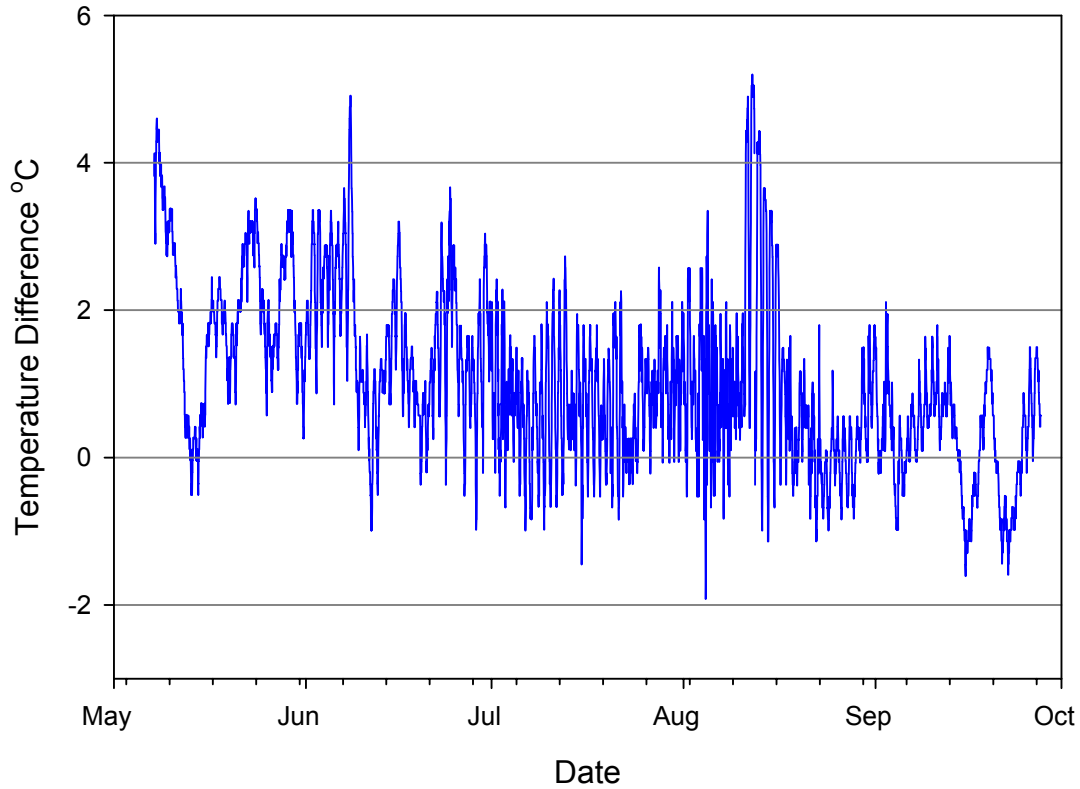


Figure 10. Water temperature difference between the below West Rosebud Lake site and the below powerhouse measuring site. Values above zero indicate that water temperatures were warmer below West Rosebud Lake than below the powerhouse.

Water temperature measured above the powerhouse, at the upper weir, is displayed in Figure 11. The warmest temperature recorded at this site was 15.39°C, measured on August 1, 2004. The coldest water temperature between May 7 and September 28 was 1.39°C, measured on May 12, 2004.

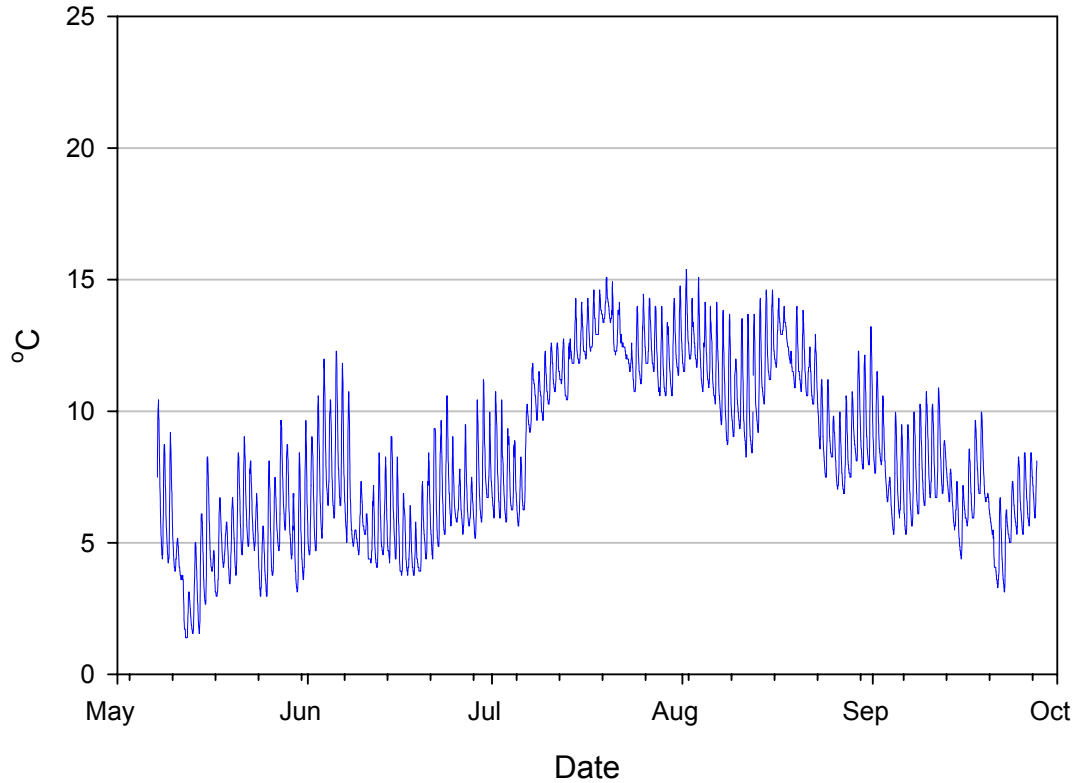


Figure 11. Temperature of West Rosebud Creek above the powerhouse, at the upper weir.

The water temperature above the powerhouse is compared to water temperature below the powerhouse in Figure 12. The warmest water temperatures at both sites were approximately 15°C. However, the above powerhouse site reached this temperature slightly earlier in the summer than the below powerhouse site. From mid-August through September water temperatures cooled more rapidly in the above powerhouse site than at the below powerhouse site. Diel fluctuations were greater at the above powerhouse site.

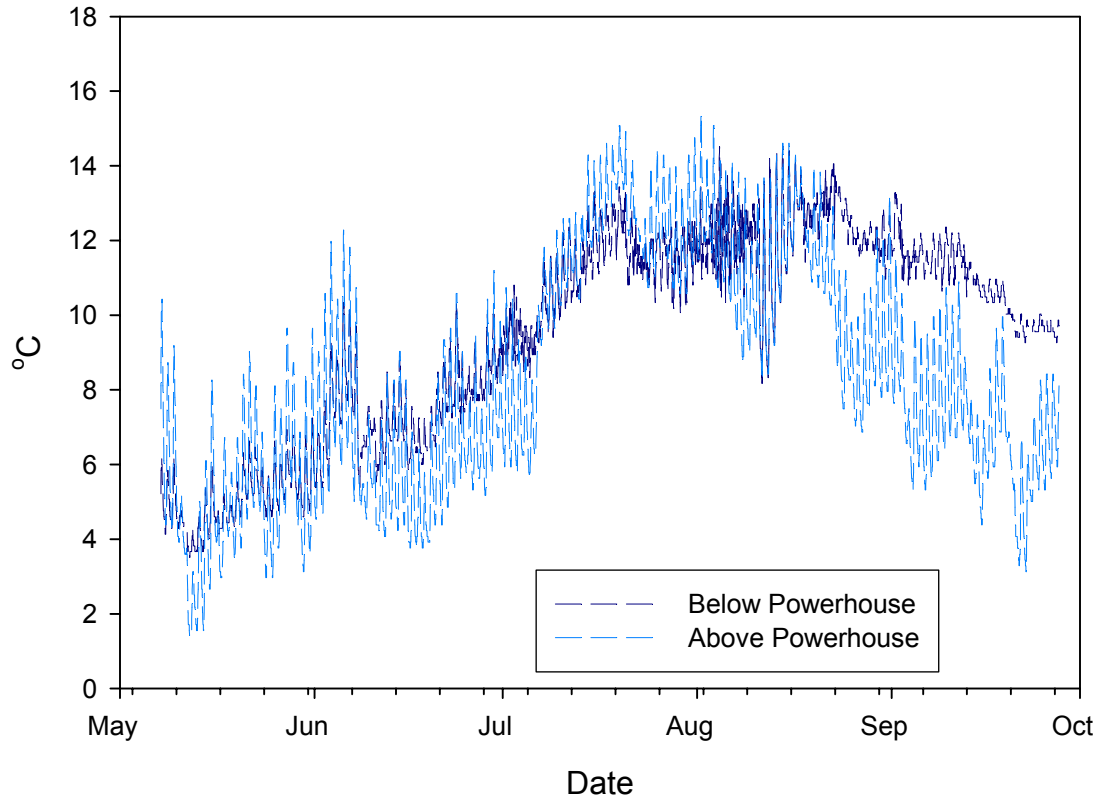


Figure 12. Comparison between the above powerhouse water temperatures and the below powerhouse water temperature.

Water temperatures were measured in Mystic Lake from July 9 – September 29, 2004. The thermograph was placed in Mystic Lake at the midpoint elevation of the intake pipe approximately 61.25 feet below the full pool elevation of 7673.5 feet. Water temperature at that location is displayed in Figure 13. The maximum water temperature in Mystic Lake was 14.54°C, measured on August 4, 2004. The minimum temperature measured was 6.80°C, measured on July 16, 2004. However, note that the thermograph was not deployed until July 9, therefore the minimum temperature measured is not as cold at this site as at other sites where the thermograph was deployed in early May.

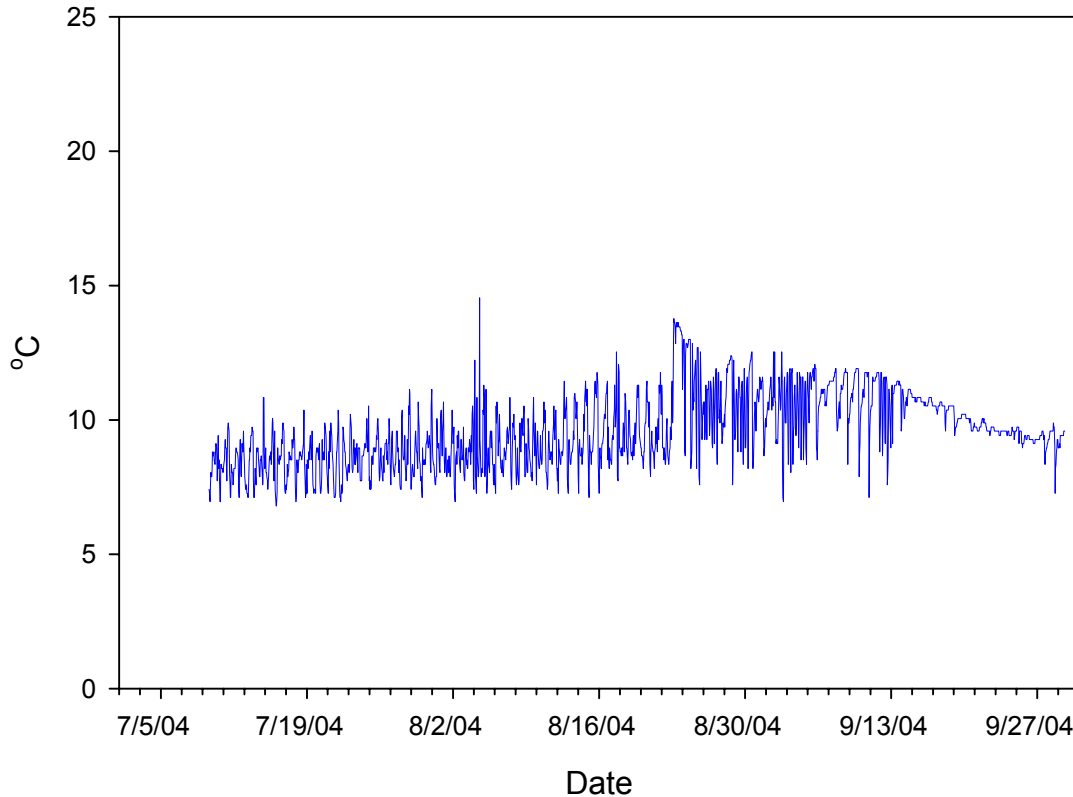


Figure 13. Water temperature measured in Mystic Lake collected from the midpoint elevation of the intake pipe in Mystic lake approximately 61.25 feet below full pool of 7673.5 feet.

Discussion

Water temperature is of interest primarily because of its potential to influence the habitat suitability of the project area lakes and streams for salmonids. Salmonids are coldwater fish with definite temperature requirements. Although some populations of salmonids have adapted to warmer temperatures, in general salmonids are not present if summer water temperatures consistently exceed 22°C (Griffith 1999). However, in small streams where daily maximum temperatures approach the upper lethal values, salmonids can thrive if the temperature is high for only a short time and then declines into the optimum range (Bjornn and Reiser 1991).

The lower lethal, upper lethal, optimum, and preferred temperatures for different species of salmonids have been determined through a variety of measures. In general, the lower lethal temperature for salmonids living in a natural environment, where acclimation to cold temperatures is gradual, is 0°C (Bjornn and Reiser 1991).

The upper lethal temperature for salmonids varies with acclimation temperature. Generally, the upper lethal temperature for brook, rainbow, and brown trout has been estimated at $\geq 25^{\circ}\text{C}$ and $< 30^{\circ}\text{C}$ (Bjornn and Reiser 1991). Upper lethal temperature for cutthroat trout was estimated by Bell (1986, cited in Bjornn and Reiser 1991) at 22.8°C .

Although fish may survive at temperatures near the extremes of the suitable range, growth is reduced at low temperatures, because metabolic processes are slowed; and at high temperatures, because most or all food is used for maintenance (Bjornn and Reiser 1991). Brown trout can survive and thrive in warmer waters ($18\text{-}24^{\circ}\text{C}$) than other species of trout (Wydoski and Whitney 2003). Rainbow trout generally prefer water $< 21^{\circ}\text{C}$, although they can inhabit water with temperatures from $0\text{-}26^{\circ}\text{C}$. Brook trout usually do best with water temperatures less than 20°C , with optimum temperatures being $13\text{-}19^{\circ}\text{C}$. Cutthroat trout preferred temperature range is $10\text{-}21^{\circ}\text{C}$ (Wydoski and Whitney 2003).

From the above discussion, it is apparent that summer water temperatures in West Rosebud Creek are generally within the preferred range for salmonids. In downstream areas of West Rosebud Creek, near the confluence with East Rosebud Creek, summer water temperatures warm to degree that could discourage brook and cutthroat trout. However, water temperatures in this location are still suitable for brown and rainbow trout.

Conclusions

Summer water temperatures are generally in the preferred range for salmonids in West Rosebud Creek within the project area. The maximum temperatures recorded in the bypass reach (above powerhouse), below the powerhouse, and below West Rosebud Lake were approximately 15°C . There is no indication that the Mystic Lake Hydroelectric Project is causing water to warm to a level that could pose any danger to salmonids at any location.

Water temperatures warm in a downstream direction. Both West Rosebud Lake and Emerald Lake have a slight warming influence on downstream water temperatures. Water temperature continues to warm downstream of Emerald Lake.

At the downstream-most site on West Rosebud Creek, just above the confluence with East Rosebud Creek, water temperatures reach a maximum of over 21°C . West Rosebud Creek temperature range ($3.07\text{-}21.93^{\circ}\text{C}$) is very similar to the temperature range of East Rosebud Creek ($4.19\text{-}21.66^{\circ}\text{C}$), a similar stream that does not contain a hydroelectric facility.

References:

- Bjornn, T.C. and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. American Fisheries Society Special Publication 19:83-138.
- Griffith, J.S. 1999. Coldwater streams. Pages 481-500 *in* C.C. Kohler and W.A. Hubert, editors. Inland fisheries management in North America, 2nd edition. American Fisheries Society, Bethesda, Maryland.
- Wydoski, R.S. and R.R. Whitney. 2003. Inland fishes of Washington. American Fisheries Society in association with University of Washington Press, Seattle and London.

Mystic Project Study Request No. 8

Title of Proposed Study: Mystic Lake Spill Hydrology

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Refer to criteria, #1 and #6, adapted from FERC Regulations 18 CFR 5.9 (b), as discussed below.

2) A schedule for conducting the study.

The study plan is scheduled for the 2005 summer field season. The schedule for submitting an initial study report, reviewing the study, and decisions to continue and/or amend the study plan is provided in the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com).

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Refer to the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com) that outlines the timeline for pre-filing milestones and the process for communications and information sharing.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

Not Applicable.

****Criteria adapted from FERC Regulations 18 CFR 5.9 (b) and 18 CFR 5.11(4)(d)****

1) Describe goals and objectives of proposed study and the information to be obtained.

This is a two-phase study. The goals of the study are to determine if and how operation of the project has changed the natural hydrograph during spring runoff and whether these changes have affected aquatic species in the bypass reach. The first objective is to identify changes in the timing and magnitude of peak flows, and changes in the rate of change of discharge for flows during the ascending limb of the annual hydrograph. The second objective would be to identify if and how these changes affect aquatic species.

2) If applicable, explain any relevant resource management goals for agencies or Tribes with jurisdiction over the resource to be studied.

Management goals, objectives and standards for riparian areas, wildlife and fish are identified in the Custer N.F. Forest Plan under Chapter II Forest Wide Management Direction and Chapter III – Management Area Direction.

Forest Plan goals for riparian areas include: “manage for water quality, provide diverse vegetation, and protect key wildlife habitat in these areas from conflicting uses” and “uses and activities that adversely impact these areas will be mitigated”.

Forest Plan objectives for riparian areas include recognition of their unique values, and management direction is to be designed to protect these key wildlife habitats and improve water quality: “these areas will be managed in relation to various legally mandated requirements including, but not limited to, those associated with floodplains, wetlands, water quality, dredged and fill material, endangered species, and cultural resources”.

Forest management standards for fisheries identify that resource management activities will be conducted in such a manner to assure maintaining water quality and quantity in order to maintain fish habitat. An implementation program will be designed to identify specific activity constraints and will be guided by the following guidelines:

- Lakes and reservoirs will be evaluated to determine their physical and chemical habitat parameters. Direct habitat improvements will be recommended on those waters found suitable for fish habitat enhancement.
- Person-caused increases and decreases of water yields will be limited so that the stream channel damage will not occur. Adequate in-stream flows will be maintained in all existing fisheries.
- Activities will be designed to maintain present quality of the water flowing on and off National Forest System lands. The appropriate state and Federal water quality standards for fisheries will be met. Predictive models will be used if available to help evaluate impacts.

Goals for Management Area M (Riparian) are: Manage to protect from conflicting uses in

order to provide healthy, self-perpetuating plant and water communities that will have optimum diversity and density of understory and overstory vegetation.

3) If applicant is not an agency, explain any relevant public interest in regard to the proposed study.

The public interest includes providing access for the use and enjoyment of public lands, waters, and other natural resources that are managed by public resource agencies. The public's interest also includes benefits from renewable energy produced by the Mystic Lake hydroelectric project.

4) Describe existing information on subject of proposed study and the need for additional information.

The project expanded the original size of Mystic Lake for increased water storage and increased power generation. Lake expansion may have altered the timing and magnitude of peak flows (spill) below the dam and the rate of change in discharge for flows during the ascending limb of the annual hydrograph. Much work has been completed to evaluate changes in the natural hydrograph, but this work focuses on flows below the power plant (and downstream of the bypass reach). There is no known documentation that evaluates hydrograph changes immediately below the dam. It would be a straightforward exercise to perform the calculations to compare slopes of the ascending limbs of the hydrographs for both pre and post project conditions.

Existing information could be used to complete this analysis. This would involve analyzing existing data and hydrograph modeling (e.g., USGS data, lake volume calculations, power generation, etc.) to provide the following information for **both** pre-project (natural waterfall) and post-project (dam-in-place) flows at the dam site:

- Range of dates and average dates for the first spill (once you see a change above baseflow in the spring) and peak spill of the season.
- Range of discharges and average discharges for the first spill and peak spill of season.
- Rate of change of discharge during ascending limb of hydrograph encompassing first and peak spills.

Display all data both in tabular format with appropriate statistical evaluation (significance of values, i.e., R-squared), and in graphical format as a hydrograph (discharge/time).

If it is determined through this analysis that project operations have substantially altered the hydrograph below the dam then the second objective would be to identify if and how these changes affect aquatic species (flushing of eggs in gravel, timing of fry emergence, rearing displacement, etc.). This objective would be further defined based on the results of the hydrograph analysis.

5) Explain any connection between project operation and effects (direct, indirect or cumulative) on the resource to be studied and how study results will help identify potential project impacts and assist in development of License conditions.

Significant flow changes can result in impacts to aquatic species and their associated habitat. It is speculated that the timing and magnitude of peak spill from Mystic Lake have been changed due to project operations and could result in impacts to aquatic species. This analysis should quantify changes to the natural hydrograph and if these changes result in detrimental effects to fish and other aquatic life within the bypass reach.

6) Explain how proposed study methods (including data collection and analysis techniques, study schedule and duration) is consistent with accepted scientific practices or considers, as appropriate, relevant Tribal values and knowledge.

Analysis of existing discharge data and use of hydrographs is a common practice used to evaluate potential effects of hydropower operations on streamflows and aquatic species.

7) Describe level of effort and anticipated cost and why alternative studies would not be sufficient to meet stated information needs.

The anticipated workload to complete the first objective is estimated at 3 days of existing information analysis (5 days @ \$900/day = \$4500)

The anticipated workload and cost estimates of the second objective of the study, if needed, would be further defined based on the results of the hydrograph analysis.

Mystic Project Study Request No. 9

Title of Proposed Study: Aerial Survey of Riparian Corridor

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Refer to criteria, #1 and #6, adapted from FERC Regulations 18 CFR 5.9 (b), as discussed below.

2) A schedule for conducting the study.

The study plan is scheduled for the 2005 summer field season. The schedule for submitting an initial study report, reviewing the study, and decisions to continue and/or amend the study plan is provided in the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com).

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Refer to the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com) that outlines the timeline for pre-filing milestones and the process for communications and information sharing.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

Not Applicable.

****Criteria adapted from FERC Regulations 18 CFR 5.9 (b) and 18 CFR 5.11(4)(d)****

1) Describe goals and objectives of proposed study and the information to be obtained.

There are questions regarding the condition and classification of the riparian community along West Rosebud Creek. The goal and objective of this proposed study would be to obtain the appropriate scale of aerial photos from upper Mystic Lake downstream to the bridge in T6SR17E Section 2, to characterize and develop a baseline of the current riparian condition and vegetation community.

At present, data are not available to evaluate or compare pre- and post-dam conditions, thus PPL Montana proposes to study existing riparian conditions and identify, from aerial photos and ground-truthing, any potential areas of concern that may need further investigation. After the 2005 field season and aerial photo survey, the need for a long-term monitoring and/or adaptive management plan would be determined.

2) If applicable, explain any relevant resource management goals for agencies or Tribes with jurisdiction over the resource to be studied.

Resource management goals of PPL Montana and resource agencies include a determination of whether the project is having any continuing or adverse effects on riparian corridor from Mystic Lake Dam downstream to the bridge located in T6SR17E Section 2.

U.S. Forest Service management goals for riparian resources are identified in the Custer N.F. Forest Plan under Chapter II Forest Wide Management Direction and Chapter III – Management Area Direction.

Forest Plan goals for riparian areas include: “manage for water quality, provide diverse vegetation, and protect key wildlife habitat in these areas from conflicting uses” and “uses and activities that adversely impact these areas will be mitigated” (page 3).

Forest Plan objectives for riparian areas include recognition of their unique values, and management direction is to be designed to protect these key wildlife habitats and improve water quality: “these areas will be managed in relation to various legally mandated requirements including, but not limited to, those associated with floodplains, wetlands, water quality, dredged and fill material, endangered species, and cultural resources” (page 5).

Goals for Management Area M (Riparian) are: “Manage to protect from conflicting uses in order to provide healthy, self-perpetuating plant and water communities that will have optimum diversity and density of understory and overstory vegetation” (page 80).

3) If applicant is not an agency, explain any relevant public interest in regard to the proposed study.

The public interest includes providing access for the use and enjoyment of public lands, waters, and other natural resources that are managed by public resource agencies. The public's interest also includes benefits from renewable energy produced by the Mystic Lake hydroelectric project.

4) Describe existing information on subject of proposed study and the need for additional information.

Healthy native riparian vegetation functions to maintain stream bank stability, promote filtering of runoff, provide shade for fish and other aquatic organisms, and provide habitat for terrestrial wildlife species. However, no known information exists describing the current condition of the riparian community or the effects that changes in flow regime (magnitude, duration and timing) have on the extent of riparian vegetation in the project area.



Figure 1. Study area outlined in red from the dam downstream to T6SR17E Section 2.

Aerial photos of Forest Service lands are available from the Forest Service for 1959, 1971, and 1998. NRCS also have aerial photos (1991 and more recent) of West Rosebud Creek drainage. PPL Montana will review available aerial photos from the Forest Service and NRCS to determine if the photos are at the appropriate scale to meet the objectives of the study. As an alternative approach, PPL Montana proposes to conduct an aerial (color

infrared) survey in 2005 using larger scale photos of the riparian corridor from upper Mystic Lake downstream to the bridge in T6SR17E Section 2 as outlined in red in the Figure 1. This aerial survey would also be utilized for Study Request No. 10 (Shoreline Erosion Inventory at Mystic Lake) and No. 11 (Sensitive Plant Survey in the Mystic Lake Hydroelectric Project Area).

5) Explain any connection between project operation and effects (direct, indirect or cumulative) on the resource to be studied and how study results will help identify potential project impacts and assist in development of License conditions.

The effects of project operations (1926-present) on riparian vegetation are currently unknown. According to Federal Power Act, the project impacts are based on existing conditions rather than pre-project conditions. Additionally, information (e.g. aerial photos or soil surveys) is not available to compare pre-project to current conditions of the riparian area or associated stream channel characteristics.

The proposed study to take aerial photos in 2005 would be the first step in developing a baseline and identifying reaches that may be of concern. Site-specific studies may be developed for areas of concern and require an adaptive management/long-term monitoring approach. The 2005 field study would be the first step in evaluating and determining any further action.

6) Explain how proposed study methods (including data collection and analysis techniques, study schedule and duration) is consistent with accepted scientific practices or considers, as appropriate, relevant Tribal values and knowledge.

The suggested methodology, aerial photography, has been developed and used by various Federal natural resource agencies. Numerous State agencies and private consultants have also used the methodology.

7) Describe level of effort and anticipated cost and why alternative studies would not be sufficient to meet stated information needs.

Task	Effort and Cost
Aerial Photography	To be determined
Data Analysis (based on aerial photos)	To be determined
Ground Truthing	To be determined

References:

Clemmer, P. 2001. *The use of aerial photography to manage riparian-wetland areas.*
Tech. Ref. 1737-10. U.S. Dept. of Interior, Bureau of Land Management. Denver,
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Mystic Project Study Request No. 10

Title of Proposed Study: Shoreline Erosion Inventory at Mystic Lake

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Refer to criteria, #1 and #6, adapted from FERC Regulations 18 CFR 5.9 (b), as discussed below.

2) A schedule for conducting the study.

The study plan is scheduled for the 2005 summer field season. The schedule for submitting an initial study report, reviewing the study, and decisions to continue and/or amend the study plan is provided in the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com).

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Refer to the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com) that outlines the timeline for pre-filing milestones and the process for communications and information sharing.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

Not Applicable.

****Criteria adapted from FERC Regulations 18 CFR 5.9 (b) and 18 CFR 5.11(4)(d)****

1) Describe goals and objectives of proposed study and the information to be obtained.

This study will inventory the extent of shoreline erosion around the perimeter of Mystic Lake at full pool elevation, 7673.5 ft during the summer field season of 2005. Any existing erosional areas will be located with GPS technology and measured to determine aerial extent. Potential impacts to surrounding vegetation from shoreline erosion will also be investigated. Based on the results from this preliminary study to determine the amount of shoreline erosion that is occurring and impacts to surrounding vegetation, a future study or long-term monitoring plan may be necessary to develop.

PPL Montana has offered their boating facilities to the Forest Service to help facilitate this preliminary review and documentation of shoreline erosion at Mystic Lake. Aerial photography of Mystic Lake shoreline will also be utilized as a tool to determine the extent and area of shoreline erosion. From the aerial survey, as described in study request No. 9, aerial photographs will be obtained and utilized to evaluate shoreline erosion in this study plan.

2) If applicable, explain any relevant resource management goals for agencies or Tribes with jurisdiction over the resource to be studied.

Resource management goals of PPL Montana and resource agencies include a determination of whether the Project is having any continuing or adverse effects to the shoreline or surrounding vegetation at Mystic Lake.

Management goals for soil, water and riparian resources are identified in the Custer N.F. Forest Plan under Chapter II Forest Wide Management Direction and Chapter III – Management Area Direction.

Forest Plan goals for riparian areas include: “manage for water quality, provide diverse vegetation, and protect key wildlife habitat in these areas from conflicting uses” and “uses and activities that adversely impact these areas will be mitigated” (page 3).

The Forest Plan goal for watershed management is to “ensure that soil productivity is maintained and that water quality is maintained at a level which meets or exceeds state water quality standards” (page 4).

Forest Wide Management Standards for wildlife and fisheries state: “e) Shorelines along reservoirs and lakes that support cold or warm water fisheries will be managed to encourage the establishment of bank vegetation, and maintenance [or] improvement of water quality” (page 19).

3) If applicant is not an agency, explain any relevant public interest in regard to the proposed study.

Under current license conditions, PPL Montana is required to keep Mystic Lake at full pool elevation, 7673.5 ft, during the summer season for the benefit of recreation. Additionally, the public's interest includes providing access for the use and enjoyment of public lands, waters, and other natural resources that are managed by public resource agencies. The public's interest also includes benefits from renewable energy produced by the Mystic Lake hydroelectric project.

4) Describe existing information on subject of proposed study and the need for additional information.

Questions have been raised regarding impacts of erosion to water quality in Mystic Lake or downstream. PPL Montana is currently and has in the past monitored the water quality of Mystic Lake and West Rosebud Creek. The data from 2003 and 2004 should be adequate to answer the water quality questions. At this time, the data do not indicate any water quality problems that would be linked to shoreline erosion (sediments, turbidity, etc.). Additionally, the data do not indicate any water quality issues exist in the Project area.

Shoreline erosion at full pool elevation, 7673.5 ft, has not been inventoried at Mystic Lake. The effects of project operations (1926-present) on the shoreline or surrounding vegetation are currently unknown. Additionally, information (e.g. aerial photos or soil surveys) is not available to compare pre-project to current conditions of Mystic Lake shoreline. According to Federal Power Act, the project impacts are based on existing conditions rather than pre-project conditions.

The proposed study to inventory the shoreline and obtain aerial photos in 2005 (at an appropriate scale) would be the first step in developing a baseline and identifying any areas of concern. On the ground shoreline surveys will also assist in determining the extent of which shoreline erosion may occur. Results from 2005 will assist in determining whether future plans of action such as a study, long-term monitoring, or mitigation measures are necessary.

5) Explain any connection between project operation and effects (direct, indirect or cumulative) on the resource to be studied and how study results will help identify potential project impacts and assist in development of License conditions.

In general, the presence of a dam and need to generate power creates higher full pool lake elevations and higher fluctuations in lake levels than under natural conditions. As drawdown occurs, unvegetated lakeshore areas are exposed to wind, rain, and waves that may result in localized areas of long-term soil exposure and erosion. The proposed shoreline inventory for 2005 will assist in determining the amount and degree of soil erosion around Mystic Lake and whether future actions are necessary.

6) Explain how proposed study methods (including data collection and analysis techniques, study schedule and duration) is consistent with accepted scientific practices or considers, as appropriate, relevant Tribal values and knowledge.

The suggested methodology is sufficient for a preliminary inventory of lake shoreline erosion.

7) Describe level of effort and anticipated cost and why alternative studies would not be sufficient to meet stated information needs.

Task	Effort and Cost
Aerial Photography	See Proposed Study Request No. 9
Field Survey	To be determined
Data Analysis (based on aerial photos and field survey data)	To be determined

Mystic Project Study Request No. 11

Title of Proposed Study: Sensitive Plant Survey in the Mystic Lake Hydroelectric Project Area

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Refer to criteria, #1 and #6, adapted from FERC Regulations 18 CFR 5.9 (b), as discussed below.

2) A schedule for conducting the study.

The study plan is scheduled for the 2005 summer field season. The schedule for submitting an initial study report, reviewing the study, and decisions to continue and/or amend the study plan is provided in the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com).

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Refer to the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com) that outlines the timeline for pre-filing milestones and the process for communications and information sharing.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

Not Applicable.

****Criteria adapted from FERC Regulations 18 CFR 5.9 (b) and 18 CFR 5.11(4)(d)****

1) Describe goals and objectives of proposed study and the information to be obtained.

The overall objective of this study is to identify whether any sensitive species exist in the project area. PPL Montana proposes a sensitive plant species survey from Mystic Lake Dam downstream to the Forest Service boundary in 2005. The study has two components: 1) to review the extent of the Jones (2001) survey that evaluated wetland habitat and vegetation species in the Stillwater drainage including West Rosebud Creek, and 2) to utilize larger scale aerial photos (based on those taken for study request No. 9 regarding riparian corridor) and further investigate whether any other riparian areas exist that may require on the ground field surveys in 2005 if not already described in Jones (2001). If other riparian areas are identified, on the ground surveys will be conducted during the flowering season of 2005.

2) If applicable, explain any relevant resource management goals for agencies or Tribes with jurisdiction over the resource to be studied.

Resource management goals of PPL Montana and resource agencies include a determination of whether the project is having any continuing or adverse effects on sensitive plant species within the project area.

The USDA Forest Service has specific policy direction regarding sensitive species, including:

- Develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions.
- Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands.
- Develop and implement management objectives for populations and/or habitat of sensitive species (USDA Forest Service Manual 2670.22).
- Assist States in achieving their goals for conservation of endemic species.
- As part of the National Environmental Policy Act process, review programs and activities, through a biological evaluation, to determine their potential effect on sensitive species.
- Avoid or minimize impacts to species whose viability has been identified as a concern.
- If impacts cannot be avoided, analyze the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole. (The line officer, with project approval authority, makes the decision to allow or disallow impact, but the decision must not result in loss of species viability or create significant trends toward Federal listing.)
- Establish management objectives in cooperation with the States when projects on

National Forest System lands may have a significant effect on sensitive species population numbers or distributions. Establish objectives for Federal candidate species, in cooperation with the FWS or NMFS and the States (USDA Forest Service Manual 2670.32).

3) If applicant is not an agency, explain any relevant public interest in regard to the proposed study.

The public interest includes providing access for the use and enjoyment of public lands, waters, and other natural resources that are managed by public resource agencies. The public's interest also includes benefits from renewable energy produced by the Mystic Lake hydroelectric project.

4) Describe existing information on subject of proposed study and the need for additional information.

At this time, no plant species are federally listed under the Endangered Species Act (ESA) within Stillwater or Carbon counties. In the Beartooth Ranger District, eight sensitive USDA Forest Service listed plant species are present (refer to PAD Table 3.6.1-1), however only four species are considered having any potential of being present within the Project area (see Table 1). None of the sensitive plant species have been documented thus far within the Project area; however, no systematic plant survey has been conducted for the entire Project area.

The elevation range from the Forest boundary upstream to Mystic Lake is approximately 5,850 to 7,600 ft. Emerald Lake is at an elevation 6,310 ft, West Rosebud Lake is at 6,387 ft, and the powerhouse is just over 6,500 ft. The four sensitive plant species, identified by the Forest Service as having the greatest potential to be present in the Project area include the false helliborin (elevation range = 2,900-6,200 ft), small yellow lady's slipper (elevation range = 2,520-6,200 ft), muskroot (elevation range = 4,400-6,000 ft), and hiker's gentian (elevation range = 4,460-8,400 ft).

Potential Sensitive Plants

Table 1. Species of rare plants that potentially occur within the project area, their suitable habitat, and the time of year when they can be identified are as follows:⁴

Common Name	Scientific Name	Type ⁵ *	Global Rank ⁶	State Rank ⁷	Elevation (ft)	Habitat	Closest known population	Potential of Occurrence	Flowering Period	Fruiting Period	Lifeform
False helliborine (Suspected)	<i>Epipactis gigantea</i>	3	G4	S2	2,900 – 6,200	Streambanks, fens with springs/seeps, often near thermal waters	Bluewater Fish Hatchery – approx. 70 air miles	Moderate	June – Early August	June – Early August	Perennial Forb
Small yellow lady’s slipper (Suspected)	<i>Cypripedium parviflorum</i>	3	G5	S2S3	2,520 – 6,200	Fens, damp mossy woods, seepage areas, and moist forest-meadow ecotones in valley to lower montane	Stillwater Co. (State)– approx. 30 air miles	High	May-June	July	Perennial Forb

⁵ Scale of risk, per Region 1 Species at Risk Protocol: Type 1: Threatened, Endangered or Proposed (ESA); Type 2: Range-wide Imperilment; Type 3: Regional/State Imperilment

⁶ The international network of Natural Heritage Programs employs a standardized ranking system to denote global (range-wide) and state status (Association for Biodiversity Information 2001). Species are assigned numeric ranks ranging from 1 (critically imperiled) to 5 (demonstrably secure), reflecting the relative degree to which they are “at-risk”. 1 = Critically imperiled because of extreme rarity and/or other factors making it highly vulnerable to extinction; 2 = Imperiled because of rarity and/or other factors demonstrably making it vulnerable to extinction; 3 = Vulnerable because of rarity or restricted range and/or other factors, even though it may be abundant at some of its locations; 4 = Apparently secure, though it may be quite rare in parts of its range, especially at the periphery; 5 = Demonstrably secure, though it may be quite rare in parts of its range, especially at the periphery; T = Rank for subspecific taxon (subspecies, variety, or population); appended to the global rank for the full species, e.g. G4T3

Common Name	Scientific Name	Type ⁵ *	Global Rank ⁶	State Rank ⁷	Elevation (ft)	Habitat	Closest known population	Potential of Occurrence	Flowering Period	Fruiting Period	Lifeform
Hiker's gentian (Known)	<i>Gentianopsis simplex</i>	3	G4	S1	4,460 – 8,400	Fens, meadows, and seeps, usually in areas of crystalline parent material, in the montane and subalpine zones	East Rosebud – approx. 30 air miles	High	July - August	July - August	Small Annual Forb
Musk-root (Known)	<i>Adoxa maschatellina</i> ⁸	3	G5	S2	4,400-6,000	Vernally moist places in the mountains at the bottom of undisturbed, open rock slides that have cold air drainage.	East Rosebud Creek and Spread Creek – approx. 30 air miles.	High	June-early July	Through July	Musky-scented Perennial Forb

⁸ *Adoxa maschatellina*, although not listed in the Region 1 1999 sensitive plant list, has been added due to new information that there are known populations of this regional sensitive species on the Beartooth District. Concurrence with this action made by Regional Botanist, December 2001.

With the exception of hiker's gentian, if the other three plant species listed in Table 1 are present in the Project area, they are most likely to be found downstream of the powerhouse based on their elevation ranges. In general, hiker's gentian is likely to be found in "moist meadows at elevations 7-8,000 ft, blooming from mid-July through August" (www.larkspurbooks.com/Gentian1.html). The habitat described for hiker's gentian is most likely not present at the higher elevations of West Rosebud Creek drainage.

Based on vegetation data provided by the Forest Service, vegetation surrounding the creek from the powerhouse upstream to the dam is comprised of forest land (subalpine fir/spruce, ponderosa pine, whitebark pine, lodgepole pine, limber pine) and rock/barren areas (GIS data received from B. Pitman, Beartooth Ranger District, *Source: Land and Vegetation Cover Classes from Anderson 1976*). This vegetation does not include moist meadows necessary for Hiker's gentian at the higher elevation.

The riparian corridor along West Rosebud Lake from Mystic Lake downstream to the Forest Service boundary is minimal as a result of geomorphic characteristics of this portion of the drainage with a confined and incised channel, steep slopes, granitic parent material, and numerous bedrock outcrops (see Photo 1).

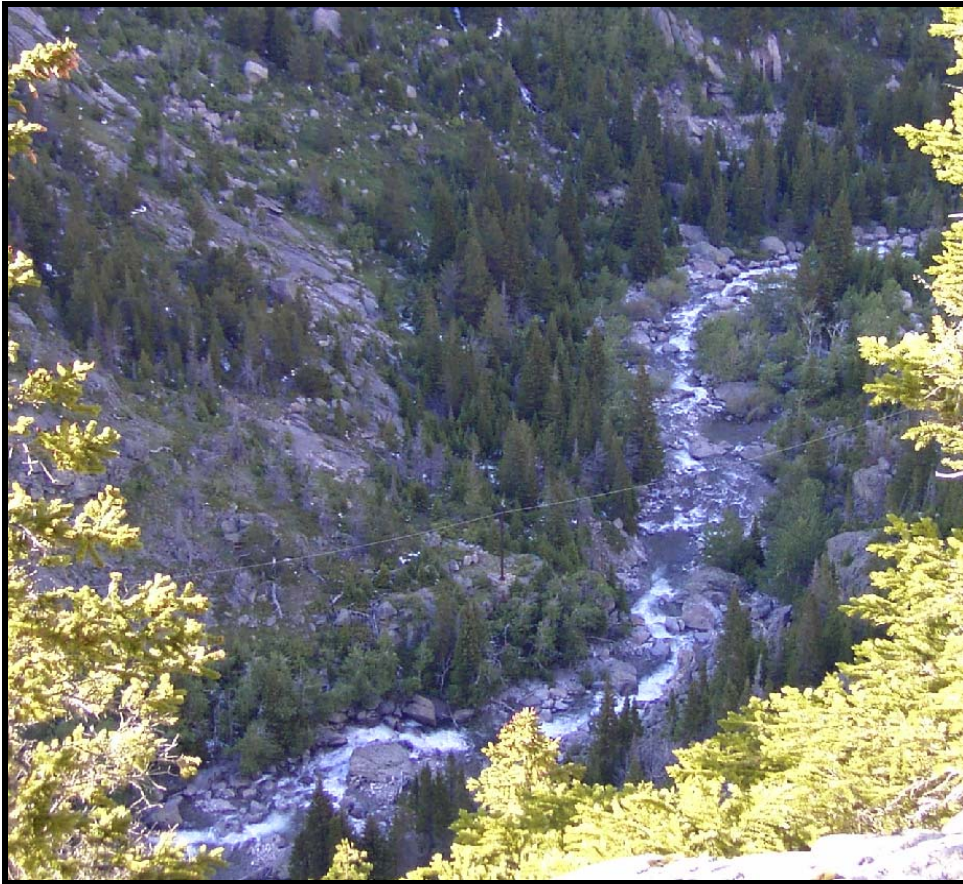


Photo 1. Photograph of the upper reach of West Rosebud Creek bypass channel.

Jones (2001) surveyed three wetland areas in or near the project area and found no sensitive plant species. Jones (2001) defined wetlands as areas with hydrophytic vegetation, hydric soils, and/or hydrology. This report will be reviewed to determine to what extent the West Rosebud Creek was evaluated prior to delineating the three wetland sites. The areas Jones (2001) surveyed in 1999 and 2000 would not be re-surveyed.

Aerial photos available from the Forest Service taken in 1959, 1971, and 1998 will be evaluated to determine if the appropriate scale and resolution can be obtained to identify additional riparian areas that may be potential habitat for sensitive plants. Other available aerial photos available from the NRCS (office in Columbus, MT) may provide the appropriate scale, but have not been reviewed as of this time. As an alternative, PPL Montana will take new aerial photos in 2005 if necessary to meet study objectives. These aerial photos taken by PPL Montana will also be utilized for Study Request No. 9 (Aerial Survey of Riparian Corridor) and No. 10 (Shoreline Erosion Inventory at Mystic Lake).

5) Explain any connection between project operation and effects (direct, indirect, and/or cumulative) on the resource to be studied and how study results will help identify potential project impacts and assist in development of License conditions.

This study will assist in identifying whether sensitive plants are present in the project area. If a sensitive plants species is (or are) present, the study may identify whether the project has any effect (direct, indirect, or cumulative).

6) Explain how proposed study methods (including data collection and analysis techniques, study schedule and duration) is consistent with accepted scientific practices or considers, as appropriate, relevant Tribal values and knowledge.

Utilizing aerial photos to identify riparian vegetation and potential areas for on-the-ground surveys is common and cost-effective practice for many federal agencies.

7) Describe level of effort and anticipated cost and why alternative studies would not be sufficient to meet stated information needs.

Task	Level of Effort and Anticipated Cost
Review Extent of Study Area in Jones (2001)	Minimal effort and cost to review report.
Aerial Photos	See comments in Aerial Survey of Riparian Corridor, Proposed Study Request No. 9
Review of Photos-Identify Riparian Areas not Already Surveyed	Minimal effort and cost to review photos and identify areas that may need on the ground surveying.

Task	Level of Effort and Anticipated Cost
Potential on the ground Field Surveys	Level of effort would vary depending on the number of areas, if any, to survey. Anticipate having a crew with at least one botanist and technician to conduct on the ground work. Level of effort and cost to be determined.

Reference:

Jones, W.M. 2001. Ecologically significant wetlands in the Upper Yellowstone River Watershed including the Boulder, Clarks Fork Yellowstone Shield, and Stillwater Drainages. Report to the Montana Department of Environmental Quality. Montana Natural Heritage Program, Helena, Montana. 37 pp. plus appendices. (Available: http://nhp.nris.state.mt.us/plants/reports/upper_yellow_sum.pdf)

Mystic Project Study Request No. 12

Title of Proposed Study: Flow Restoration Action Plan for Flow-line or Penstock Shutoff

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Refer to criteria, #1 and #6, adapted from FERC Regulations 18 CFR 5.9 (b), as discussed below.

2) A schedule for conducting the study.

The study plan is scheduled for the 2005 summer field season. The schedule for submitting an initial study report, reviewing the study, and decisions to continue and/or amend the study plan is provided in the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com).

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Refer to the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com) that outlines the timeline for pre-filing milestones and the process for communications and information sharing.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

Not Applicable.

****Criteria adapted from FERC Regulations 18 CFR 5.9 (b) and 18 CFR 5.11(4)(d)****

1) Describe goals and objectives of proposed study and the information to be obtained.

Provide restoration/maintenance of flows to West Rosebud Creek when the flow line and/or penstock are not conveying water (due to plant shut down and/or failure of pipe or pipe components) **and** sufficient spills are not occurring at the Mystic Lake dam to meet instream flow requirements. Determine the feasibility of providing improved remote flow line sensing and a valve of sufficient capacity (with flow line block just downstream) for river flow restoration in the event of a flow line rupture at any time and in particular when lake is lower than crest and spill is not possible.

2) If applicable, explain any relevant resource management goals for agencies or Tribes with jurisdiction over the resource to be studied.

Management goals for riparian areas are identified in the Custer N.F. Forest Plan under Chapter II Forest Wide Management Direction and Chapter III – Management Area Direction.

Forest Plan goals for riparian areas include: “manage for water quality, provide diverse vegetation, and protect key wildlife habitat in these areas from conflicting uses” and “uses and activities that adversely impact these areas will be mitigated” (page 3).

The Forest Plan goal for watershed management is to ensure that soil productivity is maintained and that water quality is maintained at a level that meets or exceeds state water quality standards (page 4).

The Forest Plan objective for soil and water resources is: Continue to produce water that meets State water quality standards. National Forest System lands will be managed so that the soil and watershed conditions are in a desirable condition and will remain in that condition for the foreseeable future. Soil and water quality objectives are designed to assure that these resources meet State water quality objectives and BMPs (Best Management Practices) are incorporated to assure this (page 5).

Forest Plan objectives for riparian areas include recognition of their unique values, and management direction is to be designed to protect these key wildlife habitats and improve water quality: “these areas will be managed in relation to various legally mandated requirements including, but not limited to, those associated with floodplains, wetlands, water quality, dredged and fill material, endangered species, and cultural resources” (page 5).

Forest Wide Management Standards for wildlife and fisheries state: h) Management activities, including prescribed fire, will be conducted to maintain or enhance the unique value associated within woody draws and riparian zones, as well as a variety of

successional vegetative stages (page 18), e) Shorelines along reservoirs and lakes that support cold or warm water fisheries will be managed to encourage the establishment of bank vegetation, and maintenance [or] improvement of water quality (page 19).

Goals for Management Area M (Riparian) are: Manage to protect from conflicting uses in order to provide healthy, self-perpetuating plant and water communities that will have optimum diversity and density of understory and overstory vegetation (page 80).

3) If applicant is not an agency, explain any relevant public interest in regard to the proposed study.

The public interest includes providing access for the use and enjoyment of public lands, waters, and other natural resources that are managed by public resource agencies. The public's interest also includes benefits from renewable energy produced by the Mystic Lake hydroelectric project.

4) Describe existing information on subject of proposed study and the need for additional information.

No mechanism exists to provide restoration of flows to West Rosebud Creek in the event that the flow line and/or penstock are not conveying water through the power plant and back to the stream. This situation is most critical when either: spills are not occurring at the dam, or insufficient spills are occurring to meet instream flow license requirements. It is uncertain whether this issue has been analyzed in the past or addressed by the current license.

5) Explain any connection between project operation and effects (direct, indirect or cumulative) on the resource to be studied and how study results will help identify potential project impacts and assist in development of License conditions.

In addition to possible violation of instream flow requirements in the FERC license both for the bypass reach and the reach below the re-regulating reservoir (West Rosebud Lake), this situation could result in potential detrimental effects to fish and other aquatic life within and downstream of the project boundary.

6) Explain how proposed study methods (including data collection and analysis techniques, study schedule and duration) is consistent with accepted scientific practices or considers, as appropriate, relevant Tribal values and knowledge.

The proposed study will be conducted using standard engineering practices and analyses. Several key criteria have been identified by GEI Consultants and PPL Montana. The USDA Forest Service agrees that these criteria must be considered inherent in the design of any solution:

- The system must be able to stop the flow even in the event of loss of telemetry with the powerhouse and under loss of electrical power using self contained emergency power supplies and programming.
- After a penstock breach, the calculated flows through the rock tunnel can approach 900 cfs at velocities in excess of 40 ft/sec. under full head (conditions far in excess of normal operating conditions). This requires powerful drive mechanisms and strong valve systems and support structures to allow reliable closure under runaway flow conditions.
- Provisions must be designed to allow adequate and automatic venting of the downstream flow line during valve closure.
- Provisions must be included to allow controlled manual pre-filling (to purge air from the flow line and penstock) of the flow line prior to re-opening the shutoff valve.
- Adequate armoring of the valve house and the incorporation of a flow line shear joint is necessary to improve survivability during landslides and earthquakes. Appropriately sized concrete thrust blocks may also need to be installed to resist the potentially large forces that develop when closing the valve under runaway flow conditions.
- Adequate flow sensing and instrumentation, appropriate logic for reacting to power and signal loss, and other hardware and software needs are required to enable the system to react appropriately and correctly to various emergencies.
- Properly locating a flow bypass “fish” valve is important so that it will continue to reliably operate after a flow line valve closure. The valve must be capable of releasing adequate minimum bypass and below project reach flows (at least 25 cfs) at minimum lake elevation.

GEI is performing a preliminary evaluation of several alternatives that include the use of a rotary cone valve that is designed to close against high head, high velocity flows, with high reliability and minimal cavitation. Such a valve can function as an automated regulating valve system for the flow line during normal operation, is of a configuration that allows accurate computation of the flow throughput for flow monitoring purposes, and would impose low head losses during normal operation. Other configurations are possible and are being evaluated as well.

7) Describe level of effort and anticipated cost and why alternative studies would not be sufficient to meet stated information needs.

GEI is currently investigating this issue in detail and believes it is feasible. They have briefly considered appropriate designs to respond to this complex issue and are have obtained preliminary cost estimates and preliminary design specifications to reply to this need. They are unaware of any alternative studies that have been prepared to address this issue. GEI estimates the constructed cost of this installation at about \$600,000.

Mystic Project Study Request No. 13

Title of Proposed Study: Mystic Hydroelectric Project Whitewater Flow Study

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Refer to criteria, #1 and #6, adapted from FERC Regulations 18 CFR 5.9 (b), as discussed below.

2) A schedule for conducting the study.

The study plan is scheduled for the 2005 summer field season. The schedule for submitting an initial study report, reviewing the study, and decisions to continue and/or amend the study plan is provided in the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com).

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Refer to the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com) that outlines the timeline for pre-filing milestones and the process for communications and information sharing.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

Not Applicable.

****Criteria adapted from FERC Regulations 18 CFR 5.9 (b) and 18 CFR 5.11(4)(d)****

1) Describe goals and objectives of proposed study and the information to be obtained.

The whitewater flow study will identify minimum and optimum flows for whitewater boating on West Rosebud Creek below the PPL Montana re-regulation dam at West Rosebud Lake. Other information will include boaters' perceptions of whitewater conditions and experiences, type of watercraft, put-in and take-out locations, etc.

2) If applicable, explain any relevant resource management goals for agencies or Tribes with jurisdiction over the resource to be studied.

The creek reach of interest begins on Forest Service lands and continues through privately owned lands. The Forest Service portion is managed under the Forest Plan to provide a "spectrum of opportunities and settings in and around developed sites and the access corridors to the sites in the categories of Semiprimitive Nonmotorized/Motorized, Routed Natural Appearing and Rural."

3) If applicant is not an agency, explain any relevant public interest in regard to the proposed study.

Although a relatively small recreation use, whitewater boating of West Rosebud Creek occurs below Emerald Lake during favorable flow conditions. Whitewater use occurs primarily in late June and July, when flows elsewhere are diminishing. The run is becoming increasingly popular among boaters and is listed in several whitewater resource guides.

4) Describe existing information on subject of proposed study and the need for additional information.

No formal studies were conducted prior to 2004 that focused on whitewater boating of West Rosebud Creek. The amount of whitewater use and its flow requirements are currently unknown but important because of the activity's dependence on the hydro project's water releases.

5) Explain any connection between project operation and effects (direct, indirect or cumulative) on the resource to be studied and how study results will help identify potential project impacts and assist in development of License conditions.

Naturally occurring flows in West Rosebud Creek have been altered by operation of the project. Generally, the timing of peak flow has been delayed until Mystic Lake has been filled after its winter drawdown. In other words, some spring-runoff is captured within the limited storage capacity at the lake and released later in the recreation season.

6) Explain how proposed study methods (including data collection and analysis techniques, study schedule and duration) is consistent with accepted scientific practices or considers, as appropriate, relevant Tribal values and knowledge.

The study methodology was designed by PPL Montana in cooperation with American Whitewater and the Beartooth Paddlers. After each trip on the West Rosebud, boaters are asked to complete an Internet-based questionnaire about their float. Information is gathered about the timing, watercraft, access points, perceptions of flow conditions, preferred flows, and other factors. Data will be correlated to measured creek flows and flow preference curves will be developed. The study began in June 2004 and will continue through 2005.

7) Describe level of effort and anticipated cost and why alternative studies would not be sufficient to meet stated information needs.

The cost and effort required for the study is relatively modest. The methods have already been developed and implemented and study administration is streamlined because of use of the Internet. The study is proposed to be continued during 2005 to allow boaters to experience a wider range of flows, which will help better define the lower and upper preference limits.

Mystic Project Study Request No. 14

Title of Proposed Study: Mystic Hydroelectric Project Recreation Use Counts

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Refer to criteria, #1 and #6, adapted from FERC Regulations 18 CFR 5.9 (b), as discussed below.

2) A schedule for conducting the study.

The study plan is scheduled for the 2005 summer field season. The schedule for submitting an initial study report, reviewing the study, and decisions to continue and/or amend the study plan is provided in the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com).

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Refer to the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com) that outlines the timeline for pre-filing milestones and the process for communications and information sharing.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

Not Applicable.

****Criteria adapted from FERC Regulations 18 CFR 5.9 (b) and 18 CFR 5.11(4)(d)****

1) Describe goals and objectives of proposed study and the information to be obtained.

Understanding the magnitude of recreation use of Forest Service Lands associated with the hydroelectric project is important for resource management. Although PPL Montana and Forest Service studies have provided information about the qualities of use (recreation activities, trip duration, visitor preferences, etc.) the amount of use has not been systematically documented or quantified. Vehicle use counts on West Rosebud Road and trail use counts on the Mystic Lake Trail will quantify recreation use and track changes over time. Employing multiple counters will also provide information about visitor penetration into the corridor and relative use of lands associated with the hydro-project.

2) If applicable, explain any relevant resource management goals for agencies or Tribes with jurisdiction over the resource to be studied.

The Forest Service manages all lands associated with the study. Lands along West Rosebud Road and much of the Mystic Lake Trail are managed under the Forest Plan to provide a “spectrum of opportunities and settings in and around developed sites and the access corridors to the sites in the categories of Semiprimitive Nonmotorized/Motorized, Roaded Natural Appearing and Rural.” Some portions of the Mystic Lake Trail enter the Absaroka-Beartooth Wilderness, which is managed to retain wilderness characteristics. Management Area H surrounding Mystic Lake is managed to retain the wilderness characteristics of the area until a congressional decision is made regarding future wilderness classification.

3) If applicant is not an agency, explain any relevant public interest in regard to the proposed study.

Recreation is popular on Forest Service lands associated with the hydroelectric project. The West Rosebud Road corridor provides vehicular access to developed campgrounds, day use areas and the Mystic Lake Trail. The trail provides backcountry access to day hikers and backpackers and is a major portal to the Absaroka-Beartooth Wilderness.

4) Describe existing information on subject of proposed study and the need for additional information.

A 2001 study conducted by PPL Montana provides baseline information about recreation use within the West Rosebud corridor. While it provides information on the proportions of various visitor characteristics (i.e. - campers, anglers, state residents, etc.) it did not measure the amount of recreation use. The Forest Service tracks use of its developed campgrounds at Pine Grove and Emerald Lake, but doesn't document visitor use of the

West Rosebud Lake day use areas or the Mystic Lake Trail beyond casual observation of the associated parking areas.

5) Explain any connection between project operation and effects (direct, indirect or cumulative) on the resource to be studied and how study results will help identify potential project impacts and assist in development of License conditions.

Although it is difficult to estimate what effects, if any, hydroelectric project facilities and operations have on recreation use, the lands occupied by the project have significant recreational value. Understanding the proportion of use that occurs on lands occupied by the project will assist PPL Montana and the Forest Service in defining respective roles and responsibilities for managing the recreation resource.

6) Explain how proposed study methods (including data collection and analysis techniques, study schedule and duration) is consistent with accepted scientific practices or considers, as appropriate, relevant Tribal values and knowledge.

The study will employ two vehicle counters on West Rosebud Road, one placed at the beginning of Forest Service lands immediately below Pine Grove Campground and the other placed near PPL Montana's re-regulation dam on West Rosebud Lake. The counters will be buried at the edge of the roadbed and will provide information about vehicles entering the West Rosebud corridor and vehicles accessing West Rosebud Lake and the Mystic Lake Trailhead. The number of recreationists that this represents could be estimated (if necessary) by making assumptions about the average number of recreationists per vehicle. For the purposes of understanding the amount of demand and tracking changes over time however, simple vehicle counts should be sufficient as a proxy.

The study will use four trail counters to track the number of recreationists using the trail to Mystic Lake and trails to backcountry destinations above Mystic Lake. Trail counters will be placed at: (1) lower Mystic Lake Trail, (2) trail from the lake toward the Froze to Death Plateau, (3) trail from the lake up Huckleberry Creek, and (4) trail extending beyond the west end of Mystic Lake. The combination of counters will determine how much trail use is associated with Mystic Lake as a destination versus destinations beyond the lake.

PPL Montana placed counters in August 2004 to test equipment and locations. Full season counts are planned for the 2005 use season. It is envisioned that these counts may be a long-term (e.g. every 5 years) recreation monitoring activity.

7) Describe level of effort and anticipated cost and why alternative studies would not be sufficient to meet stated information needs.

The cost and effort required for the study is relatively modest. Study administration will involve seasonal counter placement on a schedule determined in consultation with the

Forest Service, equipment maintenance and data download and analysis. When combined with information from periodic visitor surveys, recreation use within the corridor will be comprehensively monitored.

Mystic Project Study Request No. 15

Title of Proposed Study: Mystic Hydroelectric Project Water Quality Studies

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Refer to criteria, #1 and #6, adapted from FERC Regulations 18 CFR 5.9 (b), as discussed below.

2) A schedule for conducting the study.

The study plan is scheduled for the 2005 summer field season. The schedule for submitting an initial study report, reviewing the study, and decisions to continue and/or amend the study plan is provided in the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com).

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Refer to the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com) that outlines the timeline for pre-filing milestones and the process for communications and information sharing.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

Not Applicable.

****Criteria adapted from FERC Regulations 18 CFR 5.9 (b) and 18 CFR 5.11(4)(d)****

1) Describe goals and objectives of proposed study and the information to be obtained.

The Mystic Project interagency fisheries, aquatic habitats, and water quality resource work group identified a number of questions with regard to water quality in the Mystic Lake project area. PPL Montana is gathering data on water quality in 2004 and that data may be sufficient to answer the questions that have been raised. However, in the event that water quality questions still remain after the 2004 data are analyzed, PPL Montana is filing this study plan as a placeholder to allow for continued water quality studies on an as-needed basis.

Questions that are currently being analyzed include: Is spill over Mystic Dam/through Powerhouse/over West Rosebud Lake Dam creating high Total Dissolved Gas (TDG)? Is Mystic Lake winter drawdown generating sediment? Are there sediment problems below West Rosebud Lake? Is PCB in sediments/fish of West Rosebud and Emerald Lakes? Is Whirling Disease a potential threat (presence of Tubifex worms) in West Rosebud Creek. What is status of insect community? What is the nature of the water quality parameters in the three lakes in the project area? Are metal concentrations above MT standards with respect to hardness? Are metals coming from flowline?

2) If applicable, explain any relevant resource management goals for agencies or Tribes with jurisdiction over the resource to be studied.

Resource management goals of PPL Montana and resource agencies include a determination of whether the project is having any continuing or adverse affects on the water resources within the project area.

3) If applicant is not an agency, explain any relevant public interest in regard to the proposed study.

The public interest includes providing access for the use and enjoyment of public lands, waters, and other natural resources that are managed by public resource agencies. The public's interest also includes benefits from renewable energy produced by the Mystic Lake hydroelectric project.

4) Describe existing information on subject of proposed study and the need for additional information.

Studies are currently ongoing to address water quality questions. The results of these studies will not be available until later this fall. At that time, we will present the results to the agencies and discuss the need to conduct further studies.

5) Explain any connection between project operation and effects (direct, indirect or cumulative) on the resource to be studied and how study results will help identify potential project impacts and assist in development of License conditions.

Project operation has a direct effect on the timing and volume of water flow and the volume of lakes in the project area. However, at this time, it is uncertain whether or not the project has an impact on water quality in the project area. The ongoing studies will help to determine if project impacts to water quality occur.

6) Explain how proposed study methods (including data collection and analysis techniques, study schedule and duration) is consistent with accepted scientific practices or considers, as appropriate, relevant Tribal values and knowledge.

1. Total Dissolved Gases

Objective: Is spill over Mystic Dam/through Powerhouse/over WRL Dam creating high TDG?

Method: Hydrolab with TDG Sensor, Cal/Clean interval 3-4 weeks, hourly logging

Sites: Above Powerhouse
Below Powerhouse
West Rosebud Lake

Term: June 10 – Aug 1 (spill season)

Report: November 1, 2004

2. Turbidity

Objective: Is Mystic Lake winter drawdown generating sediment? Are there sediment problems below West Rosebud Lake?

Method: Hydrolab with Turbidity Sensor, Cal/Clean interval 3-4 weeks, hourly logging

Sites: Below Powerhouse
West Rosebud Lake

Term: April 5 - May 4 (Lake drawdown), June 25 - July 27 (Runoff)

Report: November 1, 2004

3. PCB's

Issue: Is PCB in sediments/fish of West Rosebud and Emerald Lakes?

Method: Sediment Cores and Fish (large brown trout) analysis/Energy Labs

Sites: West Rosebud Lake
Emerald Lake

Term: One time in August or earlier

Lab Report: November 15, 2004

4. Temperature

Issue: Does the Mystic Project affect temperature in West Rosebud Creek?

Method: Hobo water temperature loggers, hourly. More information can be found about the temperature monitoring study in Study request No 7, Water Temperature Monitoring.

Sites: Mystic Lake Intake (in about June 21)
Bypass above Powerhouse
WRC Below PH
WRC Below West Rosebud Lake Dam
WRC Below Emerald Lake Outlet
West Rosebud Creek Allen Grade Bridge
West Rosebud Creek Above East Rosebud Creek
East Rosebud Creek Above West Rosebud Creek
Also: Fall and winter monitoring in West Rosebud Creek, upper reach of the bypass

Term: May 4 – Sept 15

Report: November 15, 2004

5. Tubifex/Insects

Issue: Is Whirling Disease in WRC. What is status of insect community?

Method: Hess sampler/McGuire ID

Sites: West Rosebud Creek Above West Rosebud Lake
West Rosebud Creek Below Emerald Lake
West Rosebud Creek at campground

West Rosebud Creek downstream

Term: One time in August

Report: January 2005

6. Resource Description

Issue: Resource Description

Method: Standard methods

Parameters: Zooplankton vertical tow (EcoAnalysts)
Phytoplankton vertical tow
Chl *a* (Energy Labs)
Hydrolab Profile
Secchi Depth
Nutrients
Metals (total recoverable, low level)
Common ions
Hardness
Bacteria

Sites: Mystic Lake
West Rosebud Lake
Emerald Lake

Term: One time in August

Report: March 2005

7. Metals

Issue: Are metal concentrations above MT standards with respect to hardness?
Are metals coming from flowline?

Method: Low Level Field and Lab Methods, non-contaminating Van Dorn, acid washed containers, Total Recoverable lab analyses

Parameters: Arsenic
Cadmium
Copper
Iron
Zinc
Hardness

Anions
Cations
Hydrolab

Sites: Mystic Lake
West Rosebud Creek Above Powerhouse
Powerhouse Discharge
West Rosebud Creek Mixed Channel Below Powerhouse

Term: 2X rising limb, 1X falling limb, 1X stable, (approx. 6/21, 7/10, 8/10, 9/15)

Report: December 30, 2004

7) Describe level of effort and anticipated cost and why alternative studies would not be sufficient to meet stated information needs.

Data collection will require approximately 20 days in the field for at least one - two persons each day. Additional data analysis and lab time will be required.

Mystic Study Request No. 16

Title of Proposed Study: Biological Assessment of Federally Listed Species

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Refer to criteria, #1 and #6, adapted from FERC Regulations 18 CFR 5.9 (b), as discussed below.

2) A schedule for conducting the study.

The study plan is scheduled for the 2005 summer field season. The schedule for submitting an initial study report, reviewing the study, and decisions to continue and/or amend the study plan is provided in the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com).

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Refer to the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com) that outlines the timeline for pre-filing milestones and the process for communications and information sharing.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

Not Applicable.

Criteria adapted from FERC Regulations 18 CFR 5.9 (b) and 18 CFR 5.11(4)(d)

1) Describe goals and objectives of proposed study and the information to be obtained.

The U. S. Fish and Wildlife Service identified questions with regard to federally listed species that may be present in the Mystic Lake Project area. These species include the threatened bald eagle (*Haliaeetus leucocephalus*), threatened grizzly bear (*Ursus arctos*), threatened Canada lynx (*Lynx canadensis*), and experimental nonessential gray wolf (*Canis lupus*). A biological assessment will be developed to address these species per request of the U.S. Fish and Wildlife Service.

PPL Montana has summarized available wildlife data regarding federally listed species, provided by the U.S. Forest Service, in the Mystic Lake Hydroelectric Project FERC No. 2301 Pre-Application Document (PAD) submitted July 1, 2004. Information provided in the PAD may be sufficient to answer the wildlife questions. However, in the event that wildlife and terrestrial questions still remain, PPL Montana is filing this study plan as a placeholder to allow for additional data gathering needs for developing a biological assessment.

Additional wildlife concerns were expressed with regard to potential electrocution and collision hazards from existing power lines in the Mystic Lake Project area. Existing information is available in the Mystic Lake Hydroelectric Project FERC No. 2301 Pre-application Document (PAD) describing proposed protection, mitigation, or enhancement (PMEs) measures to improve conditions to meet raptor safe standards in the project area.

The U.S. Fish and Wildlife Service also inquired whether fish passage is warranted at this time. No passage is warranted at Mystic Lake Dam because of the natural fish passage barriers that exist downstream of Mystic Lake in the bypass reach. Fish passage at the re-regulation dam on West Rosebud Lake would be contrary to MFWP fish management plan.

The Custer Forest Management Plan addresses the remaining questions from the U.S. Fish and Wildlife Service specific to managing bears and the presence and/or increase in bear attractants in the area as well as other recreational impacts to wildlife species as a result of human activity.

2) If applicable, explain any relevant resource management goals for agencies or Tribes with jurisdiction over the resource to be studied.

Resource management goals of PPL Montana and resource agencies include a determination of whether the project is having any continuing or adverse effects on federally listed species within the project area.

Resource management goals of PPL Montana and resource agencies include a determination of whether the project is having any continuing or adverse affects on raptor species as a result of electrocution/collision hazards with existing powerlines within the project area.

The Custer National Forest Management Plan addresses management goals for threatened and endangered animal species in Appendix VII.

3) If applicant is not an agency, explain any relevant public interest in regard to the proposed study.

The public interest includes providing access for the use and enjoyment of public lands, waters, and other natural resources that are managed by public resource agencies. The public's interest also includes benefits from renewable energy produced by the Mystic Lake Hydroelectric Project.

4) Describe existing information on subject of proposed study and the need for additional information.

Federally listed species are discussed in the PAD (section 3.6). Information currently summarized in the PAD or additional, more detailed information needed for the biological assessment include the following:

- 1) a description of the specific area that may be affected by the action;
- 2) the current status, habitat use, and behavior of threatened or nonessential experimental species in the project area;
- 3) discussion of the methods used to determine the information in the Item 3;
- 4) analysis of the affects of the action on listed species and proposed species and their habitats, including an analysis of any cumulative effects;
- 5) coordination/mitigation measures that will reduce eliminate adverse impacts to threatened or nonessential experimental species;
- 6) the expected status of threatened or nonessential experimental species in the future (short and long term) during and after project completion;
- 7) a determination of "may affect, likely to adversely affect" or "may affect, not likely to adversely affect" for listed species";
- 8) a determination of "is likely to jeopardize" or "is not likely to jeopardize" for proposed species;
- 9) citation of literature and personal contacts used in developing assessment.

PME measures being proposed by PPL to meet raptor safe standards in the Project area are addressed in the PAD, section 4.4:

Over the next couple years, PPL Montana, in consultation with the Forest Service, plans to upgrade transmission line A for reliability and to raptor-safe standards. Transmission line B runs parallel to line A and is not currently scheduled for upgrade. No portions of line B are currently

known or suspected to be raptor high use areas and this line is in good condition. Thus, the need for an early upgrade of line B is not proposed.

Project distribution lines were evaluated by PPL Montana and Forest Service in May 2004. The distribution line from the powerhouse upstream to Mystic Lake is mostly below treetop level and thus is expected to have minimal collision or electrocution hazard potential to avian wildlife. The configuration of the powerline from the powerhouse to the surge tower has the potential to electrocute raptors attempting to perch on the crossarms. Potential PM&E measures include installation of perch guards or artificial perches. The possibility for raptor collisions with this line also exists and could be resolved by adding visual markers to increase line visibility.

Corner configuration power poles and poles containing transformers or uninsulated jumper wires provide potential electrocution hazards to raptors attempting to perch on them. Four such poles were identified in the housing and powerhouse area. Potential PM&E measures include installation of artificial perches or replacement of uninsulated jumper wires with insulated wires.

5) Explain any connection between project operation and effects (direct, indirect or cumulative) on the resource to be studied and how study results will help identify potential project impacts and assist in development of License conditions.

At this time, there are no known or documented effects (direct, indirect, or cumulative) between the project operation and wildlife species. Available data, as presented in the PAD, describing federally listed species will provide information to assess the potential presence of species and available habitat as well as the potential of the project operation to have any adverse effect (direct, indirect, or cumulative) on the habitat or to the species.

Existing information on transmission and distribution lines within the project area and potential raptor hazards have already been presented in the PAD, section 3.4 and 4.4, under proposed PME measures.

6) Explain how proposed study methods (including data collection and analysis techniques, study schedule and duration) is consistent with accepted scientific practices or considers, as appropriate, relevant Tribal values and knowledge.

PPL will utilize existing data provided by federal agencies, which have developed accepted and appropriate scientific methodology to survey presence of species and habitat availability for federally listed species.

Raptor safe standards are developed from accepted guidelines described by Avian Power Line Interaction Committee (ALIC 1994).

7) Describe level of effort and anticipated cost and why alternative studies would not be sufficient to meet stated information needs.

At this time a review of existing information as presented in the PAD should be sufficient to address information needs. Alternative sources of information would be from the agencies that have conducted surveys within the Project area. The level of effort and anticipated costs will be determined at a later date.

References:

- Interagency Conservation Strategy Team. 2003. Conservation strategy for the grizzly bear in the Yellowstone Ecosystem. March 2003 Final 87 p.
- Schwartz, C.C., M.A. Haroldson, K.A. Gunther, and D. Moody. 2002. Distribution of grizzly bears in the Greater Yellowstone Ecosystem, 1990-2000. *Ursus*: 13:203-212.
- Avian Power Line Interaction Committee (APLIC). 1994. Mitigating bird collisions with power lines: The state of the art in 1994. Edison Electric Institute. Washington, D.C.
- Montana Bald Eagle Working Group. 1994. Montana bald eagle management plan. USDI, Bureau of Land Management, Billings, MT. 104 pp.
- Miller, A.D., E.L. Boeker, R.S. Thorsell, and R.R. Olendorff. 1975. Suggested practices for raptor protection on power lines. Edison Electric Institute, Washington, D.C. and Raptor Research Foundation, Provo, Utah, 21 pp.

Mystic Study Request No. 17

Title of Proposed Study: Biological Evaluation for Forest Service Sensitive Species

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Refer to criteria, #1 and #6, adapted from FERC Regulations 18 CFR 5.9 (b), as discussed below.

2) A schedule for conducting the study.

The study plan is scheduled for the 2005 summer field season. The schedule for submitting an initial study report, reviewing the study, and decisions to continue and/or amend the study plan is provided in the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com).

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Refer to the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com) that outlines the timeline for pre-filing milestones and the process for communications and information sharing.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

Not Applicable.

Criteria adapted from FERC Regulations 18 CFR 5.9 (b) and 18 CFR 5.11(4)(d)

1) Describe goals and objectives of proposed study and the information to be obtained.

A biological evaluation will be developed to address potential impacts to endangered, threatened, proposed, or sensitive species (Forest Service Manual 2672.4) per request of the U.S. Forest Service.

PPL Montana has summarized available wildlife data regarding federally listed species, provided by the U.S. Forest Service, in the Mystic Lake Hydroelectric Project FERC No. 2301 Pre-Application Document (PAD) submitted July 1, 2004. To complete the biological evaluation, PPL Montana with the assistance from the Forest Service will gather additional information needed for sensitive species not fully discussed in the PAD.

An Environmental Assessment (EA) will be issued in 2008 (refer to Mystic Lake Process Plan and Communications Protocol in the PAD or on the Mystic Lake Relicensing Website www.mysticlakeproject.com) as part of the FERC ILP relicensing process. The EA will incorporate the Biological Assessment (Study Request No. 16), the Biological Evaluation (Study Request No. 17), as well as address any other relevant issues including management indicator species if appropriate.

2) If applicable, explain any relevant resource management goals for agencies or Tribes with jurisdiction over the resource to be studied.

Forest Service Manual 2600 – Wildlife, Fish and Sensitive Plant Habitat Management (WO Amendment 2600-90-1, Effective 6/1/90)

FSM 2672.4 Biological Evaluations

Review all Forest Service planned, funded, executed, or permitted programs and activities for possible effects on endangered, threatened, proposed, or sensitive species. The biological evaluation is the means of conducting the review and of documenting the findings. Document the finding of the biological evaluation in the decision notice. Where decision notices are not prepared, document the findings in Forest service files. The biological evaluation may be used or modified to satisfy consultation requirements for a biological assessment of construction projects requiring an environmental impact statement.

Custer National Forest Service Management Plan Chapter II E 4 – Management Standards for Wildlife and Fish (p.17)

A biological evaluation (see glossary) of potential impacts to T&E species and their habitat will be made for every project undertaken by the Forest Service. If not T&E species are found they will not be considered a limiting factor in the project....

3) If applicant is not an agency, explain any relevant public interest in regard to the proposed study.

The public interest includes providing access for the use and enjoyment of public lands, waters, and other natural resources that are managed by public resource agencies. The public's interest also includes benefits from renewable energy produced by the Mystic Lake hydroelectric project.

4) Describe existing information on subject of proposed study and the need for additional information.

Federally listed species are discussed in the PAD (section 3.6). Other information that has been made available by the Forest Service is presented in Table 1. As shown in Table 1, there are some information gaps that still need to be addressed for the biological evaluation.

Table 1. Federally listed threatened, endangered, or proposed species and Forest Service R-1 sensitive species on the Beartooth Ranger District, Custer National Forest, Montana.

Species	Status ^{1, 2}	Suitable habitat on R.D.	Present on R.D.	Present in project area ³	Determination of Effect
Bald eagle	Federally threatened	Yes	Yes, migrant	Yes	
Grizzly bear	Federally threatened	Yes	Yes	Habitat present	
Gray wolf	(non-essential/experimental population)	Yes	Yes	Habitat present	
Canada lynx	Federally threatened	Yes	Yes	Habitat present	
Black-footed ferret	Federally endangered	No	No	No	No effect
Yellow-billed cuckoo	Federal Candidate	Yes	Yes	No	No impact
Peregrine falcon	USFS sensitive	Yes	Yes	No	No impact
Townsend's big-eared bat	USFS sensitive	Yes	Yes	No	No impact
Pallid bat	USFS sensitive	No	No	No	N/A
Spotted bat	USFS sensitive	Yes	Yes	No	No impact
Northern goshawk	USFS sensitive	Yes	Yes	Yes	
Black-tailed prairie dog	USFS sensitive	No	No	No	N/A
White-tailed prairie dog	USFS sensitive	Yes	Yes	No	No impact
Burrowing owl	USFS sensitive	Yes	Yes (potentially)	No	No impact
Sage grouse	USFS sensitive	Yes	Yes (potentially)	No	No impact
Wolverine	USFS sensitive	Yes	Yes	Habitat present	
Fisher	USFS sensitive	Yes	No	No	N/A

Species	Status ^{1, 2}	Suitable habitat on R.D.	Present on R.D.	Present in project area ³	Determination of Effect
Harlequin duck	USFS sensitive	Yes	Yes	No	No impact
Northern bog lemming	USFS sensitive	Yes	No	No	N/A
Flammulated owl	USFS sensitive	No	No	No	N/A
Black-backed woodpecker	USFS sensitive	Yes	Yes	No	No impact
Yellowstone cutthroat trout	USFS sensitive	Yes	Yes	No	No impact
Baird's sparrow	USFS sensitive	Yes	Yes	No	No impact
Sprague's pipit	USFS sensitive	No	No	No	N/A
Loggerhead shrike	USFS sensitive	Yes	Yes	No	No impact
Boreal toad	USFS sensitive	Yes	Yes	No	No impact
Northern leopard frog	USFS sensitive	Yes	Yes	No	No impact
Tawny crescent butterfly	USFS sensitive	No	No	No	N/A
Regal fritillary butterfly	USFS sensitive	No	No	No	N/A
Dakota skipper butterfly	USFS sensitive	No	No	No	N/A

¹ Federally listed species based on consultation with the USFWS, June 30, 2003. As of Feb. 4, 2000 the black-tailed prairie dog is considered a candidate species. The determination of effects for federally listed species (threatened or endangered) is limited to: (1.) No effect; (2) May effect - Not likely to adversely affect; (3) * May effect - Likely to adversely affect; and (4) Beneficial effect. * = Considered a trigger for a significant action. Options in determination of effects for proposed federally listed species are: (1.) No effect; (2.) Not likely to jeopardize the continued existence of the species or result in destruction or adverse modification of proposed critical habitat; (3.) Likely to jeopardize the continued existence of the species or result in destruction or adverse modification of proposed critical habitat.

5) Explain any connection between project operation and effects (direct, indirect or cumulative) on the resource to be studied and how study results will help identify potential project impacts and assist in development of License conditions.

At this time, there are no known or documented effects (direct, indirect, or cumulative) between the project operation and wildlife species (Table 1). Available data, as presented in the PAD, describing federally listed species and Forest Service sensitive species will provide information to assess the potential presence of species and available habitat as well as the potential of the project operation to have any adverse effect (direct, indirect, or cumulative) on the habitat or to the species

6) Explain how proposed study methods (including data collection and analysis techniques, study schedule and duration) is consistent with accepted scientific practices or considers, as appropriate, relevant Tribal values and knowledge.

PPL will utilize existing data provided by federal agencies, which have developed accepted and appropriate scientific methodology to survey presence of species and habitat availability for federally listed species and Forest Service sensitive species.

7) Describe level of effort and anticipated cost and why alternative studies would not be sufficient to meet stated information needs.

Efforts will focus on taken existing information presented in the PAD and gathering available information from the Forest Service to address objectives of completing the Biological Evaluation. The level of effort and anticipated costs will be determined at a later date.

References:

Forest Service Manual 2600 – Wildlife, Fish and Sensitive Plant Habitat Management
WO Amendment 2600-90-1 Effective 6/1/90. Available:
www.fs.fed.us/im/directives/fsm/2600/2672.24b-2676.17e.txt

U.S. Forest Service (USFS). 1986. Custer National Forest Management Plan. Billings,
Montana. Available:
www.fs.fed.us/r1/custer/projects/Planning/Management_plan.pdf

Mystic Study Request No. 18

Title of Proposed Study: Evaluation of the Current Fish Population and Habitat in West Rosebud Creek Downstream from Emerald Lake.

Sponsor of Proposed Study: PPL Montana

Date Submitted: November 1, 2004

****Criteria adapted from FERC Regulations 18 CFR 5.11 (b)****

1) A detailed description of the study and the methodology to be used.

Refer to criteria, #1 and #6, adapted from FERC Regulations 18 CFR 5.9 (b), as discussed below.

2) A schedule for conducting the study.

The study plan is scheduled for the 2005 summer field season. The schedule for submitting an initial study report, reviewing the study, and decisions to continue and/or amend the study plan is provided in the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com).

3) Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results.

Refer to the *Mystic Lake Process Plan and Communications Protocol* (available in the Pre-Application Document, PAD, and on the Mystic Lake Relicensing Website, www.mysticlakeproject.com) that outlines the timeline for pre-filing milestones and the process for communications and information sharing.

4) If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in FERC Regulations 18 CFR 5.9(b).

Not Applicable.

****Criteria adapted from FERC Regulations 18 CFR 5.9 (b) and 18 CFR 5.11(4)(d)****

1) Describe goals and objectives of proposed study and the information to be obtained.

To evaluate the status of the existing fish population and quality of fish habitat available under the current flow regime, and to determine whether changes in the timing and magnitude of releases from Mystic Lake dam would benefit this fishery.

2) If applicable, explain any relevant resource management goals for agencies or Tribes with jurisdiction over the resource to be studied.

FWP's Fisheries Program Strategic Plan (Fisheries Beyond 2000) describes a fisheries management element with the central purpose of managing the state's fisheries to protect, enhance and restore populations of native and sport species of fish. One management goal relevant to this study request is to "provide a diversity of angling opportunities through management of self-sustaining wild fisheries and responsible use of hatchery-raised fish." The habitat element of this strategic plan focuses on protecting and improving the crucial components of good aquatic ecosystems. Three relevant goals include to: "preserve and protect aquatic habitat; restore and enhance important degraded aquatic habitat; and restore and maintain adequate water flow in streams and satisfactory water levels in lakes/reservoirs to support priority fisheries."

FWP's Stillwater River Fisheries Management Plan (1990) includes strategies to "meet public demand for high quality recreation and wild trout fishing while maximizing the opportunity to catch trout longer than 13 inches." Relevant fish habitat strategies are to: "Emphasize the need for quality fish habitat through education, cooperation and enforcement." "Maintain stream flows in the Stillwater River and its tributaries by promoting water conservation and through the instream flow reservation process." – and – "Evaluate the individual and cumulative effects of mining, highway and road construction, subdivisions and other development in the Stillwater drainage by the review of permit applications and participation in the preparation of environmental assessments and environmental impact statements."

3) If applicant is not an agency, explain any relevant public interest in regard to the proposed study.

The public interest includes providing access for the use and enjoyment of public lands, waters, and other natural resources that are managed by public resource agencies. The public's interest also includes benefits from renewable energy produced by the Mystic Lake hydroelectric project.

4) Describe existing information on subject of proposed study and the need for additional information.

PPL Montana and GEI Consultants have compared weekly average flows for existing and natural conditions from 1979-2002 below the project as part of the pre-application document (PAD). PPL Montana, in collaboration with FWP and the USFS, gathered data on fish populations in the bypass reach in the summer of 2004. This was the first time fish populations in this section of stream have been evaluated since the institution of minimum instream flows in 1981. FWP has also sampled fish populations periodically in the McKay Ranch section of West Rosebud Creek (downstream of the project area) since 1986, including fall of 2004.

No formal substrate, invertebrate, or riparian surveys have been completed in West Rosebud Creek downstream from the powerhouse, although invertebrate samples were taken and in-situ sediment conditions observed in several reaches of West Rosebud Creek in the summer of 2004. Results of the invertebrate sampling are not available at the time of this writing (October 2004).

The USFS and, potentially, the NRCS, has historic and recent aerial photographs of this stream segment.

Information needed: stream substrate characterization along representative transects, invertebrate samples at these same transects, spawning surveys during spring and fall, and a riparian assessment that extends the down to the T 6 S R17 E Section 2 Bridge.

5) Explain any connection between project operation and effects (direct, indirect or cumulative) on the resource to be studied and how study results will help identify potential project impacts and assist in development of License conditions.

Project operations reduce natural peak flows and potentially delay natural runoff (PAD Figure 3.2.2-3). It is uncertain whether or not these changes in the natural hydrograph have had an impact on fish habitat, fish populations, or riparian resources downstream of the project area. This proposal is to evaluate the current status of fisheries and riparian areas in West Rosebud Creek downstream of the project area.

6) Explain how proposed study methods (including data collection and analysis techniques, study schedule and duration) is consistent with accepted scientific practices or considers, as appropriate, relevant Tribal values and knowledge.

The riparian assessment methodology is described in study plan No. 9. Fish populations would be estimated using the mark-recapture method in the same site that has previously been studied by FWP. By maintaining consistency in methodology, we will be able to compare data over time to evaluate trends.

Aquatic insects and substrate would be characterized using methods that have been developed for the Madison River in Montana (see PPL Montana and R2 Resource Consultants, Inc 2003). In 1995, a three-year streambed-monitoring program was initiated at four sites on the Madison River. During the course of this study, the protocol for collecting and analyzing data was refined based on input from agencies and to be consistent with similar studies performed on the Missouri River. PPL Montana is proposing to transfer this methodology to West Rosebud Creek.

PPL Montana would, in collaboration with MFWP, select appropriate study locations in West Rosebud Creek below Emerald Lake. The composition of substrates within each monitoring location will be sampled using a McNeil core sampler. At each site, samples will be collected from five locations, representative of salmonid spawning gravel areas.

An estimate of embeddedness, as defined by Platts, Megahan, and Minshall (1983), will be performed at regularly spaced intervals across each transect. Embeddedness will be visually estimated as the percentage of the surface of the dominant particle size covered by fine sediment within one meter of the sample location.

A macroinvertebrate sample will be collected adjacent to each location where a substrate gravel sample is collected, to permit analyses of the correlation between sediment and macroinvertebrate metrics. A total of five kick net samples will be collected from each site. The kick net sampler has a 0.32 m by 0.62 m rectangular opening to which a 560-micron Nitex net is attached. Kick net samples will be obtained at depths ranging from 1.0 to 2.5 ft. These samples will be collected from a .25 square meter area. The net will be placed immediately downstream from the sampling area. The area will be kicked in order to dislodge all of the small particles. Rocks in the sampling area that are too large to dislodge by kicking will be hand scrubbed into the net. Because of the standardized kick area, this procedure can be considered semi-quantitative. All invertebrates caught in the net will be either back flushed and back sprayed with a hand sprayer, or picked off the net with forceps. The depth of each sampling station will be measured. Mean column velocities (0.6-ft depth) at each station will be measured using a Swoffer digital current meter or a Pygmy current meter. Substrate composition and embeddedness will be visually estimated at each sampling station. Following the completion of invertebrate sampling, all samples will be preserved with ethanol and placed in labeled containers and transported to the laboratory for processing.

Laboratory processing of the invertebrate samples will consist of: 1) sample sorting, 2) identification of taxa present and completion of a voucher specimen collection, and 3) sample enumeration according to taxonomic groups. Benthic macroinvertebrates samples will be identified to the taxonomic levels specified by MDEQ protocols (Bukantis 1996). Aquatic insects will be identified using appropriate taxonomic keys including those for caddisflies (Wiggins 1978), mayflies (Edmunds et al. 1976), other aquatic insects (Merritt and Cummins 1984), and other aquatic invertebrates (Pennak 1978). A voucher specimen will be preserved in a vial for each taxonomic group collected during the 1996 sampling effort.

All kick net samples will be subsampled following MDEQ's subsampling protocol (Bukantis 1996). All sorting will be completed under a magnifying light or dissecting microscope. Each sample will be placed into a white enamel pan, divided into 24 equal-sized grids. The sample will then be distributed as evenly as possible over the bottom of the pan. Squares within the grid will then be randomly selected for subsampling. All macroinvertebrates will be picked within a selected square. Enough squares will be sampled so that the total number of invertebrates subsampled from the entire sample will range from 270 to 330 individuals (i.e., 300 individuals +/- 10%). This procedure is similar to that employed in the EPA's Rapid Bioassessment Protocol III (Plafkin et al. 1989). Following taxonomic identification and enumeration, the abundance of each taxonomic group will be entered in computer spreadsheet files, which will then be used to calculate biotic indices and sampling statistics. Metrics calculated from the invertebrate samples will include those recommended in MDEQ's Rapid Bioassessment Macroinvertebrate Protocols (Bukantis 1996).

Fall spawning surveys would be conducted using visual estimation. PPL Montana will work collaboratively with FWP to establish index reaches to be surveyed. This reach or reaches will be walked in late fall and redds will be identified as either possible or probable. Locations of redds will be recorded with GPS, and later marked on maps. The goal will be to establish a key index reach that could be surveyed over time, to establish trends in numbers of brown trout spawners.

7) Describe level of effort and anticipated cost and why alternative studies would not be sufficient to meet stated information needs.

PPL Montana will perform this work with the assistance of FWP.

Work to be performed in 2005:

Fish population sampling will require approximately 4-6 people from 2 – 4 days in the field, and one person an additional 2 – 4 days for data entry, analysis, and write up.

Substrate sampling will require 2 –3 people from 1 –2 days in the field, and one additional person 2 days for data entry, analysis and write up. In addition, McNeil core samples will need to be sent to a laboratory for screening and weighing.

Macroinvertebrate sampling will require one person in the field for 1 – 2 days. Samples will be sent to a laboratory for analysis, total cost to depend on the number of sites sampled.

Redd surveys will require 2 persons in the field for approximately 3 days. Data entry and write up will require one additional person-day.

References:

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- Pennak, R. K. 1978. Freshwater invertebrates of the United States. Wiley, New York. 801 p.
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- Wiggins, G. B. 1978. Larvae of the North American caddisfly genera (Trichoptera). Univ. of Toronto Press, Toronto. 401 p.