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UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Green Mountain Power Corporation Project No. 2090-003

NOTICE OF AVAILABILITY OF FINAL ENVIRONMENTAL ASSESSMENT

(August 15, 2005)

In accordance with the National Environmental Policy Act of 1969 and Part 380 of the Federal Energy Regulatory Commission's (Commission) regulations, 18 CFR Part 380; FERC Order No. 486 and 52 Fed. Reg. 47,897, the Office of Energy Projects Staff (staff) reviewed the application for a new license for the Waterbury Hydroelectric Project, located on the Little River in the town of Waterbury in Washington County, Vermont, and prepared a final environmental assessment (FEA) for the project. The project does not use or occupy any federal facilities or lands.

In this FEA, the staff analyzes the potential environmental effects of the existing project and concludes that licensing the project, with staff's recommended measures, would not constitute a major federal action significantly affecting the quality of the human environment.

A copy of the FEA is available for review at the Commission in the Public Reference Room or may be viewed on the Commission's website at http://www.ferc.gov using the "eLibrary" link. Enter the docket number excluding the last three digits in the docket number field to access the document. For assistance, contact FERC Online Support at FERCOnlineSupport@ferc.gov or toll-free at 1-866-208-3676, or for TTY, (202) 502-8659.

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Magalie R. Salas
Secretary

PUBLIC

FINAL ENVIRONMENTAL ASSESSMENT
Green Mountain Power Corporation
Waterbury Hydroelectric Project
Docket No. P-2090-003

FINAL ENVIRONMENTAL ASSESSMENT FOR HYDROPOWER LICENSE

Waterbury Hydroelectric Project

FERC Project No. 2090-003

Vermont

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
Washington, DC 20426

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ACRONYMS AND ABBREVIATIONS

ADA	Americans with Disabilities Act
APE	area of potential effect
CFR	Code of Federal Regulations
cfs	cubic feet per second
COE, Corps	U.S. Army Corps of Engineers
Commission, FERC	Federal Energy Regulatory Commission
CWA	Clean Water Act
DO	dissolved oxygen
FEA	final environmental assessment
ESA	Endangered Species Act
FPA	Federal Power Act
FWS	U.S. Fish and Wildlife Service
GMP, licensee, or applicant	Green Mountain Power Corporation
HPMP	Historic Properties Management Plan
Interior	U.S. Department of the Interior
msl	mean sea level
mg/l	milligrams per liter
MW	megawatts
MWh	megawatt-hours
National Register	National Register of Historic Places
NERC	North American Electric Reliability Council
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NTU	nephelometric turbidity unit
O&M	operation and maintenance
RMP	Recreation Management Plan
SHPO	State Historic Preservation Office
staff	Federal Energy Regulatory Commission staff
VANR, agency	Vermont Agency of Natural Resources
VDFPR	Vermont Department of Forests, Parks, and Recreation
VDEC	Vermont Department of Environmental Conservation
VWSA	Vermont Water Skiers Association
WQC	Water Quality Certification
WUA	Weighted Usable Area

SUMMARY

Green Mountain Power Corporation (GMP or licensee) proposes to continue to operate the existing Waterbury Hydroelectric Project located on the Little River in the town of Waterbury in Washington County, Vermont. The project has an installed generating capacity of 5,520 kilowatts, generates about 15,880 MWh[1] of electricity annually, and supplies part of the energy needs of GMP, an electric utility organized under the laws of the State of Vermont. The project does not use or occupy any Federal facilities or lands. The lands surrounding the project belong to the State of Vermont.

In this final environmental assessment (FEA), we analyze the effects of continued operation of the project and recommend conditions for a new license. Based on our analysis, we recommend licensing the project as proposed by GMP[2] with additional staff-recommended measures. Our recommendations include, or are based in part on, recommendations made by Federal and state resource agencies that have an interest in the resources that may be affected by the continued operation of the project.

GMP proposes to: (1) continue to operate the project as it has under the current license; (2) increase minimum flows downstream of the project from three cubic feet per second (cfs) year-round, to 65 cfs for the period April 1 through June 30, and 35 cfs for the period July 1 through March 31, to start after the reconstruction of the Waterbury Dam; (3) aerate or ventilate the existing turbine such that the project discharges meet Vermont Standards for dissolved oxygen; (4) implement a long term monitoring program for turbidity; (5) modify the existing 24 inch diameter bypass valve with an automated gate that would provide minimum releases during periods when the turbine is not discharging; (6) implement a recreation enhancement program; and (7) enter into a cooperative Cultural Resources Management Plan with the State Historic Preservation Officer for the project.

Under GMP's proposal, implementation of these measures would cost about $296,900 in capital outlays and $62,750 annually in lost generation due to the proposed

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[1] Table 1 in GMP's letter filed on January 9, 2003.

[2] On January 9, 2003, GMP amended its application to propose limiting winter drawdown to elevation 570.0. GMP's reason was to improve turbidity in the reservoir and project tailrace by keeping submerged several silt deposits around the reservoir. Staff has analyzed this proposal in the draft EA issued on August 20, 2004. Citing dam safety and protection of life and property concerns, on January 3, 2005, GMP amended its application to return to the original proposal to operate the project as it does under the current license with a provision for higher minimum flows.

minimum flows and would result in a net annual benefit of $408,540. The project, as proposed by GMP, would generate 14,834 megawatt-hours (MWh) of electricity annually.

The staff-recommended additional measures include: (1) develop and implement a recreation management plan that includes a finalized schedule for whitewater boating releases, a schedule for improving the existing warning signage and provisions for establishing and maintaining a flow phone system; (2) develop and implement a wetlands management plan; (3) develop a plan to insure compliance with state dissolved oxygen standards of above 7 mg/l and 80 percent saturation and turbidity below 10 NTU's (1 nephelometric turbidity unit is ~1 part per million [ppm]); and (4) develop a plan to monitor the effectiveness of the aeration control device.

GMP's proposals with these additional staff-recommended measures would cost about $541,000 annually and would result in a net annual benefit of $407,150. The annual energy generation would be 14,834 MWh.

We recommend these measures to protect or enhance flood control, water quality, fisheries, recreational, terrestrial, and cultural resources. In addition, the electricity generated from the project would be beneficial because it would continue to reduce the use of fossil-fueled electric generating plants, conserve nonrenewable energy resources, and continue to reduce atmospheric pollution.

On the basis of our independent analysis, we conclude that issuing a new license for the Waterbury Project, with the environmental measures that we recommend, would not be a major federal action significantly affecting the quality of the human environment.

FINAL ENVIRONMENTAL ASSESSMENT

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
Washington, DC 20426

Waterbury Hydroelectric Project
FERC Project No. 2090
Vermont

I. APPLICATION

On August 31, 1999, Green Mountain Power Corporation (GMP or licensee) filed an application for a new license with the Federal Energy Regulatory Commission (Commission) for the continued operation of the existing 5,520 kilowatt (kW) Waterbury Hydroelectric Project located on the Little River in the town of Waterbury, Washington County, Vermont (Figure 1, Appendix A). The project uses the Waterbury Dam and reservoir, owned and operated by the State of Vermont and built by the U.S. Army Corps of Engineers (COE or Corps). The project does not occupy any federal lands but the COE has an interest in the management of the dam and reservoir for flood control. The dam and reservoir are not currently part of the licensed project.

II. PURPOSE OF ACTION AND NEED FOR POWER

A. Purpose of Action

The Commission must decide whether to issue a license to GMP for the project and what conditions, if any, should be placed in any license issued. Issuing a new license for the project would allow GMP to continue generating electricity at the project for the term of the new license, making electric power from a renewable resource available to its customers.

In this final environmental assessment (FEA), we, the Commission's staff (staff), assess the effects associated with project operation and alternatives to the proposed project; make recommendations to the Commission on whether to issue a new license; and recommend terms and conditions to become a part of any license issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project would be best adapted to a comprehensive plan for improving or developing the waterway. In addition to the power and developmental purposes for which a license is issued (e.g., flood control, irrigation, and water supply), the Commission must give equal

consideration to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife resources (including related spawning grounds and habitat); the protection of recreational opportunities; and the preservation of other aspects of environmental quality.

In this FEA, the staff assesses the environmental and economic effects of continuing to operate the project: (1) as proposed by GMP; and (2) as proposed by GMP with additional staff-recommended measures. We also consider the effects of the no-action alternative. Important issues that are addressed include flood control, water quality, fishery resources, geological resources, cultural resources, and recreational enhancements.

B. Need for Power

To assess the need for power, we reviewed GMP's present and future use of the project's power, together with that of the operating region in which the project is located. GMP provides power to nearly 90,000 customers in 65 Vermont municipalities. The applicant feeds the project power to its regional transmission and distribution system and also provides power to several other electric utilities through the interstate electrical transmission grid. GMP would continue to sell power to its customers if issued a new license.

The Waterbury Hydroelectric Project is located in the New England subregion of the Northeast Power Coordinating Council region of the North American Electric Reliability Council (NERC). NERC annually forecasts electrical supply and demand in the region for a 10-year period. NERC's most recent report on annual supply and demand projections indicates that, for the period from 2004-2013 peak demand (summer) in the New England area would increase by 1.3 percent annually while installed capacity margins would steadily decline from a high of 23.6% in 2007 to14.8% in 2013. The decline is forecasted assuming no capacity retirements while new capacity additions totaling 1,400 MW is expected to be on line by 2007.

The average annual generation of the Waterbury Project is 15,880 MWh. The project displaces existing and planned non-renewable fossil-fueled generation, which contributes to the production of nitrogen oxides, sulfur dioxides, and carbon dioxide.

We conclude that the power from the project, with its displacement of non-renewable fossil-fired generation, low cost, and its contribution to a diversified generation mix, support a finding that the power from the project would help meet a need for inexpensive and reliable power from renewable fuel sources in the New England subregion.

III. PROPOSED ACTION AND ALTERNATIVES

A. Applicant's Proposal

GMP proposes to continue to operate and maintain the Waterbury Hydroelectric Project to provide electric generation capacity and energy for its customers and to provide a number of environmental protection and enhancement measures to benefit non-power uses of the Little River resources. GMP does not propose any modifications to the project features.

1. Project Facilities

The Waterbury Project consists of the following facilities: (1) a submerged concrete intake structure containing a gate that controls flows to the powerhouse; (2) a 14-foot-wide by 10.5-foot-high, 828-foot-long horseshoe shaped reinforced concrete conduit (extending from the intake structure) bifurcating into two 54-inch-diameter, 205-foot-long steel penstocks that in turn connect to a 79-inch-diameter penstock supplying the powerhouse and a 24-inch-diameter bypass pipe fitted with a Howell-Bunger valve; (3) a 58-foot-long by 35-foot-wide reinforced concrete powerhouse containing one vertical Francis turbine rated at 7,800 HP with a maximum hydraulic capacity of 580 cubic feet per second (cfs) and a minimum hydraulic capacity of 85 cfs directly connected to a generator with a rating of 5,520 kW; (4) a tailrace; and (5) appurtenant facilities. Other than the generator leads, there's no primary transmission line included in the project works.

The Waterbury dam is one of seven dams built along the Winooski River and its tributaries by the U.S. Army Corps of Engineers for the purpose of flood control in the Winooski River Valley. The dam was completed and delivered to the State of Vermont in 1938; however, because it was built by the Federal Government, the dam is considered a government dam. Therefore, the dam and reservoir are not part of the project works.

2. Existing Operation

The primary purpose for which the dam was built is flood control. As such, operation of the project is subordinated to the U. S. Army Corps of Engineers Waterbury Dam and Reservoir Regulation Manual guidelines set up for the dam and reservoir. The guidelines seek to prevent high Little River spring runoff from reaching the Winooski River while keeping the reservoir level below elevation 592 feet msl. The applicant operates the reservoir below elevation 592 feet msl and the State of Vermont between elevations 592 and 630 feet msl.

The project normally operates in a weekly peaking mode, Monday through Friday. Under the current license, GMP fluctuates the conservation pool through discharges from the project powerhouse maintaining the target elevations of 588.5 feet msl and 590.5 feet msl during the period between Memorial Day and Labor Day and has the top of conservation pool set at 589.5 feet msl to allow a buffer for summer rainstorms. From Labor Day to December 31, GMP uses the storage between elevations 589.5 and 580.1 for peaking generation. The target elevation during this period is 589.5 feet msl. Beginning in January, the reservoir is drawn down to a target elevation of 550.1 feet msl by March 1. Spring run-off then fills the reservoir to the target summer elevation of 589.5 feet msl which begins on May 25. The minimum downstream flow required by the existing license is 3 cfs; however, the actual minimum flow is between 10 and 15 cfs due to leakage through the turbine wicket gates.

3. Proposed Operation

GMP would continue to run the project in a weekly peaking mode, Monday through Friday. The proposed operation of the reservoir would not change from the current operation. Minimum flows below the project would be increased to 65 cfs between April 1 and June 30 and 35 cfs between July 1 and March 31 of every year. There would be no limitations on peaking flows.

4. Proposed Environmental Measures

GMP proposes the following environmental measures at the Waterbury Project:

- increase minimum flows downstream of the project from three cfs year-round to 65 cfs for the period April 1 through June 30 and 35 cfs for the period July 1 through March 31; to start after the reconstruction of the Waterbury Dam in 2008;
- Aerate or ventilate the existing turbine such that the project discharges meet Vermont standards for dissolved oxygen;
- Implement a long term monitoring program for turbidity;
- Modify the existing 24-inch-diameter bypass valve with an automated gate that would provide minimum releases during periods when the turbine is not discharging;
- Implement a recreational enhancement program which includes a stable reservoir level during summer, improvements to three boat facilities, off-site parking, stabilize/harden shoreline banks and access points, sanitation facilities, enhanced access to the Little River, whitewater boating releases, and a flow notification system; and

- Enter into a cooperative Cultural Resources Management Plan with the State Historic Preservation Officer for the project.

B. Additional Staff-recommended Measures

Staff considered what, if any, additional enhancement measures would be beneficial to those resources affected by the project and its operation. In addition to GMP's proposed measures, we recommend the following environmental enhancements:

- develop and implement a recreation management plan that finalizes schedules for whitewater boating releases and improves the existing warning signage and establishes and maintains a flow phone system;
- develop and implement a wetlands management plan;
- develop and implement a plan to insure compliance with state DO standards; and
- develop a plan to monitor the effectiveness of the aeration control device.

C. No-Action

Under the no-action alternative, the project would continue to operate under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented. Any ongoing effects of the project would continue. We use the no-action alternative to establish baseline environmental conditions for comparison with other alternatives.

D. Alternatives Considered but Eliminated from Detailed Study

As part of the National Environmental Policy Act (NEPA) scoping process, the staff considered, but eliminated from detailed study several alternatives to the proposed project, because they are not reasonable under the circumstances of this case. These alternatives include: (1) federal takeover; (2) issuing a non-power license; and (3) project retirement via partial or total project removal.

1. Federal Takeover

We don't consider federal takeover a reasonable alternative. Federal takeover and operation of the project would require congressional approval. While that fact alone would not preclude further consideration of this alternative, there is currently no evidence showing that a federal takeover should be recommended to Congress. No agency has suggested federal takeover would be appropriate, and no federal agency has expressed an interest in operating the project.

2. Non-power License

A non-power license is a temporary license that would be in effect until the licensee either surrenders the license or the Commission determines that another government agency would assume regulatory authority and supervision over the lands and facilities covered by the non-power license. No entity has recommended a non-power license, and there is no basis for concluding that the Waterbury Project should no longer produce power. Therefore, issuing a non-power license is not a reasonable alternative to relicensing the Waterbury Project.

3. Project Retirement

This alternative would require denial of the relicense application and surrender or termination of the existing license with appropriate conditions. The project provides a viable, safe, and clean renewable source of power to the region and contributes to the local economy by providing a source of revenue to GMP and by providing recreational opportunities. No party has suggested project retirement and thus there is no basis for recommending it. Thus, project retirement is not a reasonable alternative to relicensing the project with appropriate enhancement measures.

IV. CONSULTATION AND COMPLIANCE

A. Consultation

The Commission's regulations contained in the Code of Federal Regulations (CFR) (18 CFR Section 4.38 and 16.8) require that applicants consult with appropriate resource agencies and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, the Endangered Species Act (ESA), the National Historic Preservation Act (NHPA), and other federal statutes. Pre-filing consultation must be completed and documented, according to the Commission's regulations, before the Commission can accept an application for a license.

1. Scoping

Before preparing this FEA, we conducted scoping to determine what issues and alternatives should be addressed.

A scoping document 1 for the Waterbury Project was distributed to interested agencies and others on December 22, 1999. Two scoping meetings were held on January

12-13, 2000, in Waterbury, Vermont, to request oral comments on the project. A court reporter recorded all comments and statements made at the scoping meetings, and these are part of the Commission's public record for the project. In addition to comments provided at the scoping meetings, the following entities provided written comments:

Commenting Entity	Date of Letter
Trout Unlimited, Central VT Chapter	February 4, 2000
Vermont Natural Resources Council	February 9, 2000
Nick Yardley	February 9, 2000
Patrick H. Betty	February 9, 2000
Kelly H. Lowry	February 9, 2000
Vermont Agency of Natural Resources	February 10, 2000
U.S. Environmental Protection Agency	February 11, 2000
Gomez and Sullivan Engineers, P.C.	February 11, 2000
Representative Michael Quaid, Vermont House of Representatives	February 22, 2000

Subsequent to the scoping meetings, the Commission distributed a revised scoping document on July 7, 2000. No response was required.

2. Interventions

On February 18, 2000, the Commission issued a notice accepting for filing GMP's application for a new license for the Waterbury Project. This notice set April 18, 2000, as the deadline for filing protests and motions to intervene. In response to this notice, the following entities filed motions to intervene:

Interveners	Date of Letter
American Whitewater Affiliation	March 29, 2000
Champlain Valley Canoe and Kayak Series	April 12, 2000
Umiak, LTD. and The Friends of Little River	April 11, 2000
Vermont Paddlers Club	April 13, 2000

The following entities filed motions for late intervention:

U.S. Fish and Wildlife Service	April 19, 2000
Vermont Agency of Natural Resources (VANR)	March 13, 2002

The following entities filed motions to intervene in opposition to the

Project:

Vermont Natural Resources Council	April 13, 2000
Trout Unlimited and the Central Vermont Chapter of Trout Unlimited	April 17, 2000

We address intervener and other concerns in the environmental analysis Section V.C, (Proposed Action and Action Alternatives) of this FEA.

3. Comments on the Application

On September 26, 2002, the Commission issued a public notice indicating that the license application for the Waterbury Project was ready for environmental analysis and soliciting comments, recommendations, terms and conditions, and prescriptions within 60 days. In response to these notices, the following entities filed comments:

Commenting Entities	Date of Letter
Vermont Natural Resources Council	November 8, 2002
American Whitewater Affiliation and New England Flow [3]	November 20, 2002
Vermont Agency of Natural Resources	November 25, 2002
U.S. Fish and Wildlife Service	November 25, 2002

GMP responded to these comments by letter dated January 8, 2003.

We address these comments and recommendations in the environmental analysis section Section V.C, (Proposed Action and Action Alternatives) and appendix B of this FEA.

B. Mandatory Requirements

1. Water Quality Certification

Under Section 401(a) of the Clean Water Act,[4] the Commission may not issue a license for a hydroelectric project unless the state certifying agency has either issued

[3] On October 17, 2002, New England Flow, together with American Whitewater Affiliation, filed a Motion to Intervene within 60 days from Ready for Environmental Analysis Notice. Because it was unopposed, the intervention was automatically granted.

water quality certification for the project or has waived certification by failing to act on a request for certification within a reasonable period of time, not to exceed one year.[5]

On August 31, 1999, the Applicant applied to the Vermont Department of Environmental Conservation (Department) an agency of the VANR for a WQC for the project. The Agency has requested that the Applicant withdraws its application and reapplies each year (2000, 2001, 2002, 2003 and 2004) and the applicant has complied with these requests. The most recent withdrawal and reapplication was by letter dated November 8, 2004.

2. Section 18 Fishway Prescriptions

Section 18 of the FPA provides that the Commission shall require a licensee to construct, operate, and maintain such fishways as may be prescribed by the Secretary of the Interior or the Secretary of Commerce. By letter filed on November 25, 2002, Interior filed a request for reservation of authority to prescribe the construction, operation, and maintenance of upstream and downstream fishways as Interior may prescribe in the future, to be included in any license issued for the project. Interior states that the construction of fishways is not needed until anadromous fish are able to move past the Bolton Falls Dam (FERC Project # 2879) from Lake Champlain. Bolton Falls Dam, located on the Winooski River, is approximately 15 miles downstream of the Waterbury project

The Commission recognizes that future fish passage needs and management objectives cannot always be predicted when a license is issued, nor can it be predicted if and when adult steelhead would be present above the Bolton Falls Dam. Under these circumstances, and upon receiving a specific prescription from Interior, we recommend that the Commission follow its practice of reserving Commission authority to require such fishways as may be prescribed by Interior.

3. Section 10(j) Recommendations

Under Section 10(j) of the FPA, each license issued by the Commission must include conditions based on recommendations provided by federal and state fish and

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[4] 33 U.S.C. § 1341(a)(1).

[5] Section 401(a)(1) requires an applicant for a federal license or permit to conduct any activity that may result in any discharge into navigable waters to obtain from the state in which the discharge originates certification that any such discharge would comply with applicable water quality standards.

wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

The U.S. Fish and Wildlife Service (FWS) and VANR included 10(j) recommendations in their comment letters both filed on November 25, 2002. The agency-recommended measures include: (1) run-of-river operation; (2) maintaining a stable pool year-round; (3) monitoring of water levels and flow releases; (4) installation of turbine aeration equipment and development of a monitoring plan to assess the effectiveness of the aeration system; (5) a flow management plan to show how the project would comply with the reservoir limitations; (6) a monitoring plan for reservoir and flow management; (7) a plan for measures necessary to meet dissolved oxygen standards in the project tailrace; and (8) a plan and implementation schedule for recreation enhancements. Table 8 in section VIII lists each of the recommendations, and indicates whether we recommend adopting the measures under the staff alternative. Recommendations that we consider outside the scope of section 10(j) have been considered under section 10(a) of the FPA. We address all recommendations in Section V.C, (Proposed Action and Action Alternatives) of this FEA.

4. Coastal Zone Management Act

Section 307(c) (3) of the Coastal Zone Management Act (CZMA) requires that all federally licensed and permitted activities be consistent with approved state Coastal Zone Management Programs. If a project is located within a coastal zone boundary or if a project affects a resource located in the boundaries of the designated coastal zone, the applicant must certify that the project is consistent with the state Coastal Zone Management Program.

Vermont does not have a coastal zone management program. Therefore, a coastal zone consistency certificate is not required for the Waterbury Project. States with approved coastal zone management plans may be found on the National Oceanic and Atmospheric Administration's Coastal Zone Management Program website at http://www.ocrm.nos.noaa.gov/czm/.

5. Endangered Species Act

Section 7 of the ESA requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species.

Except for transient individuals, there are no T&E species in the project area. This was confirmed by the FWS in a letter dated August 30, 2000. FWS stated that no further consultation under ESA (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) is required unless the project is modified or new information indicates that listed species may be affected.

V. ENVIRONMENTAL ANALYSIS

In this section, we first describe the general environmental setting of the project area. We then discuss the effects on the resources caused by the project's operation, including the effects of the proposed action, action alternatives, and no-action. We analyze in detail only the affected resources in this FEA. Unless noted, the data in this section are taken from project filings made by the licensee, agencies, and other stakeholders.

A. General Description of the Little River

The Little River Basin arises in the Town of Morristown, in Lamoille County, Vermont. The Little River flows in a southerly direction for about 15 miles where it joins the Winooski River about 2.5 miles northwest of the Village of Waterbury, Vermont. The Winooski River flows about 90 miles in a northwesterly direction to Lake Champlain at a location about miles north of Burlington, Vermont. The watershed upstream of the Waterbury Project is about 109 square miles. Eighty percent of the watershed upstream of the Waterbury Project is forested, 15 percent is agricultural, 3 percent is urban, and 2 percent is residential. Rainfall in the basin averages about 41 inches per year, with an average of 114 inches falling as snow.

B. Cumulative Effects

According to the Council on Environmental Quality's regulations for implementing NEPA (50 CFR §1508.7), an action may cause cumulative impacts on the environment if its impacts overlap in space and/or time with the impacts of other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively

significant actions taking place over a period of time, including hydropower and other land and water development activities.

Based on information in the license application, agency comments, other filings on the project, and preliminary staff analysis, we have determined that water, fishery, and recreation resources have the potential to be cumulatively affected by the continued operation of the project in combination with other activities in the Winooski River Basin. We used these resource areas to determine the geographic and temporal scope of our analysis in the FEA.

1. Geographic Scope

The geographic scope of analysis defines the physical limits or boundaries of the proposed action's effects on cumulatively affected resources. Based on information gathered from the license application and comments received during the scoping period, we conclude that the geographic scope of analysis for water, fishery, and recreation resources is the Winooski River.

We chose this geographic scope because these resources are directly affected in downstream areas by project operation.

2. Temporal Scope

The temporal scope of analysis includes a discussion of the past, present, and future actions and their effects on each resource that could be cumulatively affected. Based on the potential term of a new license, the temporal scope would look 30 to 50 years into the future, concentrating on the effect on water, fishery, and recreational resources from reasonably foreseeable future actions. The historical discussion is limited, by necessity, to the amount of available information. We identified the present resource conditions based on the license application, supplemental filings, agency comments, comprehensive plans, and other information.

Our discussion of cumulative effects on water, fisheries, and recreation resources are found in Sections V.C.2, V.C.3 and V.C.6.

C. Proposed Action and Action Alternatives

In this section, we discuss the effects of the proposed project and alternatives on environmental resources. For each resource, we first describe the affected environment, and then we discuss and analyze the specific environmental issues.

We have reviewed the proposed project in relation to the environmental resources in the project area and have concluded that there would be no direct or indirect environmental effects on land use, aesthetics, and socioeconomic resources. We have excluded these resources from our detailed analysis.

1. Geological Resources

a. Affected Environment

Most of the reservoir is characterized by steep slopes having a gradient of 20 to 60 percent. The project area is underlain by metamorphic rocks, including graphitic schist, quartz-albite-muscovite schist, and some quartzite. The area was formerly inundated by a glacial lake, and as a result, the metamorphic rocks are overlain by a variety of glacial[6] and lacustrine deposits (e.g., silt, sand, and minor gravel). Upstream the Little River is actively eroding the finer material (sand and silt) into the Waterbury Reservoir.

b. Environmental Effects

GMP conducted a shoreline erosion study to locate any erosion sites along the reservoir shoreline and the Little River downstream and to assess the influence of hydroelectric operations on the erosion. Significant erosion was documented at 12 sites along the Waterbury Reservoir shoreline.

GMP proposes to continue drawing the reservoir to elevation 550.1feet msl during January and February. The VANR recommended that the Waterbury Project be operated in a run-of-river mode with a target reservoir elevation of 589.5 feet msl. The VANR states that the elimination of the winter drawdown would reduce erosion along the reservoir.

Our Analysis

The shoreline erosion study concluded that principal causes of the erosion are natural erosive processes (e.g., wind, waves, ice scour, and surface runoff) and human and animal influences. Reservoir fluctuations, considered a secondary cause, influenced the occurrence of erosion in 11 of the 12 sites along the reservoir. In 2001, a study by BBC&M Engineering, Inc. revealed that when the reservoir was drawn down to 550.1 feet msl in the winter, the lacustrine silt deposits that occur along the reservoir shoreline

[6] Glacial deposits include kame moraine, kame terrace, and outwash.

were exposed. When lacustrine silt deposits froze, needle ice formations[7] occurred. Needle ice formation can loosen the soil and increase the erosion potential. In addition, the repeated freeze-thaw cycles prevalent in the region continue to loosen the soil that is already susceptible to the erosion caused by the needle ice.

The report concluded that to lessen the amount of sediment eroding, the exposure of loosened soil to moving water must be reduced. This could occur through submerging the silt deposits, either by filling the reservoir earlier than normal in February or by limiting the winter reservoir drawdown. However, the report noted that at any minimum reservoir elevation, the silt that erodes from the lacustrine deposits would continue to be deposited in the reservoir, and also that silt would continue to move into the Little River even if the reservoir did not exist (letter from Peter W. Soltys, BBC&M, November 6, 2001).

GMP's proposal to continue drawing the reservoir to 550.1 feet msl in the winter would result in the lacustrine deposits that occur along the reservoir shoreline to be exposed. These exposed deposits would continue to be susceptible to erosion, while VANR's proposal of keeping the reservoir at a stable level would result in some of the lacustrine silt deposits being submerged thus less erosion would occur. However, the degree by which the erosion would be reduced cannot be predicted. A stable reservoir would result in more reservoir lands being flooded by the spring runoff because of the backwater effect of the Waterbury Dam. VANR's proposal would result in an additional 40 acres surrounding the impoundment being inundated once every two years during the spring flooding (letter from Thomas Sullivan, Gomez and Sullivan Engineers. P.C., January 8, 2003). Although flooding could result in soil being loosened and eroded, periodic inundation of uplands under VANR's proposal would not result in very much erosion because those areas are protected by well-established vegetation, and the inundation would only occur about every 2 years.

Since many of the glacial lacustrine deposits along the reservoir bottom are below the 570-foot level, a winter drawdown of 570 feet[8] would reduce the amount of lacustrine deposits exposed thus there would be less potential for the erosion of those deposits. A winter drawdown of 570 feet msl would expose about 200 acres of unvegetated reservoir

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[7] Needle ice is an accumulation of slender ice crystals at or immediately beneath the surface of the ground.

[8] GMP had proposed to conduct a winter drawdown of the reservoir to elevation 570.0 feet msl, but they withdrew this proposal.

bottom which would otherwise remain submerged and unexposed by the VANR's stable reservoir level proposal.

c. Unavoidable Adverse Impacts:

The proposed winter drawdown of the Waterbury Reservoir would result in the exposed lacustrine deposits being susceptible to erosion.

Our recommendations for limiting the winter reservoir drawdown are found in Section VII, (Comprehensive Development and Recommended Alternative).

2. Water Resources

a. Affected Environment

The Waterbury impoundment is a steep sided, deep impoundment up to 100 feet deep, covering 868 acres at the water level mean summer pool of 589.5 feet msl. The impoundment has a mean depth of 40 feet, 15 miles of shoreline, and stores 35,000 acre-feet of water at the summer pool elevation. At the normal maximum pool of 592 feet msl the impoundment holds 37,000 acre-feet.

Water Quantity

The Little River is located in north central Vermont and drains a watershed of about 211square miles. The Little River basin at the Waterbury Project site has a watershed area of about 109 square miles. The US Geological Survey operates a flow gauging station number 04289000 on the Little River in Waterbury VT approximately one mile downstream from the project. The drainage area at the gauge is 111 square miles.

Data from the U.S. Geological Survey gaging station indicate that the typical summer peak operational flow is about 490 cfs and the project often operates with one daily peak, lasting from 8:00 am to 5:00 pm. The day to day variation from this generating regime is in response to both inflows and power demands. GMP estimated the unregulated flows in the Little River based on gaging data from the Little River and the nearby Mad River, Table 1.

Table 1. Comparison between regulated flows and estimated natural flows in the Little River. (source: GMP)

Month	Median Flows (cfs)				Mean Flows (cfs)
	Recorded Flows		Estimated unregulated flow		
	1938-52	1953-80; 1987-95	Linear Regression	Basin Proportion	Basin Proportion
January	202	216	138	114	171
February	234	259	130	105	160
March	174	308	203	183	347
April	23	518	556	560	732
May	293	336	307	294	400
June	135	149	132	108	161
July	80	106	82	54	91
August	193	90	72	44	90
September	121	100	75	47	93
October	80	141	115	90	164
November	8	202	194	174	236
December	172	228	168	146	211
Annual Average	155	194	147	123	238

GMP proposes to continue operating the project as it currently does, as shown in Table 2. This rule curve allows GMP to operate between 588.5 and 589.5 feet msl from the Friday of Memorial day weekend through Labor day weekend, and have up to 590.5 feet msl available for storm events.

Table 2. Rule curve proposed by GMP (source: GMP)

Date	Normal Maximum Elevation (Feet)	Normal Minimum Elevation (Feet)
May 25	589.5	588.5
September 3	589.5	588.5
January 1	589.5	580.0
March 1	551.5	550.0
May 25	589.5	588.5

GMP proposes a seasonal minimum flow below the project of 65 cfs (April 1 – June 30) and 35 cfs (July 1 – March 31).

Water Quality

The Little River in the Waterbury Project area is classified by the Vermont Water Resources Board as a Class B water. Class B waters are managed to achieve and maintain a high level of quality that: is suitable for bathing; consistently exhibits good aesthetic value; provides high quality habitat for aquatic biota, fish and wildlife; is suitable for public water supply with filtration and disinfection; and is suitable for irrigation and other agricultural uses. The river in the project vicinity is designated cold water fish habitat for the protection and management of fisheries, DO levels must be maintained above 7 mg/l and 80 percent saturation and turbidity below 10 NTU's (1 nephelometric turbidity unit is ~1 part per million [ppm]).

b. Environmental effects

Water Quality

DO and Water Temperature

The Waterbury Project is currently operated as a flood control and peaking project. GMP proposed to install a turbine aeration device to alleviate the project's effects on DO. The FWS and the VANR agreed with the applicant's proposal to install an aeration device and also recommend that the Waterbury Project be operated in a run-of-river mode which would moderate the project's effects on downstream water temperatures.

The Waterbury Project has a deep-water intake that, during periods of reservoir stratification, draws cold, oxygen-deficient, water from the hypolimnion, which is discharged into the tailrace. GMP conducted monitoring that showed the tailrace exhibited low DO levels (from 4.6 to 6.9 mg/l), which are below state standards, during the late summer (late August through September). The released water increases in DO levels as it passed through the downstream cascades before it reached the Winooski River.

In order to meet DO standards for Class B coldwater habitat (7 mg/L and 80 percent saturation at all times), the applicant proposes to install a turbine aeration system and to provide conservation flows (35 cfs July 1 through March 31) during non-generation periods through the 24-inch bypass valve with a free-jet discharge. This would increase the level of DO in the Little River above the gorge section.

As noted above, the project draws water from the hypolimnion. GMP's studies indicate that the flows discharged downstream of the dam during the summer are about 10°C cooler than the inflows. The data shows that leakage flows can decrease the water temperature in the Winooski River about 2°C. Generation flows can decrease the water

temperature by as much as 10°C. The decrease is not sudden, taking several hours, and it is intermittent, lasting only as long as the project generates.

The project's cooling effect on the Winooski River would be beneficial to coldwater fish if it were a consistent condition. However, the variation in the magnitude, duration, and daily number of summer generation releases (none, once, or twice a day) results in a highly variable thermal regime in the Little River and the Winooski River. The proposed minimum flows for the summer months (35 cfs July 1 through March 31) would not provide a significant improvement over current thermal conditions. If the project were operated in a run-of-river mode with the same volume of water discharged over a 24-hour period as released by the peaking regime, a more stable and constant temperature reduction would result. A stable temperature regime would improve the downstream conditions for fish and macroinvertebrates by eliminating drastic variations which can be lethal to aquatic life.

GMP indicated that the change in temperature seen in the Winooski River would not likely cause mortality in the species found in that reach (trout, suckers, and dace.) While the temperature fluctuations might not be drastic enough to cause direct mortality there is the possibility for impediment of other natural functions of the reach which could contribute to the mortality of fish (reduced spawning suitability, food production, and growth).

GMP's study of stream habitat showed that the stream has little structure or cover due to channelization of the stream bed. The proposed minimum flows in conjunction with peaking flows do not increase the wetted usable area (WUA) significantly over leakage flows for juvenile or adults fish of all target species. Flows providing significant habitat increases occurred between 50 and 70 cfs and would be required during the summer months when GMP proposes to release 35 cfs.

Sediments

Erosion or sedimentation, resulting from project winter drawdown operations was identified as a concern by the VANR. GMP's study of the reservoir during the seasonal drawdown period indicate that reservoir sediments are mobilized during the winter drawdown and are flushed from the reservoir during high spring inflows and reservoir refilling. GMP monitored turbidity in the tailrace during 1997, 1998 and 2000. The monitoring documented periods when tailrace turbidity exceeded the state standard of 10 NTUs. The standard was exceeded on two occasions in March and April of 1998, and again in April of 2000 when the reservoir was refilling.

The Waterbury Project impoundment is subject to significant annual winter drawdowns, and is refilled using the high spring flows which typically causes much of the available sediment to flush downstream. The VANR states that to protect water quality in the Little River, the winter drawdown would have to be eliminated to prevent suspension of sediments in the impoundment.

The licensee proposes to continue the winter drawdown at current levels.

Our Analysis

The documentation included with the license application indicates that operation of the Waterbury Project has great influence on water quality in the Little River and the downstream Winooski River. Under existing operational conditions at the project DO often falls below state DO standard in the summer. The seasonal disturbance of the reservoir sediments does cause a minor temporary negative effect on water quality, by raising the outflow turbidity to levels that slightly exceed the state standards; this occurs during reservoir refill periods that experience freeze-thaw cycles. Eliminating the drawdown, or reducing it to 570 feet msl would protect the sediment shelf that is being disturbed by the freeze-thaw cycle and reduce the amount of turbidity in the project's discharge. However, the duration of the current increase in turbidity is so minor, when coupled with the increased flow volume of the spring runoff, it would not have any noticeable effect on downstream aquatic resources.

Water quality data collected by the licensee and reviewed by the agencies indicate that the current operation of the Waterbury Project affects both DO concentrations and water temperature. Installing a turbine aeration device and operating the project in a run-of-river mode would lessen the effects of the project on both DO and water temperature.

Our recommendations for water quality are found in Section VII, (Comprehensive Development and Recommended Alternative).

c. Unavoidable Adverse Impacts

Low DO levels in the Little River downstream of the project, should the project continue to operate as it has, would continue to effect water quality. Lowered water temperatures downstream of the project, would benefit cold water species but could negatively affect warmer water species.

GMP's proposed turbine aeration device would improve DO levels in the Little River downstream of the Waterbury Project. Run-of-river operation would stabilize the downstream water temperatures providing a consistent thermal regime for fish.

Eliminating or limiting the drawdown of the reservoir to 570 feet msl could lessen the mobilization of sediments during the refill period and limit turbidity downstream of the project, but current operation causes only minor and very temporary increases in turbidity.

d. Cumulative Effects

The operation of the Waterbury Project is the only human influence on the aquatic environment in the Little River downstream of the Waterbury Project. The Winooski River ameliorates the effects of the Waterbury Project's operation on downstream water quality within a few miles of the confluence of the two streams. GMP's proposals to aerate the turbine outflows and release a seasonal minimum flow would further decrease temperature and DO effects from the project operation on the downstream aquatic habitats. However, since the Winooski River has a much larger flow volume than the Little River, the water quality effects of the Waterbury Project do not measurably affect the water quality of the Winooski River as one moves downstream of the confluence of the Little and Winooski Rivers.

3. Fishery Resources

The Little River is managed by the VANR for self-supporting populations of resident and migratory salmonids and cold water fish, particularly brook, brown, and rainbow trout. The impoundment supports brook, brown, and rainbow trout, rainbow smelt, smallmouth bass and yellow perch. The Little River downstream of the project supports an assemblage of resident coldwater fish species including trout, dace, suckers, and sculpin.

Trout and smelt within the reservoir move upstream into the Little River and other tributaries to spawn. The Vermont Department of Fish and Wildlife (VDFW) electrofishing surveys indicate that fish abundance in the Little River is low, especially downstream of the Waterbury Project. Downstream fisheries are affected by the current peaking flow regime and low levels of dissolved oxygen in this river segment.

a. Affected Environment

Habitat

The Little River is a tributary of the Winooski River which eventually drains into Lake Champlain. The Little River downstream of the project consists of riffles (39 percent), runs (30 percent) and pools (18 percent). There is little structure or cover habitat for fish other than the pools, the substrate is rather uniform and comprised of cobble and gravel. Large pieces of woody debris which can provide cover for trout are not found in this river segment below the dam. The habitat available during summer low flow periods would be most utilized by small species and juveniles of larger species.

Fish Community

The fish community in the project area consists of brown, brook, and rainbow trout, and is supported by both natural reproduction and periodic stocking. Other species include tessellated darter, white sucker, common shiner, dace, fallfish, sculpin, and yellow perch. No state or federally listed threatened or endangered species are known to occur in the Waterbury Project area. The fish community in the Little River downstream of the project increases downstream of the gorge as the river approaches the confluence with the Winooski River.

Management Goals

The Winooski River is a major tributary to Lake Champlain and is a component of the Lake Champlain salmonid restoration and enhancement program. The VDFW is currently working to restore landlocked Atlantic salmon to the river and to create a new run of migratory steelhead rainbow trout. Their goal is to establish self-sustaining populations of these fish. Migratory species of salmonids are currently being stocked in the Winooski River watershed below the Bolton Falls Project (FERC No. 2879). Smolts are stocked downstream of the lowest mainstem dam and fry are stocked in upriver habitats.

The Little River is not currently accessible to fish migrating upstream from Lake Champlain. One of the VANR's management goals for the Little River is for it to be an active component of the Lake Champlain salmonid enhancement program by providing high quality spawning and nursery habitat for potadromous salmonids.

b. Environmental effects

The aspects of project operations that could impact the aquatic habitat include winter flood control drawdowns, peaking operation, and reservoir fluctuations. The resource agencies have requested the project be operated in a run-of-river mode to enhance habitat conditions for aquatic life. GMP has proposed to continue to operate in a peaking mode with an increase in the minimum flow.

Run-of-River Operation and Reservoir Fluctuations

The licensee proposes to continue to operate the project in a peaking mode, limiting reservoir fluctuations to within a 12-inch band under normal conditions with the option of drawing the reservoir to elevation 580.1 for peaking between Labor Day and December 31. Reservoir elevation changes also occur during storm events with possible spillage occurring through the Taintor gates.

Agency recommendations

The VANR and the FWS recommend that the licensee operate the project in a run-of-river mode, such that instantaneous outflow approximates the instantaneous inflow. The VANR and FWS both recommend that GMP should develop a plan to continuously monitor reservoir elevation and flow releases at the project. This would demonstrate the project's compliance with the run of river operation and reservoir fluctuation requirement and also the minimum flow requirements (discussed later).

Our Analysis

Requiring the licensee to operate in a run-of-river mode would protect downstream aquatic communities and also tend to prevent shoreline erosion problems that may develop in a reservoir or downstream under peaking operation. This operational mode protects and enhances the aquatic community in the reservoir and downstream of the project by minimizing elevational and water velocity changes. This also reduces the impacts to the riparian habitat from stream bank erosion and other river bed morphological changes that short term flow alterations can cause.

However, run-of-river operation would greatly restrict flood control operation and would flood up to 60 acres of upland vegetation during average spring flow years and continue to increase stream turbidity downstream of the project. Erosion from the reservoir banks would increase as upland areas are degraded by the effects of seasonal inundation, and the fragile fringe wetlands would be seasonally inundated, suffer ice

damage, and erosion. In addition, staff's analysis indicates that restricting the winter drawdown elevation in the Waterbury Reservoir would increase peak flood flows in the Winooski River downstream.

Our conclusions on project operation and reservoir fluctuations are found in Section VII, (Comprehensive Development and Recommended Alternative).

Reservoir fisheries

The fish community in the reservoir would benefit from run-of-river operation due to the stability of water levels. The reservoir has operated for flood control with a winter drawdown (see application for historical reservoir operational data) since it was constructed and as a consequence may restrict access to reservoir tributary streams for spawning smelt, trout and smallmouth bass. However, the mainstem of the Little River upstream of the Waterbury Reservoir is accessible during the winter drawdown.

Proposed summer operation of the reservoir is to keep the reservoir at a target elevation of 589.5 feet msl and allow a fluctuation of 2 feet. This mode of operation does not negatively affect the populations of the fish species present in the reservoir. The rate of fluctuation of the reservoir is not rapid enough to strand these species and it would not impact their spawning success.

Minimum Flows

GMP proposes to release 65 cfs April 1 through June 30 and 35 cfs July 1 through March 31 as a minimum base flow for the protection of downstream fish and water quality. These flows would be the minimums released during periods of non-generation. Peaking operations would continue and the Little River would continue to be subject to rapid increases in flow and decreases in temperature and DO. These conditions can cause scouring of the substrate or stranding of fish and macroinvertebrates.

Agency Recommendation

The VANR and the FWS recommend that GMP's operate in a run-of-river mode where inflow equal outflows. Therefore a minimum flow proposal would not be necessary.

Our Analysis

There is no bypassed reach at the Waterbury Project; all flows are released at the dam so a minimum flow is not an issue during project operation. The minimum flow

proposed by GMP would only be implemented during periods of ponding for peaking operation, and during the refill period from the winter drawdown. When coupled with peaking operation, the minimum flows proposed would not provide significant improvements in aquatic habitat downstream of the project. The Little River would continue to receive daily peaking project operational flow of 475 cfs between periods of minimum flow releases of 65 or 35 cfs, resulting in large fluctuations in stream flow and water temperature and quality. However, having a minimum flow for refill periods after the winter drawdown would stabilize the downstream reach while allowing the project to operate as a flood control dam. Further the WUA measurements can be seen to change drastically between the summer minimum flow and generation flow (Table 3).

Table 3: Percent WUA for selected species and life stages (summer, fall, and winter flow only). (Source: GMP, 1999 and 2002)

Fish/lifestage	Minimum Flow 35 cfs	Generation Flow ~ 475 cfs	Maximum WUA Flow
rainbow trout			
late fry	99	25	40
juveniles	82	30	80
brown trout			
late fry	100	50	30
juveniles	94	60	60
adults	86	72	80
longnose dace			
fry	98	35	40
juveniles	100	23	30
adults	85	31	90

WUA is a measure of habitat potentially available for a species or lifestage of an organism. While the proposed minimum flow would provide over 80 percent of the maximum amount habitat available for the given species/life stages in the Little River, the hydropeaking operation of the project lowers the availability of habitat for non-mobile species. For example, at the proposed minimum flow, the majority of the streambed is considered available habitat for the rainbow trout late-fry stage, but at the generation flow habitat availability is reduced as water velocity and depth exceed the range of suitability for late-fry stage rainbow trout, and suitable habitat is restricted to narrow bands along the stream margin.

GMP states that the unregulated stream flows would provide less habitat at times than the proposed minimum flow, however, unregulated flows as would occur under a

run-of-river operating regime would provide more habitat stability on a daily basis because flow would not fluctuate as rapidly. Lower stable flows would provide more effective WUA than the WUA provided by the minimum flow and hydropeaking. However, at the flow that provides the maximum habitat area, little habitat exists when compared to that in the Winooski River basin. In addition, cover is nonexistent, and structure is very limited in availability.

c. Unavoidable Adverse Impacts

None.

d. Cumulative Effects

The operation of the Waterbury Project is the largest influence to fisheries resources in the reach of the Little River extending to its confluence with the Winooski River. Within a few miles downstream of this confluence, the water quality characteristics and the resultant effects on the downstream fishery of the Little River are superceded by the water quality characteristics of the Winooski River due to the large difference in flow volumes between the two rivers. GMP's minimum flow and turbine aeration proposals would increase DO levels in the flows from the project over current levels.

4. Terrestrial Resources

a. Affected Environment

There are a variety of habitat types in the project area. Wetlands associated with the reservoir, state forest lands, and adjacent private lands provide habitat for many wildlife species. According to the "1986 Vermont Rivers Study", several locations around the Waterbury Reservoir are designated wildlife habitat areas that support moose, deer, and waterbirds. These designated habitat areas are located along the Little River, Cotton Brook, Stevenson Brook, and Waterbury Reservoir perimeter. Most wildlife activity associated with the reservoir occurs in the fringe wetlands and associated tributaries.

GMP performed general wildlife studies of the reservoir and surrounding lands in order to document actual wildlife activity throughout the year. A general reconnaissance survey was conducted during 1997 and 1998 to record observed wildlife, tracks, and other signs, with an emphasis on recording the aquatic furbearers, waterfowl, shorebirds, and herptiles. A second survey specific to bank swallows was conducted during the summer of 1998.

Results from the general survey show that the Waterbury Reservoir is productive for numerous wildlife species. The project supports moose, white-tailed deer, and red fox. Aquatic furbearers, especially beaver and mink are abundant. River otter is also present. A mapped deer wintering area exists near Cotton Brook and the reservoir.

Several herptile species are abundant around the reservoir. The shallows around the reservoir, along with adjacent wetlands, vernal pools, and tributaries are productive for breeding frog and toad species. Species documented during the surveys include spring peepers, grey treefrogs, green bullfrogs, American toads, and red-spotted newts. VANR (letter dated 10/15/04) states that the project area wetlands are ideal habitat, and may also support, additional salamander species as well as painted turtles.

Many species of waterfowl and shorebirds utilize the project area. Osprey, northern harrier, and red-tailed hawks are commonly observed around the reservoir. Great blue heron and belted kingfisher are also present. Abundant waterfowl include black ducks, Canada goose, wood ducks, common mergansers, mallards, and cormorants. Mergansers and mallard broods have been observed on the reservoir in recent years. Common loons were observed two times, but there was no evidence of nesting. Suitable loon nesting habitat exists in the north end of the reservoir. Bank swallows currently nest at three of the eroding bank areas along the reservoir shoreline. Surveys estimated the total population at approximately 200 breeding pairs.

Waterbury Reservoir currently has approximately 35 acres of shoreline emergent plant cover (4% of the total reservoir surface area at its average summer pool). The aquatic bed submergent communities cover about 14 acres (1.5 % of total reservoir surface area).

The existing emergent and submergent aquatic communities were eliminated by reservoir draining during the early 1980s for dam repairs. However, these communities have now become reestablished. Productivity is expected to continue to gradually increase within the limitations created by the river basin's natural limits: the reservoir edge design, light penetration through the littoral zone, and the need for flood control.

GMP performed a wetlands inventory assessment during 1997 and 1998. Approximately 137 acres of wetlands are associated with the Waterbury Reservoir (Table 3). The largest complex (95 acres) is north of Cotton Brook. Two adjacent wetlands totaling 19 acres are located in the bay at the mouth of Bryant Brook. The remaining wetlands are scattered around the reservoir. Wetland boundaries have not been delineated.

Most of the wetlands in the project area are either palustrine forested/shrub-scrub or shrub-scrub/emergent. Areas within and above the zone of reservoir fluctuation that support persistent wetland vegetation are classified palustrine. The hydrology that maintains palustrine wetlands is somewhat independent of the lacustrine system. Palustrine wetlands interconnected or bordering the lacustrine wetlands are inundated by surface water during seasonal floods or periods of high water; however, they are primarily maintained by high groundwater tables, precipitation, and surface runoff (Ried and Wood, 1976, cited by Cowardin et al., 1979).

Table 4: List of wetlands classification, acreage, and dominant plants for the Waterbury Project. (Source: license application, as modified by the staff)

Wetland Classification	Approximate Acres	Dominant Plants
Palustrine Emergent	1.5	Spotted Joe-Pye weed Water horsetail Blue-joint reedgrass Ostrich fern Reed canary-grass Wool-grass
Palustrine Shrub-Scrub/Emergent	53.5	Speckled alder Water horsetail Willow Narrow-leaf meadowsweet Reed canary-grass Wool-grass
Palustrine Forested/Shrub-Scrub	51.2	Red maple Yellow birch Black willow American elm Speckled alder Japanese knot-weed Willow Blue-joint reedgrass Early meadow-rue
Palustrine Forested	16.5	Red maple Yellow birch Trembling aspen American elm Speckled alder Spotted touch-me-not Blue-joint reedgrass

Wetland Classification	Approximate Acres	Dominant Plants
Lacustrine Littoral Aquatic Bed	14.0	Early meadow-rue Slender niaid Floating-leaf pondweed Broad-leaf arrowhead

b. Environmental Effects

GMP's proposed operating rule curve is similar to the baseline operating rule curve that exists now, with a winter drawdown down to approximately 550 feet. This rule curve assumes that Waterbury Reservoir would maintain a stable pool at a normal maximum elevation of 589.5 feet from Memorial Day to Labor Day.

Interior and VANR recommend that GMP operate the project to maintain a stable pool year-round. VANR would allow exceptions for flood control purposes. However, VANR comments in response to the EA (letter dated 12/2/04) that the benefits of the winter drawdown will be given further consideration and VANR may revise their drawdown recommendation. Interior and VANR are concerned that fluctuating reservoir levels from March 1 to May 25 may cause numerous potential impacts including: a reduction in the diversity, distribution, and abundance of wetlands and invertebrates; lack of aquatic vegetation; and reduction in overwintering area for wildlife and herptiles. Interior has compared bathymetric maps to the wetlands maps and comments that additional fringe wetlands habitat may exist at elevation 587 feet. The COE comments in response to the EA (letter dated 10/15/04) that aquatic bed and emergent wetland communities would expand under the VANR constant pool proposal compared to the winter drawdown alternative. The COE requests FERC to quantify the potential submerged aquatic plant habitat within the reservoir. ACOE further comments that unvegetated suitable habitat is an indicator of ongoing disturbance. VANR also comments that abundant reed canary-grass (in the wetlands at the north end of the reservoir) is an indicator species for ongoing disturbance, such as major water level fluctuations. VANR further comments that this species can dominate sites, reducing the plant and habitat diversity. Both Interior and VANR believe that more closely mimicking "a natural system" would improve wetland function and development of a littoral plant community. However, both agencies recognize that other project-related issues (e.g., recreation, limitations of project equipment such as turbine gate and spillway gate settings) influence project operations as well. Therefore they recommend the year-round stable-pond management.

Our Analysis

Wetlands within the project area provide a multitude of functions for a diverse assemblage of aquatic and terrestrial species. Plant growth in these shallow productive waters provides food for many species, and is the foundation of an entire food web. Juvenile species are given cover from predators here. Many fauna use this habitat for spawning. Wetlands also provide a suitable overwintering habitat, especially for invertebrates and herptiles.

Under the proposed action, wetlands would remain similar to existing conditions. The drawdown/refill timing coincides with the growing season of vascular and aquatic plants and may, in some instances, aid in the establishment and growth of some wetland plant species. This is accomplished by providing more stable water levels and avoiding potential drought conditions caused by an early drawdown.

The proposed winter drawdown of approximately 40 feet in the Waterbury Reservoir reduces the potential productivity of the wetlands and littoral zone habitats, specifically palustrine emergent wetlands and lacustrine littoral aquatic beds. These annual drawdowns can make it difficult to establish native aquatic plants for fish, wildlife, and waterfowl habitat in the fluctuation zone (Washington State, 2002). This may result in a decrease of aquatic plants in the wetlands and littoral zone.

As requested by the COE (2004), we have evaluated the potential aquatic plant habitat within the reservoir. GMP's studies in 1997-1998 identified 14 acres of vegetated littoral aquatic bed habitat. From Table 1 and Figures 1-6 of GMP's Response to Additional Information Request (filed 1/30/01), there are approximately 75 acres of available submerged habitat (from elevation 589.5 down to 580 feet). This available habitat in the Waterbury reservoir is limited to the North and East arms. In general, aquatic plant growth is limited to approximately the upper 10 feet of the water column, due to water clarity, light penetration, and expected water depth habitat of aquatic plants found in the Waterbury reservoir.[9] The development of aquatic vegetation also depends on many additional factors including substrate type, availability of nutrients, water chemistry, and disturbances (e.g. boating traffic and wind). Therefore it would not be expected for the entire 75 acres to become vegetated, even under a constant pool management operation. As previously stated, we recognize that the annual winter drawdown may prevent the establishment of some aquatic plants and further limit vegetation. Scour and exposed freezing substrate contributes to unvegetated shallow

[9] See License Application, Appendix G - Water Level Management Report and http://www.ecy.wa.gov/.

water areas. However, the 1980-1986 reservoir drawdown must be taken into consideration, as the establishment of aquatic vegetation is also recovering from this period. Table E(3)-15 of the License Application lists the areas of expected vegetative development, with expansions of aquatic vegetation expected in the North and East arms of the reservoir.

It is possible that additional fringe wetlands may develop at elevation 587 feet compared to current project operations (elevation 589.5 feet) , as suggested by Interior (2002). The current wetlands boundaries have not been delineated, and therefore wetlands maps are not entirely accurate. Overlaying the current wetlands information on the bathymetry maps only provides an estimation concerning the development of additional wetlands at different water elevations. Additionally, the majority of wetlands in the Waterbury Project area are palustrine (Table 4), and therefore are somewhat independent of the water level.

We recognize that Japanese knotweed and reed canary-grass are fast-growing perennial grasses that can outcompete native species. Furthermore, these species may aggressively spread in disturbed areas (WDNR, 2004), limiting the diversity of the plant community. In the project area, reed canary-grass is located in the Palustrine Emergent and Palustrine Shrub-scrub/Emergent wetlands (although in both classification areas, five other plant species are present as well). Japanese knotweed is currently well established upstream of the reservoir, and is present in various locations at the north end of the reservoir. The development of a management plan to control these species would benefit plant and wildlife diversity.

Winter drawdowns also can affect terrestrial species by reducing the available area where wildlife can successfully overwinter. Specifically, the exposed sediments in the drawdown zone limit successful wintering habitat for herptiles because of desiccation and freezing. However, the herptile surveys conducted for this relicense showed a diversity of species, with 4 frog (including abundant spring peepers), 1 toad, and 1 salamander species recorded.

In conclusion, the existing wetlands associated with the Waterbury Reservoir are still productive under the current operating rule curve. Although the winter drawdown may be limiting the potential expansion of the wetlands community, a diverse wetlands plant and wildlife community exists. Since the negative impact from the early 1980s drawdown for dam repairs, diverse wetland plant communities have become established in all wetland classification areas. Furthermore, the herptile surveys conducted for this relicense showed a diversity of species.

c. Unavoidable Adverse Impacts

The proposed winter drawdown of the Waterbury Reservoir reduces the potential establishment and productivity of the wetlands and littoral zone habitats. Winter drawdowns also affect terrestrial species by reducing the available area where wildlife can successfully overwinter.

Our recommendations for terrestrial resources are found in Section VII, (Comprehensive Development and Recommended Alternative).

5. Cultural Resources

a. Affected Environment

Definition of Cultural Resources, Historic Properties, and Area of Potential Effects

Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA), requires that the Commission evaluate the potential effects on properties listed or eligible for listing in the National Register of Historic Places (National Register). Such properties listed or eligible for listing in the National Register are called historic properties. In this document we also use the term "cultural resource" for properties that have not been evaluated for eligibility for listing in the National Register. Cultural resources represent things, structures, places, or archeological sites that can be either prehistoric or historic in origin. In most cases, cultural resources less than 50 years old are not considered historic. Section 106 also requires that the Commission seek concurrence with the State Historic Preservation Officer on any finding involving effects or no effects to historic properties, and allow the Advisory Council on Historic Preservation (Council) an opportunity to comment on any finding of effects to historic properties. If Native American properties have been identified, Section 106 also requires that the Commission consult with interested Indian Tribes that might attach religious or cultural significance to such properties.

In this case, the Commission must take into account whether any historic property could be affected by a proposed new license within the project's area of potential effects (APE), and allow the Council an opportunity to comment prior to issuance of any new license for the project. Potential historic properties that might be located within the project's APE would include some or all of the project facilities in addition to the Waterbury Dam.

The APE for the Waterbury Hydroelectric Project includes the adjacent areas around the Waterbury powerhouse, penstock, transmission lines from the powerhouse to the substation, Waterbury Dam and Reservoir, and in other areas where project-related effects could impact historic properties. An approximate 100-foot buffer zone around project facilities roughly comprises the APE in this part of the Project, while the APE around the Waterbury Reservoir consists of a 670-acre zone between the 520-foot and 590-foot msl contour line.

Culture History

Prehistoric occupations in the general area range back to the Paleo-Indian Period (ca. 9500 - 7000 B.C.), through the Archaic (ca. 7000 - 900 B.C.), and Woodland Period (900 BC - A.D. 1600) and the Contact Period (Frink et al. 1998:15; Cherau et al. 2003:42-64). At the time of European contact in the seventeenth century, eastern Algonquian speakers affiliated to the Western Abenaki were the principal occupants of the Winooski River Drainage in the vicinity of the project area. The first contact with the Western Abenaki probably coincided with the arrival of the French explorer Samuel de Champlain in 1609 (Cherau et al. 2003:63).

Groups during the Paleo-Indian and Archaic Periods were composed of small bands of hunter gatherers who practiced a broad-based pattern of subsistence, gathering various food resources, depending on location and seasonality. The archeological record shows the predominate use of chipped and ground stone tools during these early periods, and are characterized by distinctive types of spear points which can be used to further refine the periods into smaller units based on time and spatial distribution. During the Woodland Period and at the time of European contact, local populations developed into larger aggregates of semi-sedentary (early) to fully sedentary communities (late) and practiced a mixed village economy depending on both wild and domesticated food resources. The development of the bow and arrow and use of pottery become the distinctive archeological hallmarks for these later periods, and based on distinctive arrow points and pot sherds, these periods can also be refined into smaller spatial and temporal units. European artifacts (principally those passed on by the French and English) also demarcate Contact Period archeological sites from those dating to the earlier Woodland Period.

At the time of European contact, the Western Abenaki were living in sizable villages and were cultivating large tracks of land for maize (corn) along the Mississiquoi and other principal waterways in Vermont (Hill 1995; Cherau et al. 2003:62). The Little River in the Project vicinity was more of a hinterland area, and probably never supported large groups of the Western Abenaki. Due to the influx of European diseases and

increased predation by Iroquoian groups and the English, the Western Abenaki in the more populated areas collapsed into the Abenaki Confederacy that was created in 1670.

The closest known prehistoric cultural resources to the project area are located downriver from the Waterbury Dam near the confluence of the Winooski and Little River in the Town of Duxbury (Frink et al. 1998:17). These occupations consist of a cave and rock shelter site and have been dated to the Woodland and Contact Periods. Other Woodland and Archaic Period sites have been located in the Town of Bolton.

The former town site of Waterbury was established in 1763 as a chartered land grant from King George III and was settled shortly thereafter in the 1780s (Frink 1998:20-21; Cherau et al. 2003:66-68). At the end of the 1700s, the town had a population of 644 and was made up of farmers, trappers, blacksmiths, tavern-keepers, and physicians. The local industry of the surrounding area was essentially based on farming with an emphasis on the growing of corn and other grains, in addition to maple sugaring and lumbering. The project area was located in the vicinity known as the Little River district of Waterbury, and was initially settled in the 1790s (Gove 1973; Cherau 2003:71-77). Since the Little River district was considered less desirable and was more hilly and rugged than the area around the town of Waterbury, substantial settlements did not take place there until the 1820s and 1830s. However, recognizing the early potential for hydro-mechanical power, a saw mill was built in the 1820s at the former 25-foot falls site which is presently covered by the Waterbury Dam. The saw mill continued to be in operation until 1930 when it was finally torn down to make way for the construction of the Waterbury Dam. Other saw and grist mills were established in the Little River district during the mid-1800s. Trade also became more prevalent in the area at this time by the development of the River Road which facilitated the hauling of freight between the towns of Stowe and Waterbury. Aside from the earlier Anglo-American families, Irish immigrants from the railroad labor industry settled the Little River district after the Civil War and such farming communities as Stevenson Brook, River Road, Woodward Hill, and Cotton Brook began to prosper as a result (Gove 1973; Frink et al. 1998:21, Cherau et al. 2003:71-78). At the same time, railroads made their way into the area connecting these communities to the larger markets in the Northeast which resulted in many of the farms intensifying their yields and specializing in dairying and orchard crops. Relative to Waterbury, the local economy was marginally successful in the Little River district, but it continued to develop into the last quarter of the nineteenth century until lands became exhausted due to over cropping and competition stemming from larger Midwestern farms.

By the beginning of the 1900s, the local area experienced a significant episode of outward migration, which in turn, created an opportunity for GMP to purchase thousands of acres of land as early as 1921 for the potential development of hydro-electric power. The Little River farming communities struggled along for another couple of decades until

the great and catastrophic flood of 1927. Farming communities up and down the Little and Winooski Rivers were devastated by the flood, leaving many Dead and more than13.5 million dollars in damages to farms and other local industries (Merrill 1981; Frink et al. 1998:21; Cherau 2003:78). As a result, the State of Vermont purchased approximately 10,000 acres of land from GMP in the Little River district, and under the supervision of the US Army Corps of Engineers, built the Waterbury Dam at the 25-foot falls site in order to stop any future flood from occurring in this area. The dam was built between 1933 and 1938, using 59.4 million cubic feet of sediment from the adjacent river and was considered the largest earthenwork dam in the country at the time (Frink et al. 1998:21). The dam was constructed by an army of 2000 laborers provided through the Civilian Conservation Corps (CCC). During dam construction, Camp Charles M. Smith was established and was the largest single CCC camp in the State of Vermont (Frink et al. 1998:22; Cherau and Heitert 2002:32-35). When the dam was completed in 1938, approximately 850 acres of land was seasonally inundated along the Little River, covering many of the farmsteads, houses, and other related elements of the communities in the Little River district. A majority of these structures within the impoundment had been demolished prior to inundation.

In the beginning of the 1950s, GMP decided to install a hydro-electric power facility at the Waterbury Dam, and it was completed in 1953. The Waterbury Hydroelectric Project includes a powerhouse, intake structure and penstock, substation, and transmission lines (leading from the powerhouse to substation). The powerhouse consists of a reinforced concrete structure approximately 58 feet long and 35 feet wide and contains a single vertical Francis turbine. The intake structure consists of a concrete gate tower above the Waterbury Dam and a submerged concrete conduit which leads from the dam to the powerhouse. The end of the conduit bifurcates into two 54-inch-diameter, 205-foot-long steel penstocks which connect to the powerhouse and force water into the turbine. The substation consists of a 20-x-34-foot chain-link fenced enclosure that contains a steel framed step-up transformer and outdoor switchyard.

Cultural Resources Investigations

As part of their relicensing requirements, GMP contracted cultural resource professionals in 1998 to do a cultural resources investigation and Phase 1A archeological sensitivity study within the Project's APE (Frink et al. 1998). Based on additional information requests from the Commission, and as a result of proposed repairs to the Waterbury Dam and drawdown of the Waterbury Reservoir, GMP contracted in 2001 and 2002: (1) a historic and photographic documentation study of the Waterbury Dam (Doherty and Emidy 2001); (2) an intensive archeological survey in proposed dam reconstruction areas around Waterbury Dam (Cherau and Heitert 2002); and (3) a

historic/archeological mapping and testing study around the drawdown area of the Waterbury Reservoir (Cherau et al. 2003).

In the 1998 cultural resources investigations, archival research was done to identify the locations and characteristics of known and probable archeological sites within the project's APE (Frink 1998:17). Portions of the APE were also field inspected during a one day visit by the contract principal investigator. In the 2001 investigations involving the Waterbury Dam, the dam structure and associated elements were photographed and drawn, accompanied with an extensive archival study of the dam, its construction history, and overall historic context (Doherty and Emidy 2001:4-5). The 2001 archeological investigations around the dam involved an intensive survey and subsurface probing of an eight acre area adjacent to the southern embankment of the dam (Cherau and Heitert 2002:5-8). A total of 15 50-x-50 cm test pits were excavated in the eight acre area. There was also an assessment of whether any of the proposed dam reconstruction activity would affect the National Register-listed CCC Camp Smith archeological district that was located approximately 850 feet to the south of the dam. The 2002 historic/archeological mapping and testing study within the Waterbury Reservoir entailed an archival map review and systematic pedestrian survey of the temporary drawdown zone around the reservoir between 520 and 590 feet msl (Cherau et al. 2003:8-33). The total area inventoried around the reservoir was 670 acres and included 250 acres between the lower 520 and 550-foot msl zone, and 420 acres between the upper 550 and 590-foot msl zone (Cherau et al. 2003:31). This study also included an attempt to relocate and map known inundated and partially inundated homesteads and other related historic cultural resources that had been identified in the 1998 Phase 1A archeological sensitivity study. Subsurface probes were also employed to help identify existing historic and potential prehistoric archeological sites in moderate to high sensitivity areas within the Waterbury Reservoir APE. A total of 146 50-x-50 cm test pits were dug as a result (Cherau et al. 2003:29).

Cultural Resources Located within the Area of Potential Effect and Their Eligibility for Inclusion in the NRHP

No prehistoric archeological sites, or other Native American properties were located within the Project APE (Cherau and Heitert 2002:46; Cherau et al. 2003:161). Probable causes for the lack of prehistoric sites or Native American properties may be principally due to the massive ground disturbing activities associated with construction of the Waterbury Dam which may have obliterated many of these kinds of sites, along with early historic sites (Cherau et al. 2003:159).

Of the predicted 84 historic archeological sites based on the phase 1A archeological survey and subsequent map and archival research, 26 were relocated south of the Waterbury Dam and eight were located above the 590-foot msl contour line

(Cherau and Heitert 2003:29). The remaining 50 historic sites were located within the Waterbury Reservoir APE. Historic sites located within the APE consisted mostly of nineteenth century houses, farmsteads, schools, sawmills, churches, and bridges associated with the farming communities of the Little River district (Cherau et al. 2003:85-135). Due to the effects of erosion, demolition of sites as a result of the construction of the Waterbury Dam, and inundation of the reservoir, none of the 50 historic sites located within the APE had integrity and were considered ineligible for the National Register (Cherau et al. 2003:162-163). Other than the foundations of structures, remains of stone fences, trestles from bridges and barns, and moderate amounts of associated artifacts, very little remained on these historic sites that would warrant any additional archival or archeological study.

The only National Register eligible cultural resources that have been located within the APE are the 1930s Waterbury Dam (including the gatehouse, conduit house, and valve house) and associated 1950s Waterbury Hydropower Project facilities, including the powerhouse, intake structure, penstock, and substation (Waterbury Hydroelectric Project National Register registration form).[10] The Waterbury Dam is considered eligible for the National Register due to its association with the famous and catastrophic flood of 1927 and has been recognized as one of the largest earth-fill dams in New England (Doherty and Emidy 2001:27). The Waterbury Hydroelectric Project powerhouse, intake structure, penstock, and substation have recently reached the 50-year-old threshold, qualifying them for being potential historic properties. They have also recently been considered eligible for the National Register due to their importance in providing hydro-electricity to the Waterbury region as a last-generation unit in the twentieth century and represent a good example of a retrofitted hydro-electric power facility on an existing flood control dam in New England.

Our Analysis

In GMP's license application, they propose to enter into an agreement with the Vermont Division for Historic Preservation/State Historic Preservation Office (VDHP/SHPO) and develop a Cultural Resources Management Plan that would preserve

[10] For the purposes of this relicensing process, National Register-eligible structures associated with the Waterbury Dam--including the dam--have been combined with the National Register-eligible facilities associated with the Waterbury Hydropower Power Project under a historic theme involving the development of hydro-electric power. Associated National Register-eligible structures with the dam and hydro facility have been named as a whole as the 'Waterbury Hydroelectric Project'.

and protect identified historic properties within the Project's APE for the term of a new license.

The intensive archeological investigations on the south side of the Waterbury Dam concluded that the National Register-listed CCC Camp Smith archeological district would not be affected by any aspect of the dam reconstruction activities (Cherau and Heitert 2002:46), and this archeological district would not be affected by project-related activities associated with a new license. No prehistoric archeological sites or Native American properties presently exist within the Project's APE, and none of the existing historic archeological sites located within the Waterbury Reservoir drawdown area are eligible for the National Register.

Our recommendations for a Historic Properties Management Plan (HPMP) [11] are found in Section VII, (Comprehensive Development and Recommended Alternative).

b. Unavoidable Adverse Effects

With the implementation of a HPMP over the term of a new license, all potential adverse effects to historic properties should be avoided.

6. Recreational Resources

a. Affected Environment

The Waterbury Project offers year-round recreational opportunities to the public, and is an integral part of the recreational resources of central Vermont. Between Memorial Day and Labor Day, GMP maintains a stable reservoir pool of 589.5 feet (+/- 1 foot) msl to support popular reservoir activities such as boating and fishing[12]. During the winter, snowmobiling, and ice fishing occur on or near the reservoir. Nearly all the lands surrounding the Project and the reservoir are owned by Vermont, and are managed either as a State Forest (Mt. Mansfield State Forest) or as State Parks.

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[11] The Commission and the Advisory Council on Historic Preservation have developed "Guidelines for the Development of Historic Properties Management Plans for FERC Hydroelectric Projects" that went into affect on January 11, 2002. We and the Council have agreed to use the term "HPMP" instead of the "CRMP" to denote such management plans intended for the purposes of preserving, protecting, or mitigating the effects to historic properties.

[12] Fishing is most popular in the early spring and late fall.

Waterbury Reservoir and Surrounding Lands

The majority of the recreational use[13] in the vicinity of the project occurs on or adjacent to the Waterbury reservoir. No formal recreational facilities are provided by GMP. The Vermont Department of Forests, Parks, and Recreation (VDFPR), Vermont Department of Environmental Conservation (VDEC), and the town of Waterbury own or operate numerous recreational facilities along the reservoir and in the vicinity of the project. These facilities provide year round recreational opportunities, such as camping, boating, and cross-country skiing.

The VDFPR manages two state parks, the Little River State Park and Waterbury Center State Park, located on the west and east side of the reservoir, respectively. The Little River State Park, open from mid-May to Columbus Day, provides camp sites for RVs and tents; hiking trails; a swim area; and a boat launch available to park campers. Waterbury Center State Park, a day-use park open from mid-May to Labor Day weekend, provides a swim area, a boat launch, and picnic facilities. Both boat launches provide boat trailer parking and charge a fee for use.

Along the reservoir, and within the Mt. Mansfield State Forest, three additional boat launches and 29 primitive campsites are provided. Two of the boat launches, located adjacent to the dam and at the Blush Hill site, southeast, of the dam, provide boat trailer parking. A car-top boat launch is located at the north end of the reservoir at the Moscow Access Site. No fee is assessed to launch a boat at these sites.

Water-skiing opportunities are also available. Two slalom ski courses have been designated on the reservoir; one is permanent, while the buoys for the other can be lowered when not in use.

Little River

The Little River below the Waterbury Dam to the confluence with the Winooski River offers local canoeing/kayaking and angling opportunities. Hiking trails from the Little River Road provide trout anglers access to the river, and beginner and intermediate boaters take advantage of flatwater and Class I/II whitewater.

[13] The recreation usage of the reservoir and the Little River has been estimated at 66,078 and 75,195 recreation user days per year, respectively.

b. Environmental Effects

Project Operations

GMP proposes to continue maintaining a stable reservoir level during the summer recreational season. Between Memorial Day and Labor Day the reservoir would be maintained at 589.5 feet msl (+/- 1 foot). From Labor Day to mid-December, GMP proposes a target reservoir elevation of 589.5 feet msl with the option of drawing the reservoir to elevation 580.1 for peaking generation, and from January 1 to March 1, a winter drawdown to 550.1 feet msl has been proposed.

The VANR recommends that the Waterbury Project be operated in a run-of-river mode with a target reservoir elevation of 589.5 feet msl. The VANR stated that while the operation mode would result in an increase in the winter/spring flood magnitude, the year-round pool elevation would reduced shoreline erosion and would benefit recreational use.

The Vermont Water Skiers Association (VWSA) requests that the reservoir be maintained between 589.0 and 590.0 feet msl from May 1 until the end of October, except for heavy rains or floods, or for other necessary events. The VWSA stated that the reservoir levels are necessary because the Blush Hill boat ramp is unusable if the reservoir level drops more than one foot and the boat launch at the Waterbury Center State Park is closed after Labor Day. Furthermore, the VWSA stated when the reservoir levels deviate from the target levels, safety problems may occur.

Our Analysis

Currently, GMP operates the Waterbury Project as a peaking project, with a winter drawdown to buffer the spring floods. VANR's proposal to operate the Waterbury Project as run-of-river with a target elevation of 589.5 feet msl would create a stable reservoir year-round. A more stable reservoir would enhance ice fishing opportunities and improve the clarity of the water, which would improve the aesthetics of the area; however, a stable reservoir would also result in an increase in the winter/spring flood magnitude and frequency, which would adversely affect the recreational sites around the reservoir.

The VANR's proposal would result in the beach at the Waterbury Center State Park being flooded once every two years, inundating an additional 30 to 60 acres of shoreline. The VANR's proposal would also result in the inundation of the boat launching facilities at Blush Hill, the Waterbury Center State Park, and the Little River once every ten years inundating an additional 37 to 52 acres of shoreline (letter from Thomas Sullivan, Gomez and Sullivan Engineers. P.C., January 8, 2003). Also, VANR’s

proposal would increase the frequency of flooding of the newly constructed composting toilet and concession buildings.

The VANR request to maintain the reservoir as a run-of-river project would adversely affect whitewater boating opportunities downstream in the Little River. As described below in the *Whitewater and Boating* section, GMP evaluated the optimum flows needed for whitewater boating. As part of the study, a flow release of 65 cfs was chosen to represent unregulated late summer flows. At this flow, participants were required to evaluate the 65 cfs flow from the shore, because all agreed that it was not a boatable flow release. A minimum of 300 cfs was needed for whitewater boaters to safely paddle the river.

The VANR proposal does not stipulate specific flows, but states that when the inflow exceeds 300 cfs, boatable flows would occur in the Little River. Based on the flow estimates provided in the *Little River Instream Flow Study, Additional Information for Macroinvertebrates,* VANR's proposal would result in boatable flows only between March and May. During the summer and fall, flows are estimated to be below 200 cfs. The Little River currently is used as a local resource for beginner boaters to develop their whitewater techniques. With the implementation of the VANR's proposal, whitewater instructors would be unable to use the river as a teaching resource during most of the boating season.

The VWSA requested that the summer reservoir level be altered and extended to until the end of October. The VWSA believe that current summer reservoir level inhibit access to the Blush Hill boat ramp, and their proposed reservoir levels and season extension would enable water skiers to access boat launches and water slalom ski courses after Labor Day. As part of a Commission staff request, GMP developed littoral zone maps to determine how the fluctuations in water levels would affect recreational sites and boat launches located at the Waterbury Reservoir. GMP also conducted a recreation site inventory to, among other items, evaluate the accessibility of boat ramps and the water ski courses in the Waterbury Reservoir.

Access to the boat ramps around the reservoir depend on the water level of the reservoir. The boat ramps were designed for optimum use when the reservoir level is at 589.5 feet msl (+/- 1 foot). Of the four boat ramps along the reservoir, only the Waterbury Dam ramp is unsafe to launch a boat if the reservoir level is not kept at the GMP's proposed summer reservoir level[14]. However, launching from the Blush Hill boat

[14] Although unsafe, launching had been observed at the Waterbury Dam when the reservoir was approximately 40 feet below the summer reservoir level.

ramp is safe until the reservoir elevation reaches elevation 586 feet msl and the Little River boat ramp is safe to an elevation of 575 feet msl.

Also, GMP proposes to maintain the reservoir target elevation at 589.5 feet msl from Labor Day to mid-December. At this target level, the two water ski slalom courses are useable until the end of October. In addition, the Blush Hill boat ramp is open year round, weather permitting, and the Little River boat ramp is accessible until Columbus Day.

Our recommendations for Project Operations are found in Section VII, (Comprehensive Development and Recommended Alternative).

Waterbury Reservoir

As a result of discussions with the VDFPR and the VDEC, GMP proposes to improve three of the five boat facilities surrounding the reservoir. At the boat launch near the dam, the parking lot would be resurfaced with gravel or a similar material, and a concrete boat ramp would replace the gravel ramp. The Blush Hill boat ramp would also have its gravel ramp replaced with the concrete boat ramp. In addition, GMP proposes to consult with the town of Waterbury and the state of Vermont to provide additional off-site parking at the end of Blush Hill Road. At the Moscow canoe access site, erosion of the shoreline is a concern. To address the problem, GMP proposes to improve the access site by stabilizing/hardening the surrounding shoreline banks.

The VDFPR and the VDEC also requested that GMP install sanitation facilities near the boat launch near the dam. The agencies indicated that a phased implementation of sanitation facilities would be acceptable; starting with porta-potties and as the usage of the area increases, permanent sanitation facilities should be installed.

At the request of the VDFPR, GMP proposes to provide an ADA fishing platform. The site and design of the platform would be finalized in consultation with the VDFPR and the VDEC.

Our Analysis

Boating is the number one non-park activity on the reservoir, and the formalization of the boat ramps would increase the ease by which boats are launched and retrieved. Also in many areas around the reservoir erosion is occurring. Concrete ramps would inhibit the erosion that may occur if the integrity of the gravel ramps were compromised. The resurfacing with concrete would also reduce the overall cost of operation and maintenance associated with the boat ramps.

By resurfacing the parking lot and installing rubber water-bars, the runoff water from the parking lot would be diverted from the reservoir, thus decreasing erosion in the lake. Also rubber water-bars would help prevent the parking lot gravel from entering the reservoir.

At the Blush Hill boat ramp, two parking facilities exist to accommodate car and trailer parking. However, one of the facilities has been blocked off by the state because recreationists were camping illegally in the lot. The remaining lot, which is maintained by the town of Waterbury, is used as a school bus turn around. While this parking lot is not exceeding capacity, we acknowledge that with the increase in parking, it is increasingly difficult for buses to turn around.

The Moscow canoe access is a compacted earthen site composed of erodible soils. The site is heavily used by recreationists, and during the peak recreational times, can be close to exceeding its capacity. The site, which is naturally prone to erosion, is experiencing an acceleration of erosion due to the excessive foot traffic.

The Blush Hill boat launch, which is used throughout the boating season, lacks restroom facilities, and there aren't any facilities within walking distance of the boat launch. The installation of restroom facilities at the boat launch would benefit both boaters and anglers who fish from the bank.

Fishing is second most popular activity on the reservoir, and to accommodate disabled recreationists, the VDFPR requested that GMP provide an ADA fishing platform somewhere in the reservoir. No information was provided that indicated that there was a demand for ADA fishing facilities.

Our recommendations for the recreation in the vicinity of the Waterbury Reservoir are found in Section VII, (Comprehensive Development and Recommended Alternative).

Little River (Below Waterbury Dam) Access

The access road to the Waterbury powerhouse is gated and locked, which inhibits the public from accessing the upper section of the Little River below the powerhouse. To increase the access to the upper section, the VDEC and VDFPR requested that access road be kept opened during the summer recreation season and that parking be provided at the access area. The VDFPR also indicated that state employees could supervise the access area and provide day-to-day operations and maintenance.

To address the request, GMP proposes to install a new gate closer to the powerhouse and to provide roadside parking for 4 to 6 cars near the proposed gate. GMP also proposes to enhance public access to the Little River by stabilizing the existing trails and the associated access points used by both anglers and boaters along the Upper, Middle (gorge), and lower sections of the Little River.

Our Analysis

The entire access road to the powerhouse is locked and gated throughout May to October to prevent abuse and vandalism of the powerhouse and relevant equipment. However, this situation severely limits public access to the uppermost section of the Little River. Removal of the current gate to a site approximately 520 to 560 feet further in would provide better access to the Upper section of the Little River for both boaters and anglers, while still deterring vandalism and abuse of the powerhouse.

The development of a parking area would also benefit recreationists. There are many informal access sites along the Little River, but few provide a parking area due to the terrain of the area or lack of space. With a formalized parking area, recreationists would not be required to park a far distance from the river.

Although there are approximately seven access points to the Little River, most of these access sites are unimproved and consist of little more than footpaths to the river. The terrain surrounding the Little River contains many steep areas with soft banks, and with the associated foot traffic, the access points and trails are prone to erosion. Hardening the trails and access points would reduce the potential for continuing erosion. In addition, improving the trails and access points may minimize informal foot traffic to the river, which could further reduce the overall potential for erosion along the Little River.

Our recommendations for the access to the Little River are found in Section VII, (Comprehensive Development and Recommended Alternative).

Whitewater and Boating

GMP proposes to enhance the boating opportunities in the Little River by expanding its existing flow phone system to include the Waterbury Project and to improve the existing warning signage. Whitewater boating releases between 400 cfs and 590 cfs are also proposed by GMP. Though the proposed whitewater boating releases, developed in consultation with the American Whitewater, New England Flow, Vermont Paddlers Club, and Friends of the Little River (Whitewater Parties), have not been finalized, the following is the general agreement between GMP and the Whitewater

Parties: (1) the release schedule would be in effect from June 1 to September 15; (2) provide releases Monday through Friday from 4 p.m. to 8 p.m., dependent upon lake levels; (3) provide weekend flows (eight Saturdays and seven Sundays) from 11 to 3 p.m., dependent on lake levels; and (4) provide boating flows for prescheduled events throughout the boating season.

To provide access to the Lower section of the Little River, the VDEC and VDFPR requested a formal take-out facility. In response to the request, GMP proposes to construct an additional take-out facility and parking lot for the Lower section of the Little River, in the River Ford area, near the Little River Road. The proposed facility would be located on state-owned lands, and the gravel parking area would provide parking for 6 to 8 vehicles.

Our Analysis

During the weekdays, flow releases from the project vary from minimum releases of 10 to 15, to generating flows which range between 430 to 590 cfs. Generating flows typically occur between 7 a.m. to 12 p.m. and 6 p.m. to 10 p.m. Generating flows are usually not released during the weekends.

In response to a Commission staff request, GMP conducted a whitewater boating evaluation on October 20, 2000, to determine the effects of flow releases at 65, 300, 415, and 525 cfs for whitewater opportunities on the Little River. Participants[15] of the study were asked to rate the suitability of for the Upper, Middle (gorge), and Lower sections of the Little River.

Based on the study and the responses of the participants, the optimum flow for canoeists was determined to be 525 cfs, while kayakers preferred 525 cfs and 415 cfs. Both kayakers and canoeists determined that flow of 300 cfs was needed to provide minimum whitewater opportunities on the Little River.

Under GMP's proposed project operations, the proposed whitewater boating release schedule would benefit boaters. Except during maintenance drawdowns, boaters currently are able to experience whitewater conditions only during the week. The proposed flow release schedule would ensure that local boaters would have more reliable flows in the evenings during the weekdays, and would provide whitewater recreation on the Little River during the weekends. The proposed flow releases would also benefit

[15] The nine participants included representatives from American Whitewater, New England FLOW, and a commercial whitewater rafting outfit.

novices by providing an environment for instructional boating opportunities, while more advanced boaters would experience more challenging whitewater from the higher flows.

Under VANR's proposal, the whitewater boating release schedule could not be implemented. During the summer and fall, the flows are estimated to be below 200 cfs, which are not boatable.

The major problem for whitewater recreationists is knowing when flows are high enough to warrant paddling in the Little River. GMP's proposed expansion of the flow phone system would ensure that information is provided on the timing and amount of known spillage events.

Improving the existing warning signage would reduce the risks to boaters. A weir located downstream of the snowmobile bridge is not visible from the last available take-out. A warning sign would alert paddlers to exit at the take-out. Also, the proposed flow release schedule may increase the amount of whitewater recreationists who have never paddled the Little River, and therefore are not familiar with the layout, terrain, and hazards of the Little River. Warning signage would alert them to the dangers ahead.

The proposed take-out facility and parking area in the River Ford area, near the Little River Road would provide access to the lower section of the Little River. The facility would benefit whitewater recreationists because it would provide paddlers with a final take-out before the Little River converges with the Winooski River. The proposed facility would also provide an additional access to the Lower section for anglers.

Our recommendations for whitewater and boating are found in Section VII, (Comprehensive Development and Recommended Alternative).

Whitewater Enhancements

Mr. Ray Ingram, a local citizen, requested that GMP enhance the whitewater opportunities of Upper section of the Little River. The requested enhancements include placing boulders in the river and suspending support wire across the river to hang slalom course marker to increase the whitewater level of difficulty. Mr. Ingram also suggested that a put-in site be constructed in the Middle (gorge) section of the Little River.

Our Analysis

The Upper section of the Little River consists of flatwater and quickwater, along with some areas of Class I and Class II whitewater, and has traditionally attracted

beginner and intermediate whitewater recreationists. The Upper and Lower sections of the river are also used to by local commercial outfitters for instructional boating clinics.

When GMP conducted the whitewater boating evaluation on October 20, 2000, they also asked the participants to evaluate the whitewater potential by commenting on the suitability of instruction, safety, and difficulty of the river. Both canoeist and kayaker participants stated the Upper section of the Little River provided the necessary environment for beginner whitewater instruction and was suitable for casual boating for the family. The participants also rated the river as having a local and statewide significance for beginner whitewater instruction and training.

The installation of boulders and suspending support wires for slaloms courses may increase the difficulty of the Upper section of the Little River. However, if local recreationists desire more challenging whitewater, the Middle (gorge) section of the Little River provides whitewater recreationists with Class II whitewater (i.e., eddies and medium-sized waves). Local whitewater recreationists could put-in at the Upper section of the river to take advantage of the more challenging stretch of the river. Also, within a 30-mile radius of Waterbury, Burlington, Stowe, Montpelier, Huntington, and Morristown, Vermont, there are 36 whitewater boating rivers that have Class II to Class IV whitewater ratings. Most of these rivers have substantially longer whitewater reaches than the Little River, provide both formal and informal access, and overall offer more challenging whitewater opportunities than the Little River.

Mr. Ingram also requested a put-in facility be constructed so that he could gain access to the last set of rapids at the lower end of the Middle (gorge) section of the river. The VDEC and VDFPR both requested that this area not be improved. The slope of the area is very steep and the proposed put-in site would be located on a turn of the Little River Road where road expansion was limited. The state agencies also indicated that the proposed site would be located on private lands.

An alternative to Mr. Ingram's proposal currently exists. There is an existing put-in/take-out site located approximately 380 feet downstream of the proposed put-in site requested by Mr. Ingram. Evidence at the site indicates that the put-in/take-out site receives substantial use, and there is existing access to the river from Little River Road. Boaters wishing to use the whitewater resources could put-in at the existing site and access the rapids upstream through walking along the riverbank and paddling.

Our recommendations for whitewater enhancements are found in Section VII, (Comprehensive Development and Recommended Alternative).

Recreational Management Plan

The VANR recommended that GMP develop a recreational management plan (RMP) for the Waterbury Project. The VANR requested that the plan be subject to their approval prior to implementation.

Our Analysis

The proposed flow releases for whitewater boating and when the special whitewater events would occur have not been finalized. Also, GMP has not provided a schedule as to when the existing warning signage would be improved and when the existing flow phone system would be expanded to include the Waterbury Project. The development of a recreation plan would ensure that all of these items become finalized or implemented. The development of a RMP would allow the VANR, VDEC, VDFPR, and the Whitewater Parties to provide suggestions and input.

Our recommendations for a RMP are found in Section VII, (Comprehensive Development and Recommended Alternative).

c. Unavoidable Adverse Effects

No unavoidable adverse effects to recreation have been identified.

d. Cumulative Effects

Whitewater boating on the Little River is directly affected by the operation of the Waterbury Project. The proposed whitewater flow releases would establish flows during the weekends and provide more reliable flows during the weekdays. The increased whitewater flows would result in a cumulative benefit to local and regional whitewater training opportunities. The additional recreational enhancements such as hardening the trails along Little River and improving the boat launches surrounding the reservoir would increase the opportunities for the public, anglers, and boaters to access the reservoir, Little River and surrounding lands.

VI. DEVELOPMENTAL ANALYSIS

In this section, we estimate the economic benefits of the project, the cost of various environmental measures, and the effects on project economics of implementing these measures.

Approach to Economic Analysis

To calculate the economic benefits of continuing to operate a utility-owned project, we compare the project costs with the cost of obtaining the same amount of capacity and energy from an alternative generating source. Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in Mead Corporation, Publishing Paper Division,[16] the Commission employs an analysis that uses current costs to compare the costs of the project and likely alternative power with no forecasts concerning potential future inflation, escalation, or deflation beyond the license issuance date. The Commission's economic analysis provides a general estimate of the potential power benefits and costs of a project and reasonable alternatives to project power. The estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license.

Environmental measures proposed by GMP, agencies, and staff could affect project economics through costs (capital, operation and maintenance, plan development, etc.) or effects on power generation.

For any alternative, a positive net annual power benefit indicates how much less project power would cost than power from an alternative source; a negative net annual benefit indicates how much more project power would cost than power from an alternative source.

We base our analysis of the project's benefits on the following economic information and parameters – common to all alternatives considered in this FEA – shown in Table 5.

Table 5: Parameters for economic analysis of the Waterbury Hydroelectric Project. (Source: Staff and GMP)

Economic Parameter	**Value**
Net investment	$1,659,464
O&M	$137,370/year
Period of analysis	30 years
Term of financing	20 years
Cost of money	8.74 percent
Discount rate	4.25 percent
Federal, State and Local taxes	$142,256

[16] 72 FERC ¶ 61,027 (July 13, 1995).

Table 5: Parameters for economic analysis of the Waterbury Hydroelectric Project. (Source: Staff and GMP)

Economic Parameter		Value
Fees to Federal entities		$18,841
Cost of preparing license application		$1,065,236
Energy value[17] -	peak	70.65 mills/kWh
	off-peak	53.31 mills/kWh

A. Power and Economic Benefits of the Project

In the following sections, we analyze the project's power benefits for four alternatives: (1) the applicant proposed project; (2) the VANR's proposed alternative; (3) the staff-recommend alternative; and (4) the no-action alternative. The no-action alternative represents the baseline for comparing the first three alternatives.

1. Economics of the Proposed Project

GMP is proposing no modifications to the project facilities. For the new license period, GMP is proposing to implement several environmental measures including: increase minimum flows, aerate or ventilate the existing turbines, implement a recreation enhancement program, and other measures as shown in Table 6.

A detailed description of these and other environmental protection, mitigation, and enhancement measures considered in this FEA is found in the individual resource sections of the environmental analysis chapter. Below, in section VI.B, we give the cost of all the environmental enhancement measures proposed by either the applicant or staff. We estimated the annual cost of GMP's proposed enhancements, also recommended by staff, would be $37,640.

Based on the economic parameters shown in Table 5 and an annual average project generation of 14,834 MWh, the project power would cost $539,610. The average annual value of power for the proposed project would be $948,140. By subtracting the annual project cost from the annual value of the project power, we find that GMP's proposed project would have a net annual benefit of $408,540.

[17] Value of energy and capacity in New England Division of the United States on April 12, 2005.

2. Economics of the VANR's alternative

As discussed in section V.C., VANR is proposing a run-of-river operation when inflow equals outflow while maintaining the reservoir at elevation 589.5 year-round. Besides the more severe economic losses for the project, this alternative has also the potential to affect Waterbury Reservoir's ability to provide for flood control. We'll discuss this aspect later in this section.

From an economics standpoint, VANR's proposal would decrease the value of the project generation by about $261,480 and that of all GMP hydro plants downstream of the project by about $476,984 (Waterbury included). Under VANR's recommended alternative, the project would generate 12,577 MWh having a power value of $750,050. We find that the cost of this alternative would be $541,680 annually. By subtracting the project cost from the value of the project power, we find that this alternative would have a net annual benefit of $208,380.

3. Economics of the Staff-Recommended Alternative

The staff-recommended additional measures include: (1) develop and implement a recreation management plan; (2) develop and implement a wetlands management plan; (3) develop a plan to insure compliance with state DO standards; and (4) develop a plan to monitor the effectiveness of the aeration control device.

Table 6 lists all measures under this alternative that carry a cost together with the entities that proposed them and their respective costs.

Under the staff-recommended alternative, the project would generate 14,834 MWh having a power value of $948,140. We find that the cost of this alternative would be $541,680 annually. By subtracting the project cost from the value of the project power, we find that this alternative would have a net annual benefit of $406,470.

4. Economics of the No-Action Alternative

The existing project generates an average of 16,223 MWh annually. With no new environmental enhancement measures, the project would generate at a total annual cost of $501,970, its power would be valued at $1,010,890 , and would yield a net annual benefit of $508,930.

B. Flood Control

In order to independently evaluate the effects of the applicant's proposed reservoir operating elevations and the VANR's recommended 589.5 feet msl year-round reservoir elevation, we completed a HEC-RAS hydrological model.

Our model used a 100-year peak reservoir inflow of 27,558 cfs. To derive this inflow value, we used the Federal Emergency Management Agency's (FEMA) Flood Insurance Study (FIS) done for the Township of Stowe, Lamoille County, Vermont, dated February 15, 2002. The 100-year peak flow at Adams Dam was computed to be 15,762 cfs for a drainage area of 66 square miles. We extrapolated this peak flow to obtain a peak flow of 11,796 cfs for a drainage area of 43 square miles. This resulted in a peak flow of 27,558 cfs for the 109 square mile drainage area at Waterbury Dam.

For the unsteady flow model, the peak flows from the two drainage areas were combined with a Soil Conservation Service (SCS) dimensionless unit hydrograph to obtain the inflow hydrograph for the Waterbury Reservoir. Although the SCS method is not recommended for watersheds over 20 square miles, a sensitivity analysis of the Curve Numbers used did not show a significant effect on the results of the study.

Stream centerline and channel banks were obtained from United States Geological Survey (USGS) aerial photographs. Stream cross section geometry was obtained from USGS topological quadrangles, 1/3 arc second Elevation Dataset, and Exhibit F drawings. To account for a lack of data under the water surface of the reach, an artificial trapezoidal channel was incised into the cross-sections. A low level outlet was added to simulate the hydropower project's full discharge of 600 cfs.

The starting elevations were 550.0 feet msl and 589.5 feet msl. In each case, the spillway gates were either fully open or fully closed.

The model showed that, at an initial reservoir elevation of 589.5 feet msl with the spillway gates fully closed, the water surface elevation in the reservoir would reach 615.3 feet msl. An elevation of 615.3 feet msl would add an additional 13.7 feet of hydrostatic pressure on the spillway gates when compared to an initial reservoir elevation of 550.0 feet msl, causing public safety concerns, and inundating the structures and beach of Waterbury Center and Little River State Parks. A significant increase in the maintenance costs of these recreation facilities would be anticipated.

At an initial reservoir surface elevation of 550.0 msl, with the spillway gates fully closed, the reservoir surface elevation would reach 601.6 feet msl, and result in 9.6 feet of hydrostatic pressure on the spillway gates. Under this scenario, the two principal structures in the Waterbury Center State Park – the concessions building and the toilet building – would not be affected.

The downstream effects of VANR's proposed operation could also be considerable. At an initial reservoir surface elevation of 589.5 feet msl with the spillway gates fully open, about 11,000 cfs would be released at Waterbury Dam. If the Winooski River was also experiencing a 100-year peak flow at approximately the same time as the Little River, the resulting Winooski flow would be equivalent to a 320-year flood event. This flow would pose a high risk of flooding on the Little and Winooski Rivers and to the integrity of the Bolton Dam located downstream on Winooski River.

By letter filed July 18, 2005, the VANR replied to staff's Section 10(j) letter filed May 11, 2005. The reply discusses the results of analyses done by the agency with regard to (1) the potential of increased flooding (upstream and downstream of the dam) if the current winter drawdown was eliminated and (2) purported inadequacy of minimum flows proposed by GMP for the Little River downstream of the project. By letter filed July 26, 2005, GMP commented on VANR's letter.

We first note that the agency has not addressed the following issues raised in staff's Section 10(j) letter: (1) the effect of flooding of up to 60 acres of upland vegetation (and possibly more since agency's estimate of 100-year flood level is 0.8 feet above that estimated in staff HEC-RAS analysis); (2) flooding of the reservoir boat ramps; (3) endangering of skiers participating in the water skiing slalom courses due to floating debris resulting from flooding up to 60 acres of upland; (4) the reduction of whitewater boating opportunities on the Little River downstream of the Waterbury Dam; and (5) the annual loss of generation valued up to $477,000 for GMP owned projects.

With regard to the flood benefits of the drawdown, like staff, the agency concludes that the safety of the dam would be compromised if the annual drawdown was eliminated. VANR cites COE's analysis and conclusion that the taintor gates factor of safety would be insufficient for reservoir elevations of 611 feet msl and higher. VANR's analysis shows that a 100-year flood would cause the reservoir to raise to elevation 616.1, or 5.1 feet above what the COE considers a safe elevation for the gates. Corps' analysis prompted a revision of the operations manual that in essence reduces Waterbury Reservoir's ability to hold the 100-year design flood if the pool were maintained at elevation 589.5 feet msl.

When analyzing the downstream flooding effects, VANR finds that "the drawdown has a favorable impact on downstream flood control benefits" and quantifies the winter drawdown contribution to be 30% of the total flood control benefits. "Based on the above" VANR states, "it can be estimated that the drawdown has a favorable impact on downstream flood control benefits for about 0.30 of the year." Staff estimates that 30% of the year – especially in spring, the most likely period of the year for a 100-

year flood to occur – is considerable and justifies prudence when a drastic change in the historical operation of the project is considered. However, due to the mandatory nature of the state's 401 certification, if VANR so decides, we recognize that any license issued would include conditions requiring ROR operations for the Waterbury Project.

We conclude that operating the project as VANR proposes may have the potential to put human lives and property at an elevated risk and adversely affect the ability of the project to control spring run-off. We present our recommendation for project operation in Section VII, (Comprehensive Development and Recommended Alternative).

C. Cost of Environmental Enhancement Measures and Comparison of the Alternatives

Table 6 gives the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to annual (levelized) values over a 30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost. Table 7 presents a comparison of the various alternatives.

Table 6. Cost of environmental mitigation and enhancement measures. (Source: GMP and Staff)

Enhancement/ mitigation measure	Proposed/ recommended by	Capital cost	Annual cost	Levelized annual cost
Operate project in run-of river mode such that inflow equals outflow on an instantaneous basis at all times that inflow does not exceed turbine capacity. Reservoir may rise if inflow exceeds turbine capacity.	VANR	0	$260,841	$260,841
Increase minimum flows	GMP	0	$62,750	$62,750
Aerate or ventilate the existing turbine	GMP	$50,000	0	$6,345

Table 6. Cost of environmental mitigation and enhancement measures. (Source: GMP and Staff)

Enhancement/ mitigation measure	Proposed/ recommended by	Capital cost	Annual cost	Levelized annual cost
Implement a long term monitoring program for turbidity	GMP	Implemented	0	0
Modify the existing 24 inch diameter bypass valve	GMP	$46,000	0	$5,835
Implement a plan to monitor: flows in the bypass reach, reservoir levels, and run-of-river operation	VANR	$5,000	0	$640
Plan to monitor the effectiveness of the aeration control device	FWS	$2,500	0	$310
Plan to comply with state DO standards	VANR	$2,500	0	$310
Implement a recreation management plan	Staff	$1,000	0	$125
Implement a recreation enhancement program	GMP	$198,600	0[18]	$25,000
Enter into a cooperative Cultural Resources Management Plan with SHPO	GMP	$2,300	0	$290
Develop a wetland management plan	Staff	$5,000	0	$630

[18] With the exception of the Blush Hill boat ramp, all recreational enhancements would be constructed on State of Vermont lands and would be maintained by the State. The Blush Hill boat ramp is owned and maintained by the town of Waterbury.

Table 7: Cost comparison of alternatives for Waterbury Hydroelectric Project. (Source: Staff)

Alternative	GMP's Proposed Action	VANR's Proposed Action	Staff-recommended Alternative	No-action Alternative
Annual generation (MWh)	14,834	12,577	14,834	15,880
Annual power value	$948,140	$750,050	$948,140	$1,010,890
Annual cost	$539,610	$539,610	$541,680	$501,970
Annual net benefit	$408,540	$210,440	$406,470	$508,930

The measures proposed by GMP for the Waterbury Project would increase the annual costs by $37,640 and decrease the annual net benefits by $100,390 compared to the no-action alternative.

The measures proposed by VANR would decrease the annual net benefits by $198,100 compared to GMP's proposal or by $298,490 over the no-action alternative.

Our recommended measures for the Waterbury Project would increase annual costs by $2,070 above GMP's proposal, and decrease the annual net benefits by the same amount.

VII. COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a) (1) of the FPA require the Commission to give equal consideration to all uses of the waterway on which a project is located. When we review a proposed project, we equally consider the environmental, recreational, fish and wildlife, and other non-developmental values of the project, as well as power and developmental values. Accordingly, any license issued shall be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses.

Based on our independent review of agency and public comments filed on this project and our review of the environmental and economic effects of the proposed project and its alternatives, we selected the proposed project, with staff-recommended

modifications, as the preferred option. We recommend this option because: (1) issuance of a new hydropower license by the Commission would allow GMP to operate the project as an economically beneficial and dependable source of electrical energy for its customers; (2) the 5.520-MW project would eliminate the need for an equivalent amount of fossil-fuel derived energy and capacity, which helps conserve these nonrenewable resources and limits atmospheric pollution; (3) the public benefits of this alternative would exceed those of the no-action alternative; and (4) the recommended mitigation and enhancement measures would protect and enhance flood control, fishery, cultural and terrestrial resources, and provide improved recreation opportunities at the project.

A. Recommended Alternative

The following summarizes the environmental measures we recommend to be included in any license the Commission issues for the Waterbury Hydroelectric Project.

GMP proposes to: (1) continue to operate the project as it has under the existing license and drawdown the reservoir to elevation 550.1 feet msl during January and February; (2) increase minimum flows downstream of the project from three cfs year-round to 65 cfs for the period April 1 through June 30 and 35 cfs for the period July 1 through March 31; (3) aerate or ventilate the existing turbine such that the project discharges meet Vermont Standards for dissolved oxygen; (4) implement a long term monitoring program for turbidity; (5); modify the existing 24 inch diameter bypass valve with an automated gate that would provide minimum releases during periods when the turbine is not discharging; (6) implement a recreation enhancement program which includes a stable reservoir level during summer, improvements to three boat facilities, off-site parking, stabilize/harden shoreline banks and access points, sanitation facilities, enhanced access to Little River, whitewater boating releases, and a flow notification system; and (7) enter into a cooperative Cultural Resources Management Plan with the State Historic Preservation Officer for the project.

The following is a discussion for the basis of the recommended measures:

1. Continue to operate the project as under the current license

Staff recommends the implementation of GMP's proposal to maintain the winter drawdown to elevation 550.1 feet msl for safety, environmental and economic reasons.

VANR's proposal for a steady reservoir level year-round has raised concern

among some stakeholders[19] for the safety of the Waterbury Dam due to increased hydraulic loadings on the spillway gates and the Right Abutment Area and the Toe Drain Area of the dam[20] and the potential for increased flooding within the reservoir as well as downstream of the dam. The dam is undergoing re-construction by the Corps to address liquefaction and other dam and abutment safety problems. The Corps agrees with VANR[21] to defer any changes in the seasonal pool elevations for five years after the completion of the remedial construction to enable monitoring and assessment of the dam under same loading conditions as before the rehabilitation work.

To determine the extent of flooding if VANR's proposal were adopted, staff conducted a HEC-RAS study. Our analysis shows that operating the project at a reservoir elevation of 589.5 year-round would adversely affect the ability of the project to control spring run-off, introduces substantial uncertainty with regard to the safety of the dam, and it would have the potential to put human lives and property at high risk both downstream and upstream of the dam. The study and its findings are presented in more detail in Section VI, Developmental Analysis.

From an environmental standpoint, while VANR's proposal would improve water quality with regard to turbidity and DO, we note that the degree by which the erosion would be reduced cannot be predicted. Due to the geology of the area, the silt that erodes from the lacustrine deposits would continue to be deposited in the reservoir. Under GMP's proposal, turbidity resulting from drawing down and refilling the reservoir would be short lived as it takes place during January and February when the shoreline is fairly stabilized by freezing. To address the DO, GMP is proposing to improve DO downstream of the reservoir by aerating the turbine and modifying the existing 24 inch diameter bypass valve.

We agree with VANR that a run-of-river operation would protect downstream and reservoir aquatic communities by minimizing elevational and water velocity changes. However, this mode of operation would also flood up to 60 acres of upland thus increasing erosion from reservoir banks and degrade water quality.

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[19]COE, New York District, letter to VANR dated November 10, 2004; Gomez and Sullivan Engineers, Inc., Operations Model of the Waterbury Project and the Winooski River System, November 2002; VANR, letter to the Commission dated December 2, 2004.

[20] Gannett Fleming, Inc. letter to the COE, New York District, dated April 9, 2003.

[21] COE, New York District, letter to VANR dated November 10, 2004.

We also recognize that winter drawdowns can affect terrestrial species by reducing the available habitat area. Nevertheless, a hereptile survey conducted at the site found that the existing wetlands are productive under the current operating rule and a diverse wetlands plant and wildlife community exists.

Under VANR's proposal, a stable reservoir would enhance ice fishing opportunities in winter and enhance and extend water skiing opportunities. This operation though would also result in an increase in winter/spring flood magnitude and frequency, which would adversely affect the recreational sites around the reservoir. A run-of-river operation would result in flooding of the beach at the Waterbury Center State Park, inundation of the boat launching facilities at Blush Hill, the Waterbury Center State Park, and the Little River, and would increase the frequency of flooding of the newly constructed composting toilet and concession buildings.

Under VANR's proposal, whitewater boating opportunities, one of the region's most highly valued recreational offerings, would be adversely affected downstream in the Little River. Whitewater instruction would be severely restricted during most of the boating season. Under GMP's proposal, whitewater boating releases schedule that was worked out between the interested parties and GMP would be achievable thereby preserving whitewater recreation opportunities and their contribution to the local economy. Under VANR's proposal, the whitewater boating releases schedule could not be implemented.

Finally, VANR's proposal would result in an annual loss of generation valued at about $261,000 for the Waterbury Project or about half of the power benefits of $508,930 under no-action alternative. For all GMP owned projects downstream of the Waterbury Project, the power loss would be worth about $477,000. We recommend that the existing operation rule continue for the duration of a new license.

2. Increase minimum flows

GMP's study of stream habitat showed that the stream has little structure or cover due to channelization of the stream bed. The proposed minimum flows in conjunction with peaking flows do not increase the wetted usable area (WUA) significantly over leakage flows for juvenile or adult fish of all target species. However the proposed minimum flows would provide a significant increase in the stability of the available habitat during the summer months when GMP proposes to release 35 cfs.

We recommend the implementation of GMP's proposal to increase the minimum flows below the Waterbury Project for the protection and enhancement of the aquatic

habitat of the Little River. GMP's proposed flows would incur power losses valued at $62,750.

3. and 5. Install turbine aeration device and minimum flow free-jet discharge

In order to meet DO standards for Class B coldwater habitat (7 mg/L and 80 percent saturation at all times), GMP proposes to install a turbine aeration system and to provide conservation flows (35 cfs July 1 through March 31) during non-generation periods through the 24-inch bypass valve with a free-jet discharge. Water quality data collected by the licensee and reviewed by the agencies indicate that the current operation of the Waterbury Project affects both DO concentrations and water temperature. Installing a turbine aeration device would lessen the effects of the project on DO levels.

We recommend the implementation of GMP's proposal to install the proposed turbine aeration and free-jet discharge devices to increase the DO levels in the flows below the Waterbury Project for the protection and enhancement of the aquatic habitat of the Little River.

4. Implement a long term monitoring program for turbidity

Seasonal disturbance of the reservoir sediments does cause an occasional minor temporary negative effect on water quality, by raising the outflow turbidity to levels that slightly exceed the state standards; this occurs during reservoir refill periods that experience freeze-thaw cycles. Reducing or eliminating the drawdown would protect the sediment shelf that is being disturbed by the freeze-thaw. However, the actual increase in turbidity is so minor under current operations that when coupled with the spring runoff it does not have any noticeable impact on downstream aquatic resources. Since we are recommending that GMP continue to implement the winter drawdown, they should continue to conduct this monitoring of the seasonal turbidity increases that it may cause.

We recommend the implementation of GMP's proposal to continue monitoring the seasonal turbidity in the flows below the Waterbury Project for the protection and enhancement of the aquatic habitat of the Little River.

6. Recreation Enhancement Program

Waterbury Reservoir

We recommend that GMP implement the proposed enhancements for the boat launch near the dam and the Blush Hill boat ramp, and that GMP resurface the parking lot for the boat launch near the dam. Resurfacing the boat ramps with concrete would reduce

the potential for erosion of the sites, and would enable recreationists to launch and retrieve boats with greater ease. The resurfacing of the parking lot would also reduce the potential of erosion along the reservoir, and would prevent parking lot gravel from entering the reservoir.

Also, we recommend that GMP install sanitation facilities near the boat launch near the dam. Currently there aren't sanitation facilities within walking distance of the boat ramp. Since GMP proposes to enhance the boat ramp and parking lot, this may increase the usage by boaters or other recreationists. The installation of sanitation facilities would be a benefit all recreationists.

GMP should harden and stabilize the Moscow canoe access site and the adjoining parking lot. The hardening and stabilization would retard the erosion caused by foot traffic and allow easier launching from the site.

VDFPR requested that GMP provide an ADA fishing platform somewhere in the reservoir. We do not adopt this recommendation. VDFPR did not provide any justification that the demand for such facilities exists.

All of these proposed recreational enhancements are located at sites that are outside of the project boundary, and except for the Blush Hill boat ramp[22], are located on state owned property. Also except for the Blush Hill boat ramp, all the proposed enhancement recreational sites are owned and maintained by the VDFPR or the VDEC. Because these proposed improvements consist of capital improvements and the sites are operated and maintained by the VDFPR or the VDEC, these enhancements would not be project related facilities and therefore do not need to be within the project boundary. GMP should continue to work with the VDFPR and VDEC to develop and implement the enhancements that we recommend. We also recommend that once the enhancements are installed that the respective owners/operators maintain the enhancements.

Little River (Below the Waterbury Dam) Access

We recommend that GMP move the access gate and develop the parking facility. Anglers could access the deep pools near the powerhouse, while whitewater boaters would have more of the Little River available for paddling. Also, the proposed parking area would foster the use of the access point and increase safety in the area by reducing the need for parking along the shoulder of Little River Road or blocking the access road to the powerhouse.

[22] Blush Hill boat ramp is owned and maintained by the town of Waterbury.

Also we recommend that GMP stabilize the trails and access points because this would reduce the erosion occurring along these sites. Also improving the trails and access points may centralize the access to the Little River, reducing the amount of informal trails and access points that occur along the Little River. Informal sites contribute to the overall erosion occurring in the Little River.

The Little River access points and trails and the proposed access gate and parking facilities are located outside of the project boundary. We recommend that GMP continue to work with the VDFPR and VDEC to implement the proposed facilities and enhancements. The proposed facilities and enhancements are on state land, the state agencies should assume the responsibility of operation, maintenance, and supervision of the facilities and access points and trails. However, should the agencies not agree to assume operation maintenance, and supervision of these facilities, access points and trails, GMP would be required to assume these responsibilities. Therefore, GMP would need to revise the project boundary to include these facilities.

Whitewater and Boating

Operating the project as run-of-river would limit the amount of boatable flows available to whitewater recreationists, and therefore whitewater boating would be adversely affected. Also, run-of-river could increase the flooding frequency of the recently built composting toilet and concession buildings.

We recommend that GMP, in consultation with the Whitewater Parties, finalize the proposed whitewater boating release schedule. Currently, the Whitewater Parties and GMP have not decided when the prescheduled events would occur and which weekends would have the release of boatable flows. Also we recommend that GMP expand its existing flow phone system and improve the existing warning signage. Currently, the Waterbury Project is not part of GMP's flow phone system. The cost to include the Project in the system would be minimal, and its inclusion would provide recreationists with a reliable way to determine if boatable flows are currently available downstream of the Project. Downstream of the Project, boaters can experience hazards such as weir not visible from the last available take-out prior to the weir. With improved warning signage for boaters would be alerted to such hazards. See *Develop and implement a recreation management plan* for further discussion.

We recommend that GMP continue to work with the VDFPR and VDEC to develop the proposed take-out facility and parking area in the River Ford area, near the Little River Road. Because these proposed improvements consist of capital improvements and the sites are operated and maintained by the VDFPR or the VDEC,

these enhancements would not be project related facilities and therefore do not need to be within the project boundary. However, since the proposed take-out facility/access point and parking area would be located outside of the project boundary, these recreational enhancements would not be included in any license. The state agencies should assume the responsibility of operation, maintenance, and supervision of the facilities.

Whitewater Enhancements

We do not recommend Mr. Ingram's request to install boulders and suspend support wires for slalom courses in the Little River for the enhancement of whitewater recreation. The Upper section of the Little River provides a valuable local/regional resource for beginner boaters to learn the skills necessary for whitewater boating. Many rivers in the region naturally provide more difficult whitewater, but fewer rivers in the region provide beginner whitewater opportunities. If the enhancements were installed, local and regional whitewater teaching/instructional opportunities may be adversely affected.

Also, the proposed installation of the enhancements would conflict with an established informal fishing site. The support wires could inhibit the casting ability of anglers, and both anglers and boaters would be competing for use of the deep water in the Upper section of the river.

Also we do not recommend Mr. Ingram's request for the construction of a put-in facility at the last set of rapids at the lower end of the Middle (gorge) section of the river because the area poses a safety concern. The area is quite steep and without extensive construction, boaters would not be able to safely access the river. Also since there isn't room for road expansion, parking would be limited to parking on the shoulder of the road on the curve, which may pose a danger to other motorists.

7. Cultural Resources Management Plan

Developing a HPMP would preserve and protect the National Register-eligible Waterbury Dam, along with the National Register-eligible Waterbury Hydroelectric Project facilities that includes the powerhouse, intake structure and penstock.

As a condition of any new license, and after consultation with VDHP/SHPO, GMP would need to file a final HPMP with the Commission within a year after license issuance. Commission staff has executed a Programmatic Agreement with the Vermont State Historic Preservation Officer, pursuant to our responsibilities under Section 106 of the NRHP to which a HPMP would be developed and implemented for the term of the new license.

The staff-recommended additional measures include: (1) develop and implement a recreation management plan that includes a finalized schedule of whitewater boating releases, a schedule for improving the existing warning signage, resurface the boat launch near the dam, replace the Blush Hill boat ramp with a concrete ramp, and stabilize and harden the Moscow canoe access site, and provisions for establishing and maintaining a flow phone system; (2) develop and implement a wetlands management plan; (3) develop a plan to insure compliance with state DO standards; and (4) develop a plan to monitor the effectiveness of the aeration control device.

The following is a discussion of the basis for the additional staff-recommended measures:

1. Develop and implement a recreation management plan

GMP proposes to provide flow releases for whitewater boating, improve the existing warning signage, and expand the existing flow phone system to include the Waterbury Project. The flow release schedule for whitewater boating has not been finalized, and we recommended that GMP prepare a recreational management plan, to ensure the whitewater release schedule would be finalized. The recreational management plan would also include a schedule for the improving the warning signage and for the implementation of the flow phone system.

We recommend that the RMP include the following components: (1) the finalization of the whitewater boating release schedule; (2) a site design and schedule for the improving the warning signage; (3) a schedule for the implementation of the flow phone system; (4) a description of measures to manage the flow notification system and warning signage over the term of any new license issued; and (5) a description of how the needs of the disabled were considered. The plan should be developed in consultation with the VANR, VDEC, VDFPR, and the Whitewater Parties to ensure that the recreational enhancements provided best meet recreational needs and are coordinated with other initiatives in the region.

2. Develop and implement a wetlands management plan

We have determined that the existing wetlands associated with the Waterbury Reservoir are still productive under the current operating rule curve. Although the winter drawdown may be limiting the potential expansion of the wetlands community, we recognize that these winter drawdowns are the most effective means for flood control management and therefore are necessary to support the primary purpose of the dam. We

do not agree with Interior and VANR to maintain a year-round stable reservoir elevation, as this recommendation could compromise flood control management.

Since reed canary-grass and Japanese knotweed can dominate areas that are subject to water level fluctuations (and the agencies believe this to be the case here), or other disturbances, we recommend that a wetlands management plan be developed in consultation with Interior and VANR. This management plan would provide a means for Interior and the VANR to maintain the diversity of the wetlands (including the littoral aquatic bed) in the Waterbury Project area despite the annual drawdown. We recommend that GMP conduct: (1) a survey every five years of wetland plant species (diversity and abundance); and (2) report the survey results to the VANR and FWS.

3. Develop a plan to insure compliance with state DO standards

The licensee proposed turbine aeration device would increase the DO in the outflows from the project during the summer months when the reservoir is stratified. The effectiveness of the aeration device needs to be confirmed to ensure that the outflow from the project meets the state DO level standards.

4. Develop a plan to monitor the effectiveness of the aeration control device

GMP should monitor DO in the project outflow for at least three years to show project compliance has been achieved. Periodic testing would be useful after the three years of monitoring to show the continued effectiveness of the aeration device.

B. Conclusion

From our evaluation of the environmental effects and public benefits of the project, we conclude that licensing the Waterbury Project with our recommended environmental protection measures would best adapt the project to a comprehensive plan for the project area. The proposed project with the additional staff-recommended modifications would generate an average of 14,834 MWh annually, with a net annual benefit of about $406,470.

VIII. RECOMMENDATIONS OF FISH AND WILDLIFE AGENCIES

Under the provisions of Section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on the recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project.

Section 10(j) of the FPA states that, whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purpose and requirements of the FPA or other applicable law, the Commission and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

By letter filed July 18, 2005, the VANR replied to staff's May 11, 2005, Section 10(j) letter. By letter filed July 18, 2005, the VANR replied to staff's May 11, 2005, Section 10(j) letter. The VANR noted that the cold water released by the project could have a positive effect on the Winooski River up to 8 miles downstream of the confluence with the Little River. The positive effect however would only be realized if the releases were timed to the part of the diurnal cycle of the Winooski River, from 4 pm to 6 pm, that had the largest increase in temperature. The applicant typically releases flows from 7 am to 12 pm and from 6 pm to 10 pm. VANR states that a release from 10 am to 3 pm would be more beneficial to the environment of the Winooski River.

The VANR notes that the river channel and the riparian vegetation has adjusted to the current generation regime. At flows around the August median flow (~48 cfs), the edge of the stream recedes from the stream margin cover. Aside from some deep pools the river is generally lacking in instream cover and velocity refugia. The stream is lacking boulders and other current breaks. Fish habitat declines substantially during generation flows. Ramping of flows should be required to allow fish to relocate during changes in project operation.

The VANR states that the recreational fishing potential of the Little River is very high. The VANR discussed the downstream conservation flows proposed by the applicant as being inadequate, the flows would not provide high quality habitat and the river reach would still be subject to fluctuating flows during periods of generation. While the base habitat would improve over current conditions, the habitat would remain largely unstable and would not promote fish growth or reproduction.

In our discussion of the effects of the current project operation on the downstream Winooski River's water temperatures (Section V.C.2.b.) We did not discuss the daily timing of operation in the future to maximize the potential benefit of cooling the Winooski should peaking operation continue. The daily timing of project operation is something that could be studied after licensing to establish a beneficial flow regime.

We provided a discussion of the effects of peaking operation on the fish population of the Little River (section V.C.3.b.) we noted that the habitat was lacking structure and that cover opportunities were limited. The stream has been channeled and it does not offer anything more than marginal fish habitat. The proposed base flows are not

the peak of the curve, maximum usable habitat flows calculated by the PHABSIM study, but they do potentially provide more than 80 % of the WUA in almost every case. We did also discuss that the continued peaking operation could reduce the usability of these habitats.

The potential for recreational fishing in the Little River is limited due to the lack of good structure and cover habitat. While the potential for fishing might be marginally realized with changes in project operation, the recreational use of the Little River for white water boating is highly prized and utilized by the citizens of VT and other NE states. Changes to project operation have the potential to eliminate this existing recreational use of the river. The VANR notes that there are two opportunities for developing cold water release fisheries in Vermont, one being the Little River. The Little River is also the only place in Vermont that is available for this type of boating. Considering the paucity of fish habitat in the Little River, the potential for a marginal recreational fishery should not take precedence over the existence of a prized whitewater boating opportunity.

We conclude that operating the Waterbury Project as recommended by the VANR and FWS may be inconsistent with the comprehensive planning standard of section 10(a) and the equal consideration provision of section 4(e) of the FPA, because operating the project in a run-of-river mode or maintaining the Waterbury impoundment at a minimum elevation of 589.5 ft. msl would: 1) unduly conflict with the dam's primary purpose of flood control; 2) only minimally enhance fishery resources in the Little River; 3) negatively affect whitewater boating in the Little River; 4) potentially endanger slalom water skiers; and 5) result in a loss of 3,303 MWh of generation with an annual value of about $261,000.

Table 8 lists the federal and state recommendations subject to section 10(j), and whether the recommendations are adopted under the staff alternative. Recommendations that we consider outside the scope of section 10(j) have been considered under section 10(a) of the FPA and are addressed in this and other sections of this document.

Table 8: Analysis of fish and wildlife agency recommendations for the Waterbury Project (source: Staff)

Recommendation	Agency	Within scope of Section 10(j)?	Annual Cost (2004$)	Staff Conclusion
1) Operate project in run-of river mode such that inflow equals outflow on an instantaneous basis.	FWS	yes	$261,640 (recomm. 1 and 3)	Not adopted. The project should continue to operate as a flood control dam.
2) Operate project in run-of river mode such that inflow equals outflow on an instantaneous basis at all times that inflow does not exceed turbine capacity. Reservoir may rise if inflow exceeds turbine capacity.	VANR	yes	$260,841 (recomm. 2 and 4)	Not adopted. The project should continue to operate as a flood control dam.
3) Stable pool elevation year round.	FWS	yes	included with recomm. 1	Adopted in part. Project should continue to operate as a flood control dam as proposed by the licensee.
4) Reservoir shall be maintained at an elevation of 589.5 feet msl at all times that inflow does not exceed turbine capacity. Reservoir may rise if inflow exceeds turbine capacity.	VANR	yes	included with recomm. 2	Not adopted. The project should continue to operate as a flood control dam as proposed by the licensee.
5) Develop and implement a plan to monitor: flows in the bypass reach, reservoir levels, and run-of-river operation.	VANR	yes	$640	adopted
6) Plan to monitor reservoir elevations and flow releases.	FWS	yes	incl. in recomm. 5	adopted
7) Install turbine aeration device.	FWS	yes	$6,345	adopted

Recommendation	Agency	Within scope of Section 10(j)?	Annual Cost (2004$)	Staff Conclusion
8) Plan to monitor the effectiveness of the aeration control device.	FWS	yes	$310	adopted
9) Plan to comply with state DO standards.	VANR	yes	$310	adopted
10) Plan and implementation schedule for recreation enhancements.	VANR	no	$25,000	adopted

IX. CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a) (2) of the FPA requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. Accordingly, federal and state agencies filed comprehensive plans for Vermont that address various resources in the state. Of these, we identified and reviewed eleven of the plans relevant to this project.[23] We conclude that the proposed project would not conflict with these plans.

X. FINDING OF NO SIGNIFICANT IMPACT

We've prepared this final environmental assessment for the Waterbury Hydroelectric Project pursuant to the National Environmental Policy Act of 1969. Implementing the protection measures described in this final environmental assessment would ensure that the environmental effects of the project would remain insignificant. There would be no significant unavoidable adverse impacts.

Based on this analysis, issuing a new license for the project would not be a major federal action significantly affecting the quality of the human environment. With our recommended measures, aquatic, geological, terrestrial, and any cultural resources that would be found during project operation would be protected.

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[23] Strategic Plan for the Restoration of Atlantic Salmon to the Connecticut River 1998 Connecticut River Atlantic Salmon Commission; Vermont state comprehensive outdoor recreation plan, 1983-1988. June 1983 Vermont Agency of Environmental Conservation; Vermont Rivers Study. 1986 Vermont Agency of Environmental Conservation; Hydropower in Vermont: an assessment of environmental problems and opportunities. May 1988 Vermont Agency of Natural Resources; Preliminary comprehensive river plan for the Little River watershed, Vermont: an inventory of uses, values, and goals. August 1991 Vermont Agency of Natural Resources; 1988 Vermont recreation plan. Vermont Agency of Natural Resources; Wetland component of the 1988 Vermont recreation plan. July 1988 Vermont Agency of Natural Resources; Little River watershed comprehensive river plan. August 1992 Vermont Agency of Natural Resources; North American waterfowl management plan. May 1986 U.S. Fish and Wildlife Service. Canadian Wildlife Service; Final environmental impact statement- restoration of Atlantic salmon to New England rivers. May 1989 U.S. Fish and Wildlife Service; Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Undated. U.S. Fish and Wildlife Service. Amendment 1 to the New England Fishery Management Council's Fish Management Plan on Atlantic Salmon. March 1988 National Marine Fisheries Service.

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XII. LIST OF PREPARERS

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APPENDIX A, FIGURES

Figure 1. Location of the Waterbury Hydroelectric Project (Source: GMP, as modified by staff).

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

APPENDIX B

RESPONSES TO COMMENTS ON THE DRAFT ENVIRONMENTAL ASSESSMENT

The Notice of Availability of the Waterbury Hydroelectric Project Environmental Analysis was issued on August 20, 2004. Comments were due by September 19, 2004. At the request of a stakeholder, the comment period was extended to October 15, 2004. The following entities filed comments on the environmental assessment:

Entity	**Date Filed**
Gomez and Sullivan Engineers, P.C. (GSE) on behalf of Green Mountain Power Corporation, Inc.	September 23, 2004
Fish and Wildlife Service (FWS)	September 28, 2004
Winooski One Partnership (WOP)	October 4, 2004
American Whitewater (AW)	October 7, 2004
Friends of the Little River (FLR)	October 15, 2004
Vermont Agency of Natural Resources (VANR)	October 15, 2004
Vermont Natural Resources Council (VNRC)	October 20, 2004
Vermont Paddlers Club (VPC)	October 20, 2004
U.S. Army Corps of Engineers (Corps)	October 25, 2004
Vermont Agency of Natural Resources (VANR)	December 2, 2004

Below, we summarize the substantive comments, provide responses, and explain how we modified the text of the environmental assessment, as appropriate, to address the comments. Changes addressing editorial comments were made to the final environmental assessment but are not described below. The comments are grouped below by topic for convenience.

Geology

Comment 1: The information regarding the acreage of flooded uplands is inconsistent. (Corps)

Response: Every two years, VANR's proposal would inundate 40 acres more than under GMP's proposal. Every 10 years, VANR's proposal would inundate 43 acres more than GMP's proposal. The maximum additional inundation that would occur under VANR's proposal would be 68 acres.

Comment 2: The erosion potential in upland areas that would be periodically flooded by

the VANR's proposal should be compared to those areas that would be exposed by GMP's proposal and by current project operation. The VANR and the VNRC commented that periodic inundation of uplands under VANR's proposal would not result in much erosion because those areas are protected by well-established vegetation. (Corps)

Response: The revised analysis in section V.C.1.b. of the Final EA reflects the protective effects of the vegetation and the different potential for erosion that would occur under the GMP and VANR proposals.

Aquatics/Fisheries

Comment3: Disagrees with staff conclusion that proposed minimum flows would not provide significant improvements in aquatic habitat downstream of the project. Also, disagrees with the staff's conclusion that the summer flows would not significantly increase the WUA for juvenile or adult fish over leakage flows. (G&SE)

Response: We have revised the Final EA to include a more comprehensive analysis of the WUA for fish in the downstream Little River. WUA for a minimum flow is most useful in determining the flow to a bypassed section of stream. By attempting to apply a minimum flow WUA analysis to a stream reach proposed for peaking operation, that analysis becomes of limited value.

Comment 4: Disagrees with staff's analysis that peaking operations result in a highly variable thermal regime in the Little and Winooski Rivers. (G&SE)

Response: Staff's analysis of the water temperature data indicates that the temperature regime produced by peaking operations is in excess of what would be considered a natural daily occurrence; the analysis in the Final EA was clarified.

Comment 5: Staff didn't adopt the recommendation that the project should operate in a year round run-of-river mode with a stable pool elevation. Staff elected to use a seasonal run-of-river operation mode and restrict the stable pool elevation to periods when the project is not conducting a winter flood control drawdown. (FWS)

Response: Staff's review of the project's operation since construction was completed indicates that a winter drawdown for flood control was in place prior to the operation of the project for hydropower. Year round run-of-river was not selected as a best option for this project and the reasons were discussed in the DEA and revised in the Final EA.

Comment 6: Staff didn't fully explain the conclusion that eliminating the winter drawdown would compromise flood control. Flow augmentation during the winter drawdown is an incorrect statement as peaking operation during the winter drawdown would not increase available habitat during the drawdown as the fluctuation between generation and inadequate minimum flows would result in negative effects. (FWS)

Response: We have revised the Final EA to explain how flood control is compromised by eliminating the winter drawdown.

Comment 7: Staff did not explicitly say that the run-of-river operation period that Staff proposed would be from Memorial Day through December, with the target elevation for the reservoir being 589.5 feet during this period (FWS)

Response: We have revised the DEA to describe the proposed best option for the operation of the Waterbury project.

Comment 8: Staff required the project to operate in run-of-river mode during a time period where it is also allowed for white water releases for recreational boating. The two operational modes are incompatible. (VANR)

Response: We have revised the DEA to describe the proposed best option for the operation of the Waterbury project.

Comment 9: Staff did not address the reservoir drawdown on fisheries resources in the reservoir, including fish spawning movement. (VANR)

Response: We have included in the Final EA further discussion on the effects of the winter drawdown on the fisheries of the reservoir.

Comment 10: The analysis did not compare the effects on reservoir fisheries to the effects on the downstream reach. Peaking flows during the winter drawdown would offset any positive habitat effects due to flow augmentation (VANR).

Response: We have revised the DEA to further discuss the effects of project operation on the reservoir and downstream fisheries of the Little River.

Comment 11: Effects of the winter drawdown on: the littoral zone of the reservoir, flood control run-of-river operation, and mercury bioaccumulation were not discussed. (VNRC)

Response: The DEA discussed the first two issues but not the mercury bioaccumulation. The bioaccumulation of mercury in reservoirs is a factor of watershed and not of fluctuating water levels. For water levels fluctuations to impact mercury there has to be a summer drawdown and the growth of terrestrial vegetation which is then flooded in the fall. This replicates the 'new reservoir' syndrome that causes elevated mercury levels in fish. Winter drawdowns do not simulate that problem as the methylation of mercury is not encouraged by bacterial processes in the winter.

Comment 12: Staff should clarify the habitat availability for rainbow and brown trout at operational flows. (VPC)

Response: We have revised the DEA to include a more thorough discussion of fish habitat.

Comment 13: General comments on the DEA. (Corps)

Response: We have revised the DEA to include the corrections where applicable.

Comment 14: Mercury bioaccumulation in fish would be nearly eliminated if run of river alternative would be chosen (VANR).

Response: See response to comment 11.

Terrestrial

Comment 15: The staff analysis notes the impacts of the winter drawdown on littoral areas and wetlands, but concludes that there are no adverse effects that result. VANR disagrees with this conclusion for the following reasons: (1) the development of productive littoral plant communities has been limited by the annual drawdown; (2) the disturbance caused by the annual drawdown contributes to the dominance of reed canary grass in the wetlands at the north end of the reservoir; and (3) freezing of the sediments can impact species that may overwinter in the drawdown zone. (VANR)

Response: We have revised the DEA to include a discussion of the unavoidable adverse impacts (section V.C.4.c).

Comment 16: Lizards are not known to occur in the project area and the species was more likely a salamander. VANR would expect to find at least four or five salamander species in the project area wetlands. VANR further comments that the project area contains ideal habitat for painted turtles, although none were found. Turtles burrow into

the bottom mud of a body of water and remain dormant from October or November until late March or early April. The drawdown of the project reservoir would expose hibernating turtles to freezing and would therefore prevent this species from ever becoming established. (VANR)

Response: We have corrected our reference to the red-spotted newt as a salamander and have added VANR's information to the Final EA (section V.C.4).

Comment 17: It is very likely that aquatic bed and emergent wetland communities would expand under the VANR constant pool proposal relative to either winter drawdown alternative. The FERC EA should quantify potential submerged aquatic plant habitat within the reservoir. Absence of aquatic vegetation in locations with otherwise suitable habitat (depth, substrate) is a reasonable indicator of an "ongoing adverse effect." Note that winter drawdown is often cited as a control measure to reduce growth of unwanted vegetation. (Corps)

Response: We agree with the Corps. In section V.C.4.b of the FEA, we conclude that the winter drawdown may be limiting the potential expansion of the wetlands community associated with the Waterbury Project. We have added additional analysis to section V.C.4.b to address potential submerged aquatic plant habitat. We have also revised the DEA to include a discussion of the unavoidable adverse impacts (section V.C.4.c).

Comment 18: The DEA fails to consider the biological impacts of the winter drawdown on the wetlands and littoral zone of the reservoir. Much evidence exists of the degradation that occurs from reservoir winter drawdowns, including a decrease in diversity of plants and animals, the elimination of sensitive plants and animals, an increase in nuisance species that are able to colonize new areas, and the freezing of herptiles that have buried into the drawdown zone. (VNRC)

Response: We have discussed the biological impacts of winter drawdowns in section V.C.4.b. We have also revised the DEA to include a discussion of the unavoidable adverse impacts (section V.C.4.c).

Recreation

Comment19: The staff states that the VANR's proposal would result in a 55 cfs flow in Little River – not a boatable flow release. Boatable flows would occur only when inflow to the reservoir exceeds 300 cfs.. (FWS)

Response: We agree that only when the inflow exceeds 300 cfs boating could occur

under VANR's proposal. Based on the flow estimates provided in the *Little River Instream Flow Study, Additional Information for Macroinvertebrates,* VANR's proposal would also result in boatable flows between March and May. Indeed, for the majority of the boating season, the flows in the Little River would not be boatable. See Section V.C.6.b. *Project Operations, Our Analysis.*

Comment 20: The DEA does not state that boats could be launched at the Water Dam at water elevations down to 550 msl. (VANR)

Response: We agree that the Waterbury Dam boat launch could be used when the reservoir elevation is 550 msl; however, launching and retrieving at an elevation other than 589.5 ft (+/- 1 ft) msl is dangerous due to ramp's excessive slope (> 18%).

Comment 21: The whitewater boating schedule, as agreed upon by GMP and various whitewater interests, would be impossible to implement, without infringing upon the run-of-river operation required within the FERC recommended alternative. If in fact run-of-river operation is required there would be no means of providing the scheduled whitewater flows. (GSE, FWS, AW, FLR, VPC, VANR, VNRC)

Response: In the Final EA, staff still recommends that the whitewater boating release schedule be implemented but also recommends a different mode of operation under which boating schedules would be met. Also see Section V.C.6.b., *Whitewater and Boating, Our Analysis.*

Comment 22: An analysis of the effects of project proposals on recreation facilities must be done. (VANR)

Response: In Final EA, staff has analyzed the effects of GMP's proposed project operations and alternative project operations on recreation facilities. See Section V.C.6.b., *Project Operations, Our Analysis.*

Developmental Resources

Comment 23: The developmental analysis section should assess the total generation loss as well as the peak generation at the Waterbury Project and at all other GMP owned projects on Winooski River downstream of the Waterbury Project. (GSE)

Response: Under staff's preferred alternative in the Final EA, there will be no change in the operation of the project and consequently no energy loss (except from providing increased minimum flows).

Comment 24: The average annual generation of the project is 16,623 MWh, not 15,880 MHh. (GSE)

Response: Per GMP's Table 1 in letter filed January 9, 2003, the annual total energy for the "Existing Conditions" was updated to 15,880 MWh.

Comment 25: "VWSA's" should be replaced with "VANR's." (FWS)

Response: We agree and make this correction.

Comment 26: The Commission should initiate the 10 (j) process due to rejection of two of its recommendations. (FWS)

Response: We sent a Determination of Inconsistency notice to FWS on December 3, 2004, and, following the change in staff's preferred alternative, on May 11, 2005.

Comment 27: Chace Mill/Winooski One hydro project would be directly impacted by any change from the historical operating regime of the Waterbury Project. (WOP)

Response: The new staff alternative detailed in the Final EA is adopting the existing project operation.

Comment 28: Staff should substantiate its conclusion reached in the Comprehensive Development section that a year-round run-of-river operation would compromise flood control downstream of the project. (VANR)

Response: Staff conducted a HEC-RAS study to show the possible consequences of compromising the flood control function of the dam if a year-round run-of-river operation were adopted. The study and the results are described in the Final EA.

Comment 29: The Commission should initiate the 10 (j) process due to rejection of two of the agency's recommendations. (VANR)

Response: We sent a Determination of Inconsistency notice to VANR on December 3, 2004, and, following the change in staff's preferred alternative, on May 11, 2005.

Comment 30: Table 5 of the DEA does not indicate a cost estimate for implementation of the recommended Wetland Management Plan. (Corps)

Response: We added the cost for the Plan in the table.

Comment 31: The Commission should evaluate the potential of flooding downstream of the dam to people, properties, and activities. (Corps)

Response: See reply to comment 28.

Comment 32: The Commission should determine whether reservoir operations are subject to FERC jurisdiction under the Federal Power Act. (VANR)

Reply: The primary purpose for which the dam was built is flood control. As such, operation of the project is subordinated to the U. S. Army Corps of Engineers Waterbury Dam and Reservoir Regulation Manual guidelines set up for the dam and reservoir. The guidelines seek to prevent high Little River spring runoff from reaching the Winooski River while keeping the reservoir level below elevation 592 feet msl. The Licensee operates the reservoir below elevation 592 feet msl and the State of Vermont between elevations 592 and 630 feet msl. Given that the Commission has jurisdiction only with regards to the Licensee, only reservoir operations below elevation 592 feet msl are subject to the Commission's jurisdiction.