FINAL
ENVIRONMENTAL ASSESSMENT
FOR HYDROPOWER LICENSE

WEYBRIDGE HYDROELECTRIC PROJECT

FERC No. 2731-020

MIDDLEBURY LOWER HYDROELECTRIC PROJECT

FERC No. 2737-002

Vermont

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Environmental and Engineering Review
888 First Street, NE
Washington, DC 20426

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ACRONYMS AND ABBREVIATIONS

ADA	Americans with Disabilities Act
APE	area of potential effect
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission (FERC)
CRMP	Cultural Resources Management Plan
CVPS	Central Vermont Public Service Corporation
CWA	Clean Water Act
DO	dissolved oxygen
EA	environmental assessment
ESA	Endangered Species Act
ESCP	Erosion and Sedimentation Control Plan
FPA	Federal Power Act
GHG	greenhouse gasses
GWh	gigawatt-hours
Interior	U.S. Department of the Interior
kWh	kilowatt-hour
Mgal/day	million gallons per day
msl	mean sea level
MW	megawatt
NEPA	National Environmental Policy Act
NEPOOL	New England Power Pool
NERC	North American Electric Reliability Council
NHPA	National Historic Preservation Act
NPCC	Northeast Power Coordinating Council
NRCS	National Resources Conservation Service
NWI	National Wetland Inventory
PA	Programmatic Agreement
RM	river mile
ROR	run-of-river
SD1	Scoping Document 1
SD2	Scoping Document 2
SHPO	State Historic Preservation Officer
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VANR	Vermont Agency of Natural Resources
WQC	Water Quality Certificate

SUMMARY

Central Vermont Public Service Corporation (CVPS) filed an application on May 26, 1998, for a new license for the existing Weybridge Project, and filed an application on June 23, 1998, for a new license for the existing Middlebury Lower Project, under Part I of the Federal Power Act (FPA), to continue operating both projects. The 3.0-megawatt (MW) Weybridge Project is located on Otter Creek at river mile (RM) 19.5, in the towns of Weybridge and New Haven and in the county of Addison, Vermont. The 2.25-MW Middlebury Lower Project is located on Otter Creek at RM 24, in the towns of Middlebury and Weybridge and in the county of Addison, Vermont. The projects do not occupy any federally owned lands.

On March 9, 2000, Commission staff issued, for public comment, a draft environmental assessment (draft EA) for the relicensing of the Weybridge and Middlebury Lower Projects. This final environmental assessment (final EA) reflects the comments received on the draft EA, and analyzes the effects of the proposed action, the proposed action with additional staff-recommended measures, and no action. Our analysis shows that the preferred alternative for the Weybridge and Middlebury Lower Projects, to reduce or avoid adverse effects on environmental resources, is the proposed action with additional staff- recommended measures. For the Weybridge Project, these include:

- providing a constant minimum flow of 125 cubic feet per second (cfs) into the project's bypassed reach when the project is generating, with the proviso that this minimum flow would be raised to 250 cfs for walleye spawning during April and May, once walleye are introduced to this reach of Otter Creek;

- providing a non-generation minimum flow in the bypassed reach of 250 cfs;

- constructing an instream diversion structure, in consultation with the resource agencies, that will ensure a minimum flow of 125 cfs is passed into both the East and West Channels around Wyman Island during non-generation periods, and facilitate the movement of fish between the tailrace on the east side of Rock Island and the bypassed channel on the west side of Rock Island;

- conducting dissolved oxygen (DO) monitoring in the tailrace, for two years after licensing, during the months of July, August, and September, whenever project shutdowns exceed two consecutive days, to identify if reduced DO levels are occurring, with the requirement to release flows to the tailrace, if necessary, to maintain state water quality standards;

- reserving the U.S. Department of the Interior's (Interior's) authority to prescribe the construction, operation, and maintenance of fishways under Section 18 of the FPA;

- imposing peaking constraints under normal operations of no greater than a 4.5:1 ratio between maximum and minimum flow in a 24-hour period;

- eliminating all reservoir drawdowns between April 1 and June 15 to enhance fish spawning opportunities;

- eliminating 4-foot drawdowns (except in emergency situations) between October 15 and April 1;

- requiring that drawdowns greater than 2 feet for annual maintenance be scheduled in consultation with the agencies, and occur during a biologically non-critical time period;

- restricting reservoir drawdowns to 2 feet or less during normal operations to enhance wetland development and protect other shoreline aquatic resources;

- maintaining existing downramping and upramping procedures, when reducing flows to, or increasing flows above, the new proposed minimum flow of 250 cfs;

- providing recreational enhancements to include relocating the canoe portage take-out, installing an interpretive sign on the downstream side of the old powerhouse, and modifying one of the existing picnic tables to provide access to persons with disabilities; and

- completing Phase 1B archeological testing and enter into a Programmatic Agreement with the Vermont State Historic Preservation Office, the Federal Energy Regulatory Commission (Commission), and the Advisory Council on Historic Preservation, that provides for the development of a Cultural Resources Management Plan (CRMP).

For the Middlebury Lower Project, the recommended measures include:

- continuing operation of the project in a run-of-river (ROR) mode;

- providing a minimum flow of approximately 157 cfs in the 750-foot-long bypassed reach, as a continuous veiling flow over the project dam;

- reserving Interior's authority to prescribe the construction, operation, and maintenance of fishways under Section 18 of the FPA;

- providing recreational enhancements to include: a canoe take-out and portage trail with signs, improved parking facilities, and a disabled-accessible picnic table in the existing recreation area; constructing and maintaining a footbridge over the historic mill channel that bisects the hill on the west bank of the bypassed reach; and re-establishing vegetation on the hillside in the existing recreation area;

- requiring CVPS to develop, in consultation with appropriate agencies, a site-specific erosion and sedimentation control plan (ESCP) for any significant land-disturbing activities associated with the proposed action and enhancements; and

- entering into a Programmatic Agreement with the Vermont State Historic Preservation Office, the Commission, and the Advisory Council on Historic Preservation, that will provide for the development of a CRMP.

Overall, these measures, along with the standard articles provided in any license issued for the projects, would protect or enhance water quality, fisheries, terrestrial, recreational, and cultural resources within the project areas.

Under the provisions of Section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations of federal and state fish and wildlife agencies to adequately and equitably protect, mitigate damages to, and enhance fish and wildlife (including spawning grounds and habitat) affected by the project. The Vermont Agency of Natural Resources (VANR) and Interior filed recommendations for the protection, mitigation, and enhancement of such resources in response to the Notices of Application Ready for Environmental Analysis issued on January 25, 1999, for both projects. All of our recommendations are consistent with those of the resource agencies, made under Section 10 (j) and Section 10 (a) (comprehensive development requirement). We discuss these measures and our recommendations in sections V and VIII of this final EA.

The VANR granted CVPS, pursuant to Section 401 of the Clean Water Act, a Water Quality Certificate (WQC) with conditions, for the Middlebury Lower Project, on June 2, 1999. In this final EA, we make recommendations consistent with the terms of the WQC to ensure protection of water quality at the site. As of the date of this final EA,

VANR has not yet issued a WQC for the Weybridge Project. CVPS reapplied for a WQC on April 6, 2000, and the VANR indicated it would complete processing by July.

On the basis of our independent analysis, we conclude that issuing new licenses for the Weybridge and the Middlebury Lower Projects, with our recommended measures, 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 Environmental and Engineering Review
Washington, DC

WEYBRIDGE HYDROELECTRIC PROJECT
FERC No. 2731-020–VERMONT

MIDDLEBURY LOWER HYDROELECTRIC PROJECT
FERC No. 2737-002–VERMONT

I. APPLICATIONS

Central Vermont Public Service Corporation (CVPS or applicant) filed an application on May 26, 1998, for a new license for the existing Weybridge Project, and filed an application on June 23, 1998, for a new license for the existing Middlebury Lower Project, under Part I of the Federal Power Act (FPA), to continue operating both projects. The Weybridge Project is located on Otter Creek at river mile (RM) 19.5, in the towns of Weybridge and New Haven and in the county of Addison, Vermont. The Middlebury Lower Project is located on Otter Creek at RM 24, in the towns of Middlebury and Weybridge and in the county of Addison, Vermont (figure 1). The projects do not occupy any federally owned lands.

II. PURPOSE OF ACTIONS AND NEED FOR POWER

A. Purpose of Actions

The Federal Energy Regulatory Commission (Commission) must decide whether to license CVPS's two existing projects, and what, if any, conditions should be placed on any licenses issued. On March 9, 2000, Commission staff issued, for public comment, a draft environmental assessment (draft EA) for the relicensing of the Weybridge and Middlebury Lower Projects. This final environmental assessment (final EA) reflects the comments received on the draft EA, and analyzes the environmental and economic effects of: (1) operating the two projects as CVPS proposes; (2) operating the projects as CVPS proposes with additional staff-recommended measures; and (3) no action.

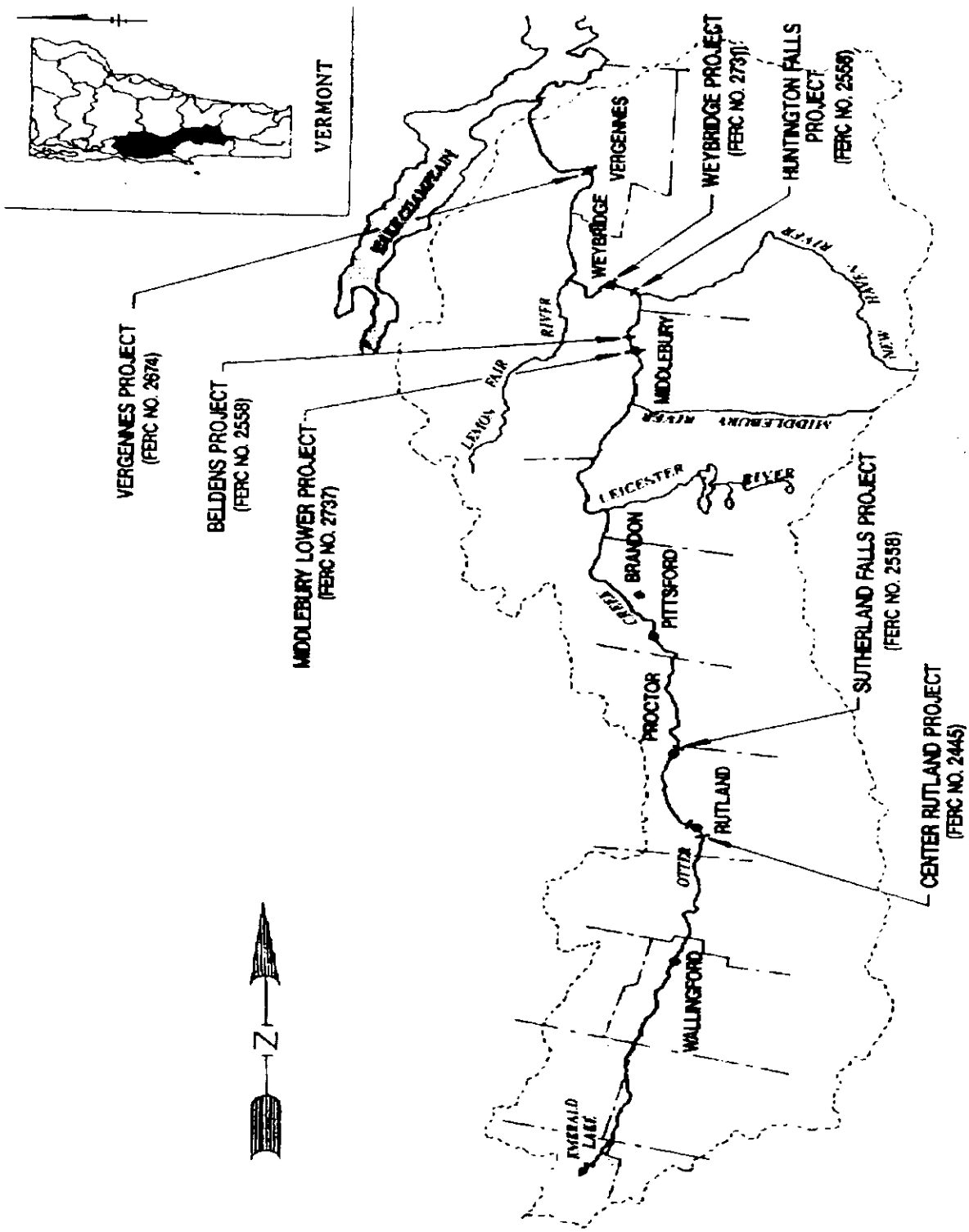

Figure 1. Otter Creek Basin, showing locations of existing hydroelectric projects (Source: CVPS, 1998a, as modified by staff).

B. Need for Power

To assess the need for power, we reviewed CVPS's present and future use of the projects' power, together with that of the operating region in which the projects are located. CVPS provides power to more than 139,000 customers in 136 Vermont municipalities and to 10,000 customers in New Hampshire. CVPS's power sources include hydro (38 percent), nuclear (36 percent), wood/other (15 percent), coal (9 percent), and oil (2 percent). CVPS owns 20 small hydroelectric plants that have a total capacity of 44 megawatts (MW). CVPS would continue to sell power to its customers if issued new licenses for the Weybridge and Middlebury Lower Projects.

The Weybridge and Middlebury Lower Hydroelectric Projects are located in the New England Power Pool (NEPOOL) subregion of the Northeast Power Coordinating Council (NPCC) region of the North American Electric Reliability Council (NERC). NEPOOL annually forecasts electrical supply and demand in the region for a 10 year period. NEPOOL's most recent report on annual supply and demand projections indicates that, for the period from 1998-2007, the average annual growth rate is 1.9 percent for the summer peak demand and 1.7 percent for the winter peak demand. Energy growth is projected to be 1.9 percent. In response to this projected growth, applications have been filed for 42 gas-fired plants representing more than 23,000 MW of generating capacity (NERC, 1998).

With the applicant's and staff's proposed environmental enhancement measures, the Weybridge and Middlebury Lower Projects would generate an annual average of about 11.92 gigawatt-hours (GWh) and 6.64 GWh of power, respectively, for the CVPS system. In addition, the projects would continue to displace nonrenewable fossil-fired generation and contributes to diversification of the generation mix in the NEPOOL region.

By producing hydroelectricity, the Weybridge and Middlebury Projects displace the need for other power plants, primarily fossil-fueled facilities, to operate, thereby avoiding some power plant emissions and creating an environmental benefit. Among the atmospheric emissions of concern are greenhouse gases (GHG), the most important of which is carbon dioxide (National Laboratory Directors, 1997). Continued operation of the subject hydropower projects would likely reduce annual carbon dioxide emissions in the region. The amount of GHG emissions that are avoided depends on the type of power displaced, which is region-specific.

In the Northeast Power Coordinating Council (NPCC) reliability region where the Weybridge and Middlebury Projects are located, the kinds of power generating facilities that would make up the power lost for the subject hydropower projects includes a large amount of natural gas and oil fired generation. Using the Oak Ridge Competitive Electricity Dispatch (ORCED) computer model,[1] we estimated the regional carbon intensity factor.[2] The carbon intensity factor for the Weybridge and Middlebury Projects is 207 kg of C/MWh.

Without the projects, annual carbon emissions in this region would increase by 3,700 metric tons per year. The comparable GHG emissions for the total NPCC region are estimated at 29.5 million metric tons of carbon. In terms of the emissions originating from power generating facilities in the entire NPPC reliability region, carbon emissions would increase by less than 0.1 percent if power produced by the Weybridge and Middlebury Projects was not available. The emission avoidance benefit of the projects is equivalent to the emissions of more than 2,800 passenger cars.[3] Considering the total carbon emissions for all the power generating facilities that exist only in the state of Vermont, carbon emissions would increase about 3 percent (Energy Information Administration, 2000).

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1 The ORCED model is a personal computer spreadsheet program for analyzing the electricity supply system for a given region based on power generating plant information and the region's hourly electric load demands. ORCED uses the plant dispatch information and fuel costs and region's power demands to calculate air emissions, electricity costs and prices, and other operational factors of a regional electricity market. (Also, see http://www.ornl.gov/orced/).

2 The carbon intensity factor represents the amount of carbon released per megawatt hour of fossil fueled generation. The carbon intensity factor is calculated by running the ORCED model both with and without the hydroelectric project and comparing the carbon emissions. Thus, looking at the mix of generation facilities that are in the NPCC, if the two projects were not available, natural gas and oil fired facilities would be used more.

3 This passenger car equivalent figure is based on the amount of carbon emissions that a passenger car would produce driving 12,000 miles annually with a fuel consumption rate of 22.4 miles per gallon. Each car would produce about 1.31 metric tons of carbon each year.

We conclude that the present and future use of the Weybridge and Middlebury Lower Project's power, its displacement of nonrenewable fossil-fired generation, and contribution to a resource diversified generation mix, support a finding that the power from the project would help meet both the short- and long-term need for power in the NEPOOL region.

III. PROPOSED ACTIONS AND ALTERNATIVES

A. Proposed Actions

1. Weybridge

a. Project description and current mode of operation: The existing Weybridge Project consists of the following features: (1) a 30-foot-high, 302.6-foot-long concrete gravity dam consisting of two spillway sections, a 150-foot-long west spillway section, topped with a 6-foot-high hinged steel flashboard, and abutted by a 20-foot-wide and 10-foot-high Taintor gate, and a 116-foot-long east spillway section topped with an automatically-inflated rubber weir; (2) a 1.5-mile-long, 62-acre impoundment with a normal water surface elevation of 174.3 feet above mean sea level (msl); (3) a powerhouse integral with the dam containing a single vertical Kaplan turbine generator with an installed capacity of 3.0 MW, and an intake containing steel trashracks with a 3-inch clear spacing; (4) transmission facilities; and (5) appurtenant facilities (figure 2).

The Weybridge Project is operated as a daily cycling facility during low and normal flow conditions, 200 to 1,200 cubic feet per second (cfs), using up to 2-foot drawdowns during normal flow conditions (500 to 1,200 cfs), and up to 4-foot drawdowns during low flow conditions (200 to 500 cfs). Project operation relies upon inflows from upstream developments and from the Otter Creek drainage basin. When inflows exceed the hydraulic capacity of the unit (1,600 cfs), the project operates in a run-of-river (ROR) mode. Drawdowns of up to 6 feet can occur but are typically associated with annual maintenance activities. As required by the existing Commission license, a minimum flow of 140 cfs, or inflow if less, is maintained from the project via the bypassed reach channel (figure 2), whenever the project is not generating. The bypassed reach channel currently receives no flows when the project is generating.

Downramping procedures are implemented and require that generation be reduced to the minimum efficient hydraulic capacity of 450 cfs at the end of any generation period. The Taintor gate (which discharges into the bypassed reach) is then opened 18 inches, and generation is ceased, resulting in the cessation of flows to the tailrace channel (figure 2). Discharge through the Taintor gate is then decreased through gradual closing

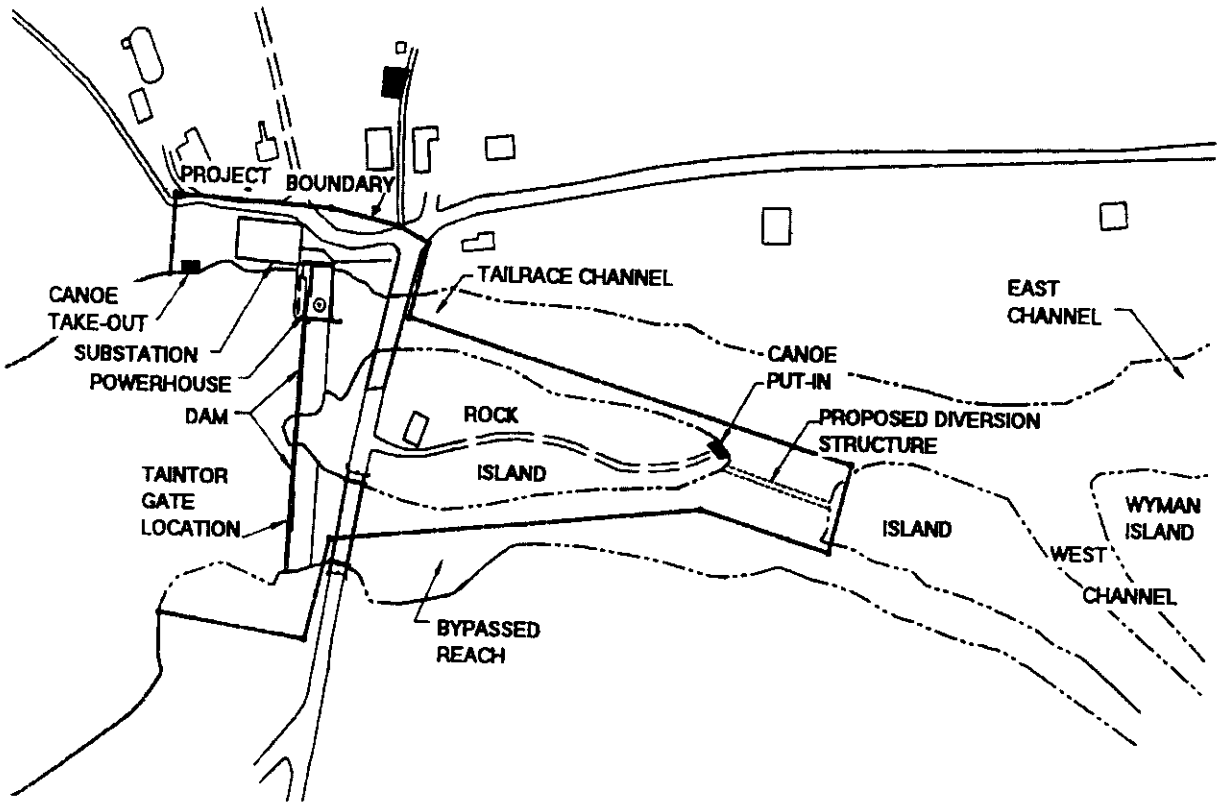

Figure 2. Layout of the Weybridge Hydroelectric Project (Source. CVPS, 1998a, as modified by staff).

of the gate over a 30 minute period until the gate is opened at 6 inches, providing the project minimum flow of 140 cfs to the bypassed reach. The first stage of the upramping procedure consists of closing the Taintor gate while initiating generation at the minimum efficient turbine capacity of 450 cfs for 20 minutes to allow downstream flows to stabilize. During the second stage of upramping procedures, flows are gradually increased to the desired level and corresponding generation load.

b. Applicant's proposed operations and enhancement measures: CVPS is not proposing any changes in the project installed capacity, and proposes to continue operating the Weybridge Project as a cycling facility. Changes in operation would occur. however, associated with the following proposed measures:

- passing a constant minimum flow of 125 cfs into the project's bypassed reach when the project is generating, with the proviso that this minimum would be

raised to 250 cfs for walleye spawning during April and May, once walleye are introduced to this reach of Otter Creek;

- raising the non-generation minimum flow in the bypassed reach to 250 cfs;
- constructing an instream diversion structure that will ensure a minimum flow of 125 cfs is passed into both the East and West Channels around Wyman Island during non-generation periods (see figure 2);
- imposing peaking constraints under normal operations of no greater than a 4.5:1 ratio between maximum and minimum generation flow in a 24-hour period;
- eliminating all reservoir drawdowns between April 1 and June 15 to enhance fish spawning opportunities;
- eliminating 4-foot drawdowns (except in emergency situations) between October 15 and April 1;
- requiring that drawdowns greater than 2 feet for annual maintenance be scheduled in consultation with the agencies, and target a biologically non-critical time period;
- restricting reservoir drawdowns to 2 feet or less during normal operations to enhance wetland development and protect other shoreline aquatic resources; and
- maintaining downramping and upramping procedures, when reducing flows to, or increasing flows above, the new proposed minimum flow of 250 cfs.

In addition to the above measures, which would affect project operations, CVPS proposes the following non-operational environmental measures for the Weybridge Project:

- providing recreational enhancements to include installing an interpretive sign on the downstream side of the old powerhouse and modifying one of the existing picnic tables to provide access to persons with disabilities;
- completing Phase 1B archeological testing and enter into a Programmatic Agreement (PA) with the Vermont State Historic Preservation Office (SHPO), the Commission, and the Advisory Council on Historic Preservation; and

- developing, in consultation with the resource agencies, a flow monitoring plan.

2. Middlebury Lower

a. Project description and current mode of operation: The existing Middlebury Lower Project consists of the following features: (1) a 30-foot-high, 478-foot-long concrete gravity dam consisting of two ogee spillway sections, a 123-foot-long western spillway section, and a 260-foot-long eastern spillway section; (2) a 1-mile-long, 16-acre impoundment with a normal water surface elevation of 314.5 feet msl; (3) a 400-foot-long, 40-foot-wide intake canal, controlled by a gate structure containing two 23-foot-wide, 13-foot-high gates; (4) a powerhouse located at the downstream end of the intake canal, containing three Francis turbine units for a total installed capacity of 2.25 MW, and an intake containing steel trashracks with a 1.75-inch clear spacing; (5) transmission facilities; and (6) appurtenant facilities (figure 3).

The Middlebury Lower Project is operated as a ROR facility. The impoundment elevation typically fluctuates not more than 1 inch from the crest elevation of 314.5 feet during normal operation, and water generally spills over the crest of the dam. However, no minimum flow release is currently required for the 750-foot-long bypassed reach downstream of the east and west spillway sections. Project operation relies upon inflows from upstream developments and from the Otter Creek drainage basin.

b. Applicant's proposed enhancement measures: To protect and enhance project-related environmental resources, CVPS proposes the following environmental and operational measures for the Middlebury Lower Project:

- continuing operation of the project in a ROR mode;
- providing a continuous veiling flow over the project dam;
- providing a minimum flow of approximately 157 cfs in the 750-foot-long bypassed reach; and
- providing recreational enhancements to include: a canoe take-out and portage trail with signs, improved parking facilities, and a disabled-accessible picnic table in the existing recreation area; construction and maintenance of a footbridge over the historic mill channel that bisects the hill on the west bank of the bypassed reach; and reestablished vegetation on the hillside in the existing recreation area.

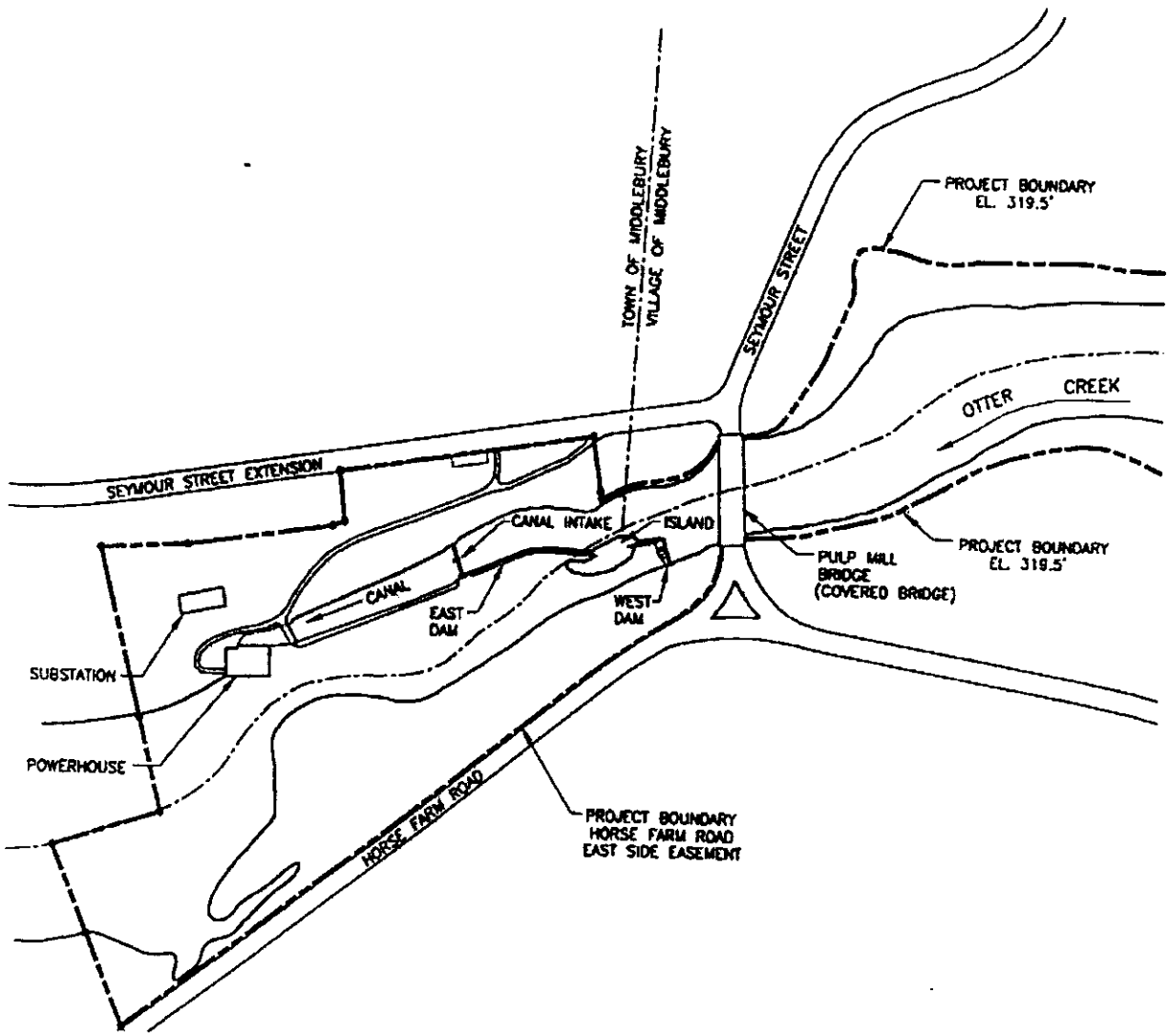

Figure 3. Layout of the Middlebury Lower Hydroelectric Project (Source. CVPS, 1998a, as modified by staff).

B. Proposed Actions with Additional Staff-recommended Measures

In addition to CVPS's proposed measures, we recommend the following measures for the two projects:

- reserving Interior's authority to prescribe the construction, operation, and maintenance of fishways under Section 18 of the FPA, for both projects;

- for the Weybridge Project, completing Phase 1B archeological testing and entering into a PA with the Vermont SHPO, the Commission, and the Advisory Council on Historic Preservation, that will provide for the development of a Cultural Resources Management Plan (CRMP);

- for the Middlebury Lower Project, requiring CVPS to develop, in consultation with appropriate agencies, a site-specific erosion and sedimentation control plan (ESCP) for any significant land-disturbing activities associated with the proposed action and enhancements;

- for the Middlebury Lower Project, entering into a PA with the Vermont SHPO, the Commission, and the Advisory Council on Historic Preservation, that will provide for the development of a CRMP; and

- developing a Weybridge Project dissolved oxygen (DO) monitoring plan in consultation with the U.S. Fish and Wildlife Service (USFWS) and the Vermont Agency of Natural Resources (VANR), with provisions for DO monitoring in the tailrace during the months of July, August, and September, whenever project shutdowns exceed two consecutive days, with the requirement to release flows to the tailrace, as necessary, to maintain state standards.

C. No Action

Under no action, the projects would continue to operate under the terms of the original licenses, and no new environmental protection or enhancement measures would be implemented. We use this alternative to establish the baseline environmental conditions for comparison with other alternatives.

D. Alternatives Considered and Eliminated from Detailed Study

As part of the National Environmental Policy Act (NEPA) issue scoping process, the staff considered several other alternatives to the relicensing proposal, but eliminated: (1) Federal takeover of the Weybridge and Middlebury Lower Projects, (2) issuing non-power licenses, and (3) dam decommissioning, from detailed study because they are not reasonable under the circumstances of this proceeding.

Federal takeover has been eliminated from further investigation. No person or entity has suggested that federal takeover would be appropriate or reasonable, and no Federal agency has expressed an interest in operating the Projects. Federal takeover of the Projects would require further Congressional approval. While these facts alone

would not preclude further consideration of this alternative, there is no evidence indicating that Federal takeover should be recommended to Congress.

Issuing non-power licenses would be temporary measures that the Commission would terminate whenever it determines that another governmental agency will assume regulatory authority and supervision over the lands and facilities covered by the non-power licenses. Issuing non-power licenses would not provide a long-term resolution of the issues presented. During the scoping process, no participant has sought non-power licenses, and there is no basis for concluding that the Projects should no longer be used to produce power; therefore, issuing non-power licenses is not a reasonable alternative to relicensing.

Dam decommissioning is not a reasonable alternative because the Projects are viable, safe and provide a significant contribution to renewable, non-polluting energy resources in the Projects' area, as well as contributing to the local economy through their recreational attributes and as a source of revenue to the Applicant.

IV. CONSULTATION AND COMPLIANCE

A. Agency Consultation and Interventions

The Commission's regulations require that applicants consult with appropriate state and federal environmental resource agencies and the public before filing a license application. This consultation is required to comply 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 complete and documented in accordance with the Commission's regulations.

The Commission issued Public Notices on January 25, 1999, stating the applications for the Weybridge and Middlebury Lower Projects were ready for environmental analysis, and that all comments and recommended terms and conditions should be filed within 60 days of the notice. In response to a request from the VANR, the Commission granted a 60-day extension of time for agencies to file comments and terms and conditions on the Weybridge Project. The following entities filed comments:

Commenting Entities	Date of Letter
Weybridge	
U.S. Department of the Interior	May 24, 1999

Vermont Agency of Natural Resources	May 25, 1999
Middlebury Lower	
Vermont Agency of Natural Resources	March 23, 1999
U.S. Department of the Interior	March 30, 1999.

CVPS responded to the recommended terms and conditions filed by the resource agencies, by letter dated June 23, 1999.

Organizations and individuals also may petition to intervene and become a party to subsequent proceedings. On April 13, 1999, the VANR filed a motion to intervene in, but not in opposition to, the proceedings.

B. Scoping Process

Before preparing the draft EA, we conducted scoping for the Weybridge and Middlebury Lower Projects, to determine what issues and alternatives should be addressed. A Scoping Document (SD1) was distributed to agencies and other interested parties on October 21, 1998. Two scoping meetings were held in the vicinity of the projects. One scoping meeting was held at 7:00 p.m. on Tuesday, November 17, 1998, at the Ilsley Public Library Meeting Room, 75 Main Street, Middlebury, VT 05753, and the other scoping meeting was held at 9:00 a.m. on Wednesday, November 18, 1998, at the Municipal Building Conference Room, 94 Main Street, Middlebury, VT 05753.

The scoping meetings were recorded by a court reporter, and all statements (oral and written) made at the meetings are included in the transcripts of the meetings. These transcripts are part of the Commission's public record for the projects. In addition to the comments provided at the scoping meetings, the following entities provided written comments in response to the issuance of the SD1:

Commenting Entity	Date of Letter
National Park Service	December 7, 1998.

Few comments were received at the scoping meetings (only one agency, the VANR, and no members of the public attended the scoping meetings), and only one letter of comment was filed in response to the SD1. Because no substantive additional issues were raised regarding the proposed scope of the EA, we determined that a second

scoping document (SD2) was not required. The SD1 sufficiently describes the proposed scope of this EA.

C. Draft Environmental Assessment

On March 9, 2000, Commission staff issued a draft EA for the relicensing of the Weybridge and Middlebury Lower Projects. Two letters of comment were received on the draft EA, as follows:

Commenting Entities	Date of Letter
Vermont Agency of Natural Resources	April 7, 2000
Central Vermont Public Service	April 7, 2000.

Copies of these letters and our responses to the specific comments are included in Appendix A. Minor revisions have also been made in this final EA to reflect the comments received.

D. Water Quality Certifications

Under Section 401(a)(1) of the Clean Water Act (CWA), license applicants must obtain either state certification that any discharge from a project would comply with applicable provisions of the CWA, or a waiver of certification by the appropriate state agency.

Weybridge

CVPS originally applied for a Water Quality Certificate (WQC) on May 14, 1998, but withdrew this application and concurrently reapplied for a WQC by letter to the VANR dated March 25, 1999, and received by the VANR on March 29, 1999. CVPS reapplied for a WQC, a second time, by letter to the VANR dated and filed April 6, 2000. In their comment letter on the draft EA, dated April 7, 2000, the VANR stated that the agency "..expects to complete processing by July." As of the preparation date of this final EA, the Commission has not received notice from the applicant or the VANR that the WQC has been issued.

Middlebury Lower

CVPS applied for a WQC for the Middlebury Lower Project on June 10, 1998, as required by Section 401 of the CWA. On June 2, 1999, the VANR issued the WQC for the project, subject to 17 conditions. These conditions are as follows:

1. The applicant shall operate and maintain this project consistent with the findings and conditions of this certification, where those conditions relate to protection of water quality and support of designated and existing uses under Vermont Water Quality Standards and other appropriate requirements of state law.

2. **Flow Management**. Except as allowed in Condition C below, the facility shall be operated in a true run-of-the-river mode where instantaneous flows below the project shall equal instantaneous inflow to the impoundment at all times. A minimum flow of 157 cfs, or instantaneous project inflow if less, shall be spilled along the full spillway crest at all times. When the facility is not operating, all flows shall be spilled at the dam.

3. **Flow Management during Impoundment Refill**. Following an approved maintenance drawdown, up to 10 percent of instantaneous project inflow may be placed in storage in order to refill the impoundment without significantly reducing downstream flows.

4. **Plan for Method to Maintain Bypass Flows and Run-of-the-River Operating Conditions**. The applicant shall develop a plan, including descriptions, hydraulic design calculations, an implementation schedule, and design drawings for the measures to be used to release the bypass flows set forth in Condition B and to maintain a stable headpond with true run-of-the-river operating conditions. After Department approval of the plan, the plan shall be filed with FERC no later than 120 days from the date of license issuance. FERC shall either approve the plan or return the plan to the applicant for revision to incorporate FERC-recommended changes. After revision, the applicant shall submit the plan to the Department for approval of the changes. The plan shall then be filed with FERC for final approval. The Department reserves the right of review and approval of any material changes made to the plan at any time.

5. **Monitoring Plan for Impoundment and Flow Management**. The applicant shall develop a plan for continuous monitoring of flow releases at the project (spillage into the bypass and discharges from the powerhouse), impoundment levels, and inflows. The applicant shall maintain continuous records of flows and

impoundment levels and provide such records on a regular basis as per specifications of the Department. The plan shall be developed in consultation with the Department and the U.S. Fish and Wildlife Service. After Department approval of the plan, the plan shall be filed with FERC no later than 120 days from the date of license issuance. FERC shall either approve the plan or return the plan to the applicant for revision to incorporate FERC-recommended changes. After revision, the applicant shall submit the plan to the Department for approval of the changes. The plan shall then be filed with FERC for final approval. The Department reserves the right of review and approval of any material changes made to the plan at any time.

6. **Prevention of Fish Entrainment at Intakes**. Prior to the next replacement of the intake trashrack, the applicant shall consult with the Department of Fish and Wildlife with respect to trashrack design to determine the appropriate bar clear spacing and rack location and shall file the trashrack design information with the Department of Environmental Conservation for approval prior to commencement of work.

7. **Turbine Rating Curves**. The applicant shall provide the Department with a copy of the turbine rating curves, accurately depicting the flow/production relationship, for the record within one year of the issuance of the license.

8. **Debris Disposal Plan**. The applicant shall develop a plan for proper disposal of debris associated with project operation, including trashrack debris. The plan shall be developed in consultation with the Department. After Department approval of the plan, the plan shall be filed with FERC no later than 120 days from the date of license issuance. FERC shall either approve the plan or return the plan to the applicant for revision to incorporate FERC-recommended changes. After revision, the applicant shall submit the plan to the Department for approval of the changes. The plan shall then be filed with FERC for final approval. The Department reserves the right of review and approval of any material changes made to the plan at any time.

9. **Maintenance and Repair Work**. Any proposals for project maintenance or repair work, including desilting, drawdowns below the spillway crest to facilitate repair/maintenance work, and tailrace dredging, shall be filed with the Department for prior review and approval, if said work may adversely affect water quality or cause less-than-full support of designated and existing uses of State waters.

10. **Public Access**. The applicant shall allow public access to the project lands for utilization of public resources, subject to reasonable safety and liability limitations. Such access should be prominently and permanently posted so that its availability is made known to the public. Any proposed limitations of access to State waters to be imposed by the applicant shall first be subject to written approval by the Department. In cases where an immediate threat to public safety exists, access may be restricted without prior approval; the applicant shall so notify the Department and shall file a request for approval, if the restriction is to be permanent or long term, within 14 days of the restriction of access.

11. **Recreational Facilities**. Recreational facilities shall be constructed and maintained consistent with a recreation plan approved by the Department. The plan shall be filed with the Department within 60 days of license issuance and shall include an implementation schedule. The applicant is advised to consult with the Department in the development of plans. Where appropriate, the recreation plans shall include details on erosion control. Modifications to the recreation plan shall also be subject to Department approval over the term of the license.

12. **Erosion Control**. Upon a written request by the Department, the applicant shall design and implement erosion control measures as necessary to address erosion occurring as a result of use of the project lands for recreation. Any work that exceeds minor maintenance shall be subject to prior approval by the Department and FERC.

13. **Compliance Inspection by Department**. The applicant shall allow the Department to inspect the project area at any time to monitor compliance with certification conditions.

14. **Posting of Certification**. A copy of this certification shall be prominently posted within the project powerhouse.

15. **Approval of Project Changes**. Any changes to the project that would have a significant or material effect on the findings, conclusions, or conditions of this certification, including project operation, must be submitted to the Department for prior review and written approval where appropriate and authorized by law and only as related to the change proposed.

16. **Reopening of License**. The Department may request, at any time, that FERC reopen the license to consider modifications to the license as necessary to assure compliance with Vermont Water Quality Standards.

17. **Continuing Jurisdiction**. The Department reserves the right to add and alter the terms and conditions of this certification, when authorized by law and as appropriate to carry out its responsibilities during the life of the project with respect to water quality.

E. Fishway Prescriptions

Section 18 of the FPA states that the Commission shall require the construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretary of the Interior, or the Secretary of Commerce, as appropriate.[4]

Under Section 18, Interior filed with the Commission, by letters dated March 30 and May 24, 1999, requests to reserve its authority to prescribe, through the USFWS, the construction, operation, and maintenance of fishways at the Middlebury Lower and Weybridge Projects, as necessary, to include measures to evaluate the need for fishways, and to determine, ensure, or improve the effectiveness of such fishways. Interior stated that the fishways would be for existing riverine fish species, and any fish species (including American eels) to be managed, enhanced, protected, or restored in the basin during the term of the licenses.

The Commission recognizes that future fish passage needs and management objectives cannot always be determined at the time of project licensing. Under these circumstances, and upon receiving a specific prescription from Interior, we recommend that the Commission follow its practice of reserving the Commission's authority to require such fishways as may be prescribed by the Secretary of the Interior. [5]

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[4] Section 18 of the FPA provides that "the Commission shall require construction, maintenance, and operation by a licensee at its own expense of such fishways as may be prescribed by the Secretary of Commerce or the Secretary of the Interior, as appropriate."

[5] The Commission has specifically sanctioned the reservation of fishway prescription authority at relicensing. See Wisconsin Public Service Corporation, 62 FERC ¶ 61,095 (1993); affirmed, Wisconsin Public Service Corporation v. FERC, 32 F.3d 1165 (1994).

F. Coastal Zone Consistency Determinations

The State of Vermont does not have a Coastal Zone Management Program. Our assessment is that no coastal zone consistency is needed for these projects.

V. ENVIRONMENTAL ANALYSIS

In this section, we first describe the general environmental setting in the project areas, including a discussion of environmental resources in the project areas that may be subject to cumulative effects from the Weybridge and Middlebury Lower Projects, when considered in combination with other actions affecting the resources. Then, we discuss each affected environmental resource. For each resource, we first describe the affected environment–which is the existing condition and the baseline against which to measure the effects of the proposed project and any alternative actions– and then the environmental effects of the project, including proposed protection and enhancement measures.

We include in our discussion only resources that would be affected, or about which comments have been made by interested parties. Unless as cited otherwise, the primary sources of our information are the license applications (CVPS, 1998a; 1998b) and supplemental filings by the applicant.

A. General Description of the Otter Creek Basin

The Otter Creek River basin is part of the Lake Champlain basin located along the western border of Vermont. The United States Geological Survey (USGS) divides Vermont into 16 river basins, with the Otter Creek River Basin having a drainage area of 1,106 square miles (Medalie, 1997). According to the USGS, the Otter Creek River Basin is the third largest among Vermont's 16 river basins. In 1995, the basin population was about 76,700 people.

Otter Creek is the longest river entirely within Vermont. Its headwaters are in the northern part of Bennington County, beginning at Emerald Lake in the town of Dorset, Vermont (figure 1). The stream flows northerly about 100 miles through urban and agricultural areas in Rutland and Addison counties before terminating at Lake Champlain at Fort Cassin Point. Ten major tributaries to Otter Creek are Mill River, Cold River, East Creek, Clarendon River, Tinmouth Channel, Leicester River, Middlebury River, New Haven River (largest tributary to Otter Creek), Lemon Fair and Dead Creek. Tributaries in closest proximity to the Middlebury Lower Project include the Leicester and Middlebury Rivers, which enter Otter Creek upstream of the project. For the

Weybridge Project, the New Haven River enters Otter Creek upstream of the project, immediately upstream of the Huntington Falls Project, while the Lemon Fair River enters the river downstream of the Weybridge Project (figure 1).

Forest predominates as the land cover type, covering 60 percent of the watershed. Agricultural uses comprise 23 percent of land cover type for the watershed. Developed land, including a mix of residential, commercial, industrial, transportation, and utility uses, accounts for 6 percent of land cover type. Wetlands and surface waters each occupy about 5.5 percent. The three largest lakes in the watershed are Lake Dunmore (985 acres), Chittenden Reservoir (702 acres), and Winona Lake (248 acres). Approximately 45,579 acres of National Wetland Inventory (NWI) mapped (Class II) wetlands are found in the Otter Creek watershed. The marsh at the mouth of Otter Creek and Little Otter/Lewis Creek Marsh are among the larger complexes. The Otter Creek River Basin has four state-listed endangered and threatened plant species, which are found in Scanlon Bog in Brandon (DEC, 1999).

Otter Creek is distinguished by three main reaches. The upper reach begins at its origin at RM 100, and is characterized by rapid flow and a steep gradient to Procter at RM 60. The middle section of Otter Creek goes from Procter at RM 60, characterized by a mix of slow meandering stream sections with elevation drops over a series of dams, to Vergennes at RM 7.6. The lower portion from the Vergennes dam at RM 7.6 to the mouth of Otter Creek is low gradient, with bordering low lying marsh lands and stream elevations influenced by the seasonal variation of Lake Champlain.

Instream uses of Otter Creek include hydropower generation, wastewater assimilation from local communities, and recreation. The Otter Creek River Basin ranks third in hydroelectric water use (2,100 million gallons per day [Mgal/d]) after the Upper Connecticut-Mascoma (6,200 Mgal/day) and Winooski (2,200 Mgal/day) River Basins. Overall, Vermont's hydroelectric instream use in 1995 totaled 17,000 Mgal/d (Medalie, 1997). The estimate does not account for instream uses of water other than hydroelectric.

Other licensed projects in the river basin include: Center Rutland Project No. 2445, Vergennes Project No. 2674 and the Sutherland Falls, Belden's, and Huntington Falls developments of Project No. 2558.

B. Scope of the Cumulative Effects Analysis

According to the Council of Environmental Quality's Regulations for implementing the NEPA (50 CFR §1508.7), cumulative effects are the impacts on the environment, which result from the incremental impact of the action when added to other

past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such 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 the license application, comments from agencies and other interested entities, and our preliminary analysis, we reviewed all resources to determine if they could be affected in a cumulative manner by the relicensing of the Middlebury Lower and Weybridge Projects. We used this review to determine the geographic and temporal scope of our cumulative effects analysis. We identified possible cumulative effects on aquatic, terrestrial, and recreational resources.

Otter Creek has been extensively used as a source of power and water supply for more than 200 years. Early usage of the river was for hydromechanical power for local mills, which resulted in the placement of dams at several locations in the river, generally at natural falls. The basin also experienced clearing for agricultural purposes, as well as for the establishment of several small towns along the river, particularly in the vicinity of the several mill dams and associated industries. In the 20th century, the dams that were originally established for hydromechanical power were converted to hydroelectric projects. In addition, although agriculture is still an important activity in the Otter Creek basin, some of the former agricultural land has been developed for housing, as the basin supports more "bedroom" communities for the city of Burlington, the largest city in the state of Vermont.

As a result of the development of the Otter Creek basin over the past 200+ years, much of the free-flowing Otter Creek has been transformed into a series of relatively small, shallow impoundments separated by hydroelectric dams. Other development associated with agricultural activities and establishment of towns and villages has changed the watershed characteristics from that of a primarily forested watershed to one with more cleared agricultural land (23 percent of the basin) and urban areas (6 percent of the basin). As a result, streamside vegetation has been reduced or eliminated in some areas, and water quality has been affected by increased runoff from agricultural areas and urban centers. Fishery resources have likely changed due to the reduction in water quality and the fragmentation of the river corridor by several dams, resulting in a predominance of warmwater species and a probable reduction in salmonid species.

1. Geographic Scope

The geographic scope of our cumulative effects analysis defines the physical limits or boundaries of the proposed action's effects on the resources. Because the

proposed action would affect the resources differently, the geographic scope for each resource may vary. In this case, for aquatic, terrestrial, and recreational resources, the scope of analysis will encompass the main stem of Otter Creek from the Sutherland Falls Project (Project No. 2558), located approximately at RM 64 on Otter Creek, downstream to where Otter Creek discharges into Lake Champlain. We chose this geographic scope for these resources because the effects of hydroelectric project operations are limited to this area, and Otter Creek serves to link these resources via the river corridor.

For all other resources, we confine our analysis to the immediate project areas.

2. Temporal Scope

The temporal scope of our cumulative analysis in this final EA will include past, present, and future actions and their effects on aquatic, terrestrial, and recreational resources. Based on the typical license term, the temporal scope will look 30 to 50 years into the future, concentrating on the effect on these resources from reasonably foreseeable future actions. The historical discussion will, by necessity, be limited to the amount of available information for each resource. We determined the present resource conditions based on the license applications, comprehensive plans, and on scoping comments received from the agencies and other entities.

Relicensing the Weybridge and Middlebury Lower Projects would not contribute to adverse cumulative effects on aquatic, terrestrial, and recreational resources in the Otter Creek basin, based on CVPS's and additional staff-recommended mitigative measures that would be implemented to protect these resources (see sections V.C.3, V.C.4, and V.C.6).

C. Environmental Analysis of the Proposed Actions and Alternatives

1. Geology and Soils

a. Affected environment: There are two bedrock formations in the Weybridge and Middlebury Lower Project areas associated with the Champlain Valley. These formations are carbonates (limestones and dolostones) and quartzites that were formed 750 million years ago. In the area to the east of the Champlain Valley, schists that were formed 500 million years ago are found. Glaciers retreated from this area about 11,000

years ago, leaving behind glacial deposits of silt, clay, sand, gravel and glacial till over the bedrock.[6]

Weybridge

The project-impoundment extends upstream for about 1.5 miles. The upper half of the impoundment varies in width from 150 to 200 feet with steeply sloped banks. The lower half varies in width from 250 to 600 feet with bank slopes ranging from gentle to moderate. All impoundment banks are forested.

The predominant soil type adjacent to the impoundment is classified by the Natural Resources Conservation Service (NRCS) as Vergennes clay with slopes ranging from 12 to 50 percent. These soils are formed in clayey glaciolacustrine deposits on lake plains. These soils have a depth to water table of 1 to 3 feet below the surface from early winter through late spring. They are very deep to bedrock and are moderately well drained.

The downstream project area extends from the dam approximately two miles to the upstream end of the Vergennes Project impoundment. Just downstream of the dam, both banks are forested with rock cliffs. About 1,000 feet downstream is Wyman Island, with the river forming two channels as it passes the island. Downstream of Wyman Island the topography levels off to a flat meadow/marsh floodplain consisting mostly of open fields with isolated pockets of forested land.

There are two predominant soil types adjacent to Otter Creek downstream of the dam. The NRCS classifies them as Hadley very fine sandy loam and Winooski very fine sandy loam. The Hadley soil is formed in loamy alluvium on floodplains, and the Winooski soil in alluvial deposits on floodplains. Both of these soils are frequently flooded for brief durations from fall/winter to spring. The Hadley and Winooski soils depth to water table is 4 to 6 feet and 1.5 to 3 feet, respectively, from late fall through early spring. They both are very deep to bedrock. The Hadley soil is well drained, and the Winooski soil is moderately well drained.

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[6] University of Vermont Geology Department website: http://geology.uvm.edu.

Middlebury Lower

The NRCS classifies the predominant soil near the Middlebury Lower Project as Vergennes clay with slopes ranging from 5 to 25 percent. These soils are formed in clayey glaciolacustrine deposits on lake plains. These soils have a depth to water table of 1 to 3 feet below the surface from early winter through late spring. They are very deep to bedrock and are moderately well drained.

b. Environmental effects:

Proposed Action

Weybridge

CVPS's proposed relicensing of the Weybridge Project would have no effect on the geology in the project area. Potential effects on soils would primarily relate to soil stability, erosion, and sedimentation.

The applicant conducted a study to assess the soil stability and erosion potential along the shoreline of the impoundment and the downstream channel to the Vergennes Project impoundment (Knight Consulting Engineers, Inc., 1997). This study concluded that none of the shoreline along the project impoundment exhibits erosional characteristics that could be attributed, beyond a very minor extent, to the normal two-foot drawdown. The shoreline erosion that was observed was not considered to be severe and was most likely caused by high water conditions.

The Knight study also observed several minor, near vertical clayey silt escarpments along the Wyman Island shoreline, as well as several streambank areas that have slumped into the stream over the 2 miles downstream to the Vergennes impoundment. One major area that was noted occurred about 6,000 feet downstream of the project, where several hundred feet of the bank has slid into the streambed. High-water marks on the trees suggest that spring flows are the major cause of this slumping, and the regulated project discharges are a minor factor in the rate of downstream shoreline erosion (Knight, 1997).

Our Analysis

After reviewing all available information on potential erosion at the project, we conclude that the probable cause of the limited amount of shoreline erosion along the project impoundment is primarily high flow events, and not the periodic two-foot

drawdown associated with project operation, or the occasional deeper reservoir drawdowns associated with maintenance activities.

The several streambank areas downstream of the project that are slumping into the river are the result of the naturally occurring process for a meandering river in a flat floodplain area. The major cause of the shoreline erosion occurring downstream of the project is high flow events during the spring and other periods of the year, and not the regulated project discharges.

Middlebury Lower

CVPS's proposed relicensing of the Middlebury Lower Project would have no effect on the geology in the project area. Potential effects on soils would primarily relate to soil stability and concerns for erosion and sedimentation.

Many of the proposed recreation enhancements, such as constructing the canoe take-out, improvements to the parking facilities, and the footbridge could result in localized short-term increases in erosion and sedimentation.

Our Analysis

Any erosion and sedimentation associated with the construction of the proposed recreational enhancements can be minimized by development and adherence to a site-specific ESCP. We recommend that CVPS develop, in consultation with appropriate agencies, such a site-specific ESCP for any significant land-disturbing activities associated with the proposed action and enhancements.

This recommended ESCP would be consistent with Condition L of the WQC issued by the VANR for this project, which requires design and implementation of erosion control measures for any erosion that may occur as a result of use of project lands for recreation.

No Action

Under no action, CVPS would continue to operate the Weybridge and Middlebury Lower Projects under the terms of the existing licenses, and no new environmental protection and enhancement measures would be implemented. This continued operation would have no effect on erosion and sedimentation, because current operations do not appear to affect shoreline erosion, and no new recreational facilities would be developed.

c. Unavoidable adverse effects: None.

2. Water Resources

a. Affected environment:

Water Quantity

The USGS Gage Number 04282500 at Middlebury, Vermont is used to assess streamflow conditions on Otter Creek for the Weybridge and Lower Middlebury Projects. The period of available record for this gage is April 1903 to April 1907, October 1910 to January 1920, and October 1928 to 1997. The USGS gage records are considered good except for estimated daily discharges, which are considered fair. There is some regulation by Chittenden Reservoir, a 702-acre reservoir located on East Creek, a tributary to Otter Creek (Coakley et al., 1997).

The drainage area at the USGS gage is 628 square miles. The gage is located 5.5 river miles upstream from the Weybridge Project, which has a drainage area of 750 square miles and includes the additional inflow from a major tributary, the New Haven River. The difference in river flow between the Weybridge Project and the USGS gage is adjusted by prorating the USGS streamflow data by a factor of 1.15 (750/628, raised to the 0.8 power). This method of prorating is consistent with the method used by CVPS in its analysis of flows and energy at the Weybridge Project, and to be consistent with the previous analyses on the project, we have continued to use the 1.15 factor. The USGS gage is located 1 mile upstream from the Middlebury Lower Project. The drainage area at the Middlebury Lower Project is 629 square miles, and does not include any additional major inflows downstream of the gage, so no prorating of flow data is required for this project.

Weybridge

The Weybridge Project reservoir extends 1.5 miles upstream to the Huntington Falls Hydroelectric Project. The reservoir has a width of from 150 to 200 feet and shoreline slopes of 12 to 50 percent in its upper reach, and a width of from 250 to 600 feet and shoreline slopes from 0 to 25 percent in the lower reach. At elevation 174.3 feet (full pond), the reservoir's estimated surface area is 62 acres and its perimeter is 17,365 feet. The gross storage capacity is 600 acre-feet.

At a 2-foot drawdown, the usable storage capacity is about 115 acre-feet, and the reservoir area is about 51 acres. Because the Weybridge Project is a cycling facility, the

reservoir is subject to periodic drawdown of 2 feet; however, daily drawdowns may range from 1 to 4 feet. Depending on the amount of inflow from the upstream drainage basin, more than one cycle per day may occur.

When inflow to the reservoir approaches or exceeds 1,600 cfs (the maximum hydraulic capacity of the project turbine), the Weybridge Project operates in a ROR mode, with spillage occurring at discharges more than 1,600 cfs (Table 1). This typically occurs during March through May. For inflow to the reservoir less than 1,600 cfs, the project operates on a daily-cycle basis. When inflow is 500 to 1,200 cfs, two and possibly three cycles per day may occur, making drawdowns and recharge of the reservoir short daily events. Available inflow refills the reservoir by the start of the next day. The daily-cycling operation typically results in a 2-foot drawdown. Drawdowns of 4 to 6 feet also may occur under current operations, during unusual operational events or low flow periods, and during annual maintenance activities such as flashboard installation and rubber dam inspection.

During low flow conditions, inflows of 200 to 500 cfs, which typically occur during July through October, the reservoir is drawn down faster, because more reservoir storage is used for turbine operation. Four-foot drawdowns can occur during the project cycling mode under these conditions. Very low flow conditions, with inflow less than 200 cfs, result in powerhouse shutdown. Under these conditions, the current license requires a minimum flow of 140 cfs into the bypassed reach downstream of the Taintor gate, and also requires downramping and upramping procedures (described above in section III.A.1.a.) to minimize downstream impacts.

Table 1. Weybridge Project existing operating regime with corresponding inflow types and inflow volumes (cfs) (Source: CVPS, 1998a).

Operating regime	Inflow type	Inflow volume (Q)
Run-of-river	Very high flow	$Q \geq 1{,}600$ cfs
Daily cycling	High inflows	$1{,}200 \text{ cfs} < Q < 1{,}600$ cfs
	Normal inflows	$500 \text{ cfs} < Q < 1{,}200$ cfs
	Low inflows	$200 \text{ cfs} < Q < 500$ cfs
Unit goes off-line	Very low inflows	$140 \text{ cfs} < Q < 200$ cfs

River flow data for the Weybridge Project site, prorated from USGS data are presented in table 2. The 7Q10 flow is defined as the 7-day mean low flow with a

recurrence interval of 10 years. The 7Q10, for the period starting April 1, 1904, and ending March 31, 1997, is 155 cfs for Otter Creek at the USGS gage [7] and 179 cfs for the Weybridge Project.

Based on the operational parameters summarized in table 1 and the available flow data summarized in table 2, table 3 presents the percent of time by month and annually that certain inflow regimes occur for the existing operation of the Weybridge plant.

Table 2. Weybridge Project annual and monthly flow duration for 1903 - 1997 in cfs (Source: USGS data from Gage No. 04282500, Otter Creek at Middlebury, VT).

	(1) Median flow	(2) Average flow	(3) Maximum flow	(4) Minimum flow
January	719	994	7,061	173
February	713	979	5,796	201
March	1,346	1,743	12,650	242
April	2,887	2,926	9,269	237
May	1,461	1,768	7,395	193
June	725	964	6,187	121
July	434	614	3,634	109
August	368	525	4,520	106
September	386	551	7,521	113
October	512	739	4,083	138
November	771	1,001	3,496	159
December	826	1,055	5,049	115
Annual	725	1,152	12,650	106

[7] E-mail dated 1/27/99 from ktoppin@usgs.com.

Table 3. Percent of time inflow regimes occur by month and annually for the existing operation of the Weybridge Project (Source: Flow duration curves for the period of record, 1903 to 1997, USGS Gage No. 04282500, Otter Creek at Middlebury, VT).

	Percent of time			
	Run-of-river operation	Daily cycling operation		Unit off-line
	(1) High inflow [Q>1600 cfs]	(2) High to normal inflow [500<Q<1600 cfs]	(3) Low inflow [200<Q<500 cfs]	(4) Very low inflow [Q<200cfs]
Jan.	17	53	30	0
Feb.	16	58	26	0
March	43	46	11	0
April	83	17	0	0
May	46	49	5	0
June	14	57	28	1
July	6	35	53	6
Aug.	4	26	60	10
Sept.	5	31	55	9
Oct.	11	39	46	4
Nov.	17	58	25	0
Dec.	16	61	23	0
Annual	26	38	33	3

Middlebury Lower

The Middlebury Lower reservoir extends about one mile upstream from the project dam. The reservoir shape is long, narrow and generally shallow, covering about 16 acres at the full-pond elevation of 314.5 feet with an average width of 100 to 250 feet. The gross storage capacity is 46 acre-feet, but the usable storage capacity is negligible and the project operates in ROR mode. The reservoir elevation typically does not fluctuate more than one inch from the crest elevation of 314.5 feet during normal operation. Water generally spills over the dam crest. The normal tailwater elevation is 285.38 feet, with the tailwater flowing into the upstream end of the Beldens Project reservoir.

ROR operation of the Middlebury Lower Project maintains a stable reservoir surface elevation, and the flow in Otter Creek is not regulated by this ROR operation.

Drainage basin runoff influences project operation, but this operation generally remains the same under low, normal or high water conditions, with the project using as much inflow as is feasible. Each of the three Francis turbines are brought on line to match river flow. The total hydraulic capacity is 945 cfs: units 1 and 2 operate up to 270 cfs; unit 3 operates up to 405 cfs. Any inflow to the project exceeding the turbines' maximum hydraulic capacity of 945 cfs spills over the crest of the dam. The minimum hydraulic capacity for generation is 100 cfs. Table 4 presents flow data for Otter Creek at the Lower Middlebury Project site.

Table 4. Middlebury Lower Project annual and monthly flow duration data for 1903 - 1997 in cfs (Source: USGS data from Gage No. 04282500, Otter Creek at Middlebury, VT).

	(1) Median flow	(2) Average flow	(3) Maximum flow	(4) Minimum flow
January	625	865	6,140	150
February	620	851	5,040	175
March	1,170	1,516	11,000	210
April	2,510	2,545	8,060	206
May	1,270	1,538	6,430	168
June	630	838	5,380	105
July	377	534	3,160	95
August	320	456	3,930	92
September	336	479	6,540	98
October	445	643	3,550	120
November	670	871	3,040	138
December	718	918	4,390	100
Annual	630	1,002	11,000	92

Analysis of these flow duration data indicates that the project hydraulic capacity is exceeded 35 percent of the time on an annual basis, ranging from a low of 8 percent of the time in August up to 94 percent of the time in April. Inflows almost always exceed the minimum unit capacity of 100 cfs.

Water Quality

Weybridge

Vermont Water Quality Standards specify the Weybridge Project portion of Otter Creek as Class B waters. [8] Class B waters are managed for good aesthetic value, high quality habitat for aquatic biota, fish and wildlife, swimming and recreation, public water supply with filtration and disinfection, irrigation, and other agricultural uses.

The reach of Otter Creek from the upstream Huntington Falls Dam to the downstream Vergennes Project, which includes the Weybridge Project area, is also designated as warmwater fish habitat by the Vermont Water Quality Standards. This designation requires a minimum DO concentration of not less than 5 mg/L or 60 percent saturation at all times.

DO measurements were taken at various sites below and above the Weybridge Project during the summer low-flow period of 1996 and 1997, and all values met the current Vermont Water Quality Standards of 5 mg/L or 60 percent saturation for warmwater fisheries, as well as the coldwater fisheries standards of 6 mg/L or 70 percent saturation (GSE, 1997; Wallin, 1997a). The 1996 below-dam values were taken over a two-day period in early August as part of the instream flow study. The 1997 below-dam values were taken over a seven-week period before dawn, between 4:30 and 6:00 am, to target the period of the day when DO levels were expected to be at the minimum, prior to the daily onset of photosynthesis. The lowest project discharge sampled was 200 cfs.

During the 2 years of sampling, three supersaturated DO concentrations were recorded downstream of the dam and two upstream of the dam. The supersaturated values were attributed to measurement error or algae overabundance, with the most likely cause excess algal growth. Phosphorus levels as recorded by the VANR for Otter Creek indicate that while levels have decreased in recent years, the levels are high enough to support high algal growth (table 5). Figure 4 summarizes the results of the 1997 DO study.

[8] Vermont Water Quality Standards, adopted April 2,1998 and effective April 21, 1998, available from www.state.vt.us/wtrboard /rules/vwqs.htm.

Table 5. Phosphorus values (metric tons/year) for 1991 and 1995 point and non-point source (NPS) loads in the Otter Creek Watershed (Source: Portion of phosphorus table from http://www.anr.state.vt.us/champ/phostab2.htm).

1991 loads (metric tons/year)			1995 loads (metric tons/year)			Change 1991↔1995 (%)		
Point	Non-point	Sum	Point	Non-point	Sum	Point	Non-point	Sum
62.8	58.9	121.7	9.8	51.4	61.2	-84	-13	-50

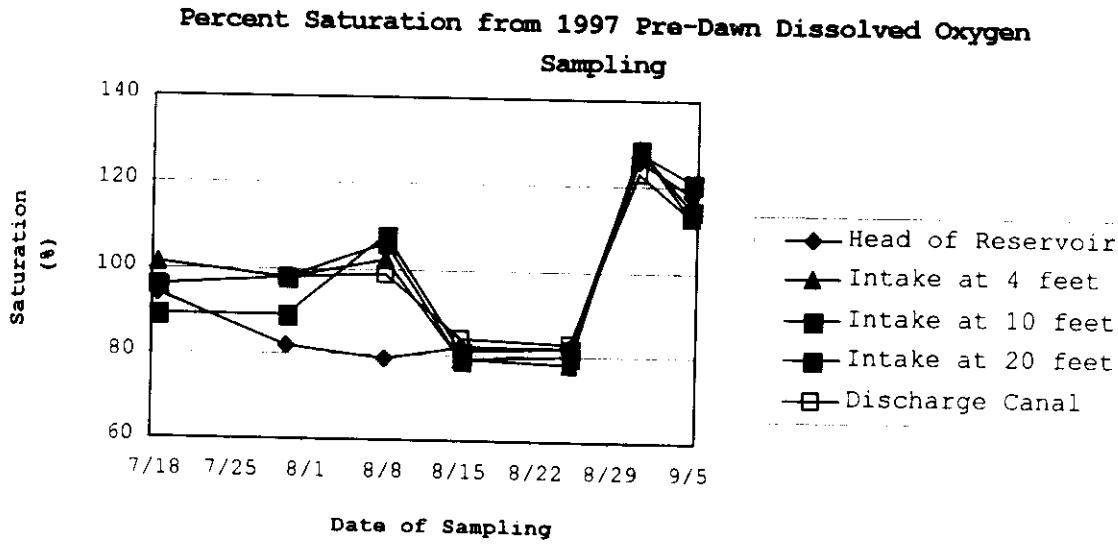

Figure 4. Results of the 1997 dissolved oxygen monitoring at the Weybridge Project (Source: Wallin, 1997a).

Middlebury Lower

The State of Vermont classifies water quality in the vicinity of the Middlebury Lower Project as a Class B Waste Management Zone. The sewage treatment facility for the town of Middlebury discharges into the project reservoir approximately one-quarter mile upstream of the dam. The Vermont Water Quality Standards define a waste management zone as a specific reach of Class B waters designated by a permit to accept the discharge of properly treated wastes that prior to treatment contained organisms pathogenic to human beings. Throughout the receiving waters, water quality criteria must be achieved, but increased health risks exist due to the authorized discharge.

The Middlebury Lower reservoir is also designated as warmwater fish habitat, so water quality must meet the DO criteria of not less than 5 mg/L or 60 percent saturation. Pre-dawn DO monitoring was also conducted at the Middlebury Lower Project in 1997, at locations both above and below the dam. All values recorded exceeded the warmwater fisheries criteria and the coldwater fisheries criteria (Wallin, 1997b). Similar to Weybridge, supersaturated DO levels were recorded on three dates above the dam and on one date below the dam. Because phosphorus levels are likely very similar to those occurring at Weybridge, excess algal growth and associated photosynthesis are the likely cause of the supersaturated levels.

b. Environmental effects:

Proposed Action

Weybridge

The applicant proposed several changes in project operation to protect and enhance aquatic resources in Otter Creek. These were described previously in section III.A.1.b, and include:

- passing a constant minimum flow of 125 cfs into the project's bypassed reach when the project is generating, with the proviso that this minimum would be raised to 250 cfs for walleye spawning during April and May, once walleye are introduced to this reach of Otter Creek;
- raising the non-generation minimum flow in the bypassed reach to 250 cfs;
- constructing an instream diversion structure that will ensure a minimum flow of 125 cfs is passed into both the East and West Channels around Wyman Island during non-generation periods (figure 2);
- imposing peaking constraints under normal operations of no greater than a 4.5:1 ratio between maximum and minimum generation flow in a 24-hour period;
- eliminating all reservoir drawdowns between April 1 and June 15 to enhance fish spawning opportunities;
- eliminating 4-foot drawdowns (except in emergency situations) between October 15 and April 1;

- requiring that drawdowns greater than 2 feet for annual maintenance be scheduled in consultation with the agencies, and target a biologically non-critical time period;

- restricting reservoir drawdowns to 2 feet or less during normal operations to enhance wetland development and protect other shoreline aquatic resources; and

- maintaining downramping and upramping procedures, when reducing flows to, or increasing flows above, the new proposed minimum flow of 250 cfs.

Both Interior's and VANR's 10(j) recommendations are in agreement with the applicant's proposed operational measures, although VANR has additional recommendations that are further described below.

Our Analysis

Table 6 summarizes the proposed operating regime and the percent of time by month that each regime would occur, based on existing flow data. This can be compared to table 3, which summarizes existing operations. Table 6 indicates that daily cycling operation (scenarios 2 and 3) would continue to be the most common type of operation, with scenario 3 being the most common, occurring 46 percent of the time on an annual basis. Scenario 4, with the unit off line and all inflow discharged to the bypassed reach, would be least common, occurring only 5 percent of the time annually.

The effects on water quality from this proposed operation are not expected to be significant. DO data for the project area indicates that existing conditions already consistently exceed state standards. Provision of higher minimum flows in the bypassed reach and within both channels of Otter Creek around Wyman Island may provide some enhancement of DO levels through aeration within the channel. This enhancement, however, might not be measurable, because DO saturations are high under existing conditions.

Table 6. Percent of time river inflow and operating regime would occur by month and annually for proposed operation of the Weybridge Project (Source: Flow duration data for the period of record, 1903 to 1997, USGS Gage No. 04282500, Otter Creek at Middlebury, VT).

	Percent of Time			
	Run-of-river operation	Daily cycling operation		Inflow=Outflow
	(1) Inflow [Q>1725 cfs] Turbine stays at 1600 cfs Bypass flow [≥125 cfs] (%)	(2) Inflow [730<Q<1725 cfs] Turbine range [1600 to 450 cfs] Bypass flow [125 cfs] (%)	(3) Inflow [250<Q<730 cfs] Turbine range [1000 to 0 cfs] Bypass flow [250 to 125 cfs] (%)	(4) Inflow [Q<250 cfs] Turbine is off Bypass flow = inflow (%)
Jan.	14	34	50	2
Feb.	14	34	51	1
March	40	35	25	0
April	79	18	3	0
May	42	39	14	5
June	12	36	50	2
July	5	17	68	10
Aug.	4	11	65	20
Sept.	4	13	66	17
Oct.	9	23	61	7
Nov.	15	37	46	2
Dec.	14	42	40	4
Annual	22	27	46	5

The one section of Otter Creek downstream of the project that would not receive flow releases would be the tailrace, when the project is shut down and all inflow is diverted through the Taintor gate and bypassed reach (figure 2). If these conditions were to occur for an extended period of time during the summer low-flow, high-temperature period, there is the potential for DO depletion within the tailrace. During the warmest summer months (July and August) project shutdown could occur up to 20 percent of the time. In September, shutdowns could occur up to 17 percent of the time, and if warmer weather continued into September, there is also the potential for reduced DO levels. The proposed 125 cfs minimum flow that would be passed over the proposed diversion weir

into the East Channel would unlikely provide aerated water upstream to the entire tailrace channel.

Although this potential operational scenario would not be common, except during July, August, and September, and would unlikely result in significant DO depletion during most of the year, CVPS should implement a DO monitoring program within the tailrace channel whenever project shutdown exceeds two consecutive days during July, August, and September. If reduced DO levels are detected and have the potential to violate state water quality standards, CVPS should provide flow releases into the tailrace to aerate the channel until state water quality standards are assured. This monitoring program should be conducted for two years following issuance of the license, to identify under what conditions low DO conditions occur, and what level of flow releases are required to ensure state standards are met. Thus, CVPS should develop a DO monitoring plan for the tailrace, and file this plan for Commission approval. The plan should be developed in consultation with the VANR and USFWS, and should include criteria for triggering the monitoring, and measures proposed for releasing flows into the tailrace, if they are needed. Depending on the results of the two-year monitoring program, CVPS may be required to propose long-term measures for the maintenance of DO levels in the tailrace channel.

Other water quality parameters are not expected to be affected by the proposed operations of the Weybridge Project. As of the issuance date of this final EA, the VANR had not yet issued a WQC for the Weybridge Project, and the potential conditions of the WQC are not known. However, based on VANR's 10(j) recommended terms and conditions outlined by letter dated May 25, 1999, and on their April 7, 2000 letter of comment on the draft EA, both of which will likely be reflected in the WQC, the VANR is in general agreement with the applicant's proposed protection and enhancement measures described above. The VANR also recommended that: (1) a flow monitoring program described by the applicant in a letter to the VANR dated April 22, 1999, should be included as a license condition; (2) any license articles related to minimum flows should specify both the volume and applicable locations for the flow standards; (3) the volume of flow released into the bypassed reach during project generation should equal the 125 cfs required for habitat in the West Channel, plus whatever flow is required for provision of fish passage through the diversion structure; (4) the development of a low flow management plan should be included as a license condition, to determine how flows should be released at the project under drought conditions when inflow to the project is less than 250 cfs; and (5) the flow management plan should provide for "freshening flows" in the tailrace channel, to prevent low DO conditions.

We agree with the applicant and the VANR that a flow monitoring program should be implemented at the project, because there are several components to the applicant's operations to protect and enhance aquatic resources. We recommend that this flow monitoring program be included as part of a flow management plan for the project, which CVPS should develop in consultation with the VANR and the USFWS. The plan should describe how CVPS will implement all aspects of its instream flow release and reservoir management proposals under all levels of inflow (including drought conditions), as well as provisions for measuring and documenting flow releases from the project into the bypassed reach and East and West Channels, and reservoir water surface elevations. This monitoring program should also document the volume of flow passing through the diversion structure for fish passage, and the volume continuing down the West Channel. The plan should be filed with the Commission for approval.

The need for "freshening flows" in the tailrace channel is addressed above, and would be determined by the tailrace monitoring plan previously recommended.

Middlebury Lower

CVPS proposes to continue to operate the project in a ROR mode, while providing a constant minimum flow of 157 cfs to the bypassed reach for habitat and aesthetic enhancement. The proposed minimum flow is the result of a Delphi flow study[9] and is nearly identical to the 7Q10 flow for USGS gage No. 04282500, located just upstream from the project. The entire minimum bypassed reach flow would be spilled over the dam and would pass through a turbulent bypassed reach. Thus, aeration would occur throughout the year, resulting in DO levels that exceed state standards (existing conditions already exceed state standards). DO levels in the project tailrace would also remain adequate throughout the year, even during project shutdowns, because the bypassed reach flows pass through the tailrace at the downstream end of the bypassed reach. The applicant's proposed operations are in agreement with the 10(j) recommendations of both Interior and VANR.

The only other water quality issue in the project vicinity is unrelated to project operations. The Middlebury waste water treatment plant is being replaced and relocated through construction of a new facility located north of Middlebury (DEC, 1998).

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[9] The Delphi methodology often is employed when standard instream flow incremental methodology (IFIM) techniques are not appropriate for a given study reach, and is based on visual estimates of habitat quality and availability made by a study team comprised of agency and applicant personnel.

Funding was received for the construction of the new facility that would include phosphorus removal upgrades to reduce their phosphorus discharge concentration level to 0.8 mg/L on a monthly average basis. The National Pollution Discharge Elimination System permit issued to the Middlebury wastewater treatment facility required compliance with the phosphorus limit by December 31, 1999. The town of Middlebury is also involved in a combined sewer overflow correction project, which when completed would also improve water quality in Otter Creek.

Our Analysis

On June 2, 1999, the VANR issued a WQC for the Middlebury Lower Project (Agency of Natural Resources, Department of Environmental Conservation Notice, June 2, 1999). This Certification included 17 conditions, which were previously listed in section IV.C.1. These conditions included requirements related to: flow management, minimum flows, flow monitoring, fish entrainment, debris management, erosion control, recreation, and administration/compliance. Conditions specifically relating to operations and water quality required by the WQC will be discussed in this section, while WQC conditions related to other resources will be discussed in other appropriate sections of this EA.

Conditions B (Flow Management), C (Flow Management during Impoundment Refill), D (Plan for Method to Maintain Bypass Flows and Run-of-the-River Operating Conditions), and E (Monitoring Plan for Impoundment and Flow Management) all specify requirements for project operation, minimum flows, and flow/water level monitoring (see section IV.C.1). Condition B requires that the project be operated in a ROR mode and that a continuous minimum flow of 157 cfs be spilled over the full spillway crest at all times.

Condition C requires that following an approved drawdown, up to 10 percent of the instantaneous project inflow may be placed into storage during the refilling of the impoundment, without significantly reducing downstream flows.

Condition D requires the applicant to develop a plan for maintaining ROR operations, and associated stable impoundment levels and minimum flow releases, for Commission and VANR approval.

Condition E requires development of a monitoring plan for flow releases, impoundment levels, and inflows, after consultation with the VANR and USFWS, with the plan to be approved by the Commission and VANR.

Other conditions of the WQC relating to project operations or water quality include: Condition G (Turbine Rating Curves), H (Debris Disposal Plan), I (Maintenance and Repair Work), and L (Erosion Control). Condition G requires that the applicant provide the VANR accurate turbine rating curves depicting the flow/production relationship.

Condition H requires that the applicant develop a plan for proper disposal of debris associated with project operations, including debris accumulated on the trashracks, and file this plan for Commission and VANR approval.

Condition I requires that CVPS file any proposals for maintenance or repair work with the VANR for prior review and approval, if the work may affect water quality or other designated uses of Otter Creek.

Condition L requires that CVPS, upon written request by the VANR, must design and implement erosion control measures to address any erosion that may occur as a result of the use of project lands for recreation.

The remaining conditions of the WQC (not including those to be discussed under Aquatic Resources and Recreational Resources), are related to administration and compliance. These include: Condition M (Compliance Inspection by Department), N (Posting of Certification), O (Approval of Project Changes), P (Reopening of License), and Q (Continuing Jurisdiction). In keeping with recent Commission policy, these conditions would be made requirements of the license, because the WQC conditions are mandatory.

No Action

Weybridge

Under no action, existing project operations would continue, resulting in fluctuating bypassed reach flows, from a 140 cfs minimum during times of no generation to leakage flow from the dam during generation periods. The West Channel around Wyman Island would continue to receive inadequate flows to protect aquatic resources, while the East Channel would receive the majority of the flow. Reservoir drawdowns would continue throughout the year with daily drawdowns ranging from 1 to 4 feet. In summary, there would be no enhancement of flow and reservoir conditions that would improve aquatic habitat and have the potential to improve water quality in the project area. Although existing operations do not violate state water quality standards,

continuing the existing operational regime would preclude the potential for some improvement in water quality.

Middlebury Lower

No action would also continue existing operations at the Middlebury Lower Project and preclude the potential enhancements related to the proposed bypassed reach minimum flow. Current operations provide a low level of continuous leakage flow into the bypassed reach, plus occasional higher flows, and water quality standards do not appear to be violated. The potential enhancements to water quality related to a higher minimum bypassed reach flow, however, would not occur.

Proposed Action with Additional Staff-recommended Measures

The applicant's proposed operational changes would enhance aquatic habitat and potentially water quality in both project areas. Staff, however, recommends additional measures (a DO monitoring program) for the protection of DO levels in the Weybridge tailrace during project shutdown periods during the summer and early-fall months. The addition of this DO monitoring program would ensure that water quality remains at or above state standards during all operational conditions.

Staff does not recommend any additional water quality measures for the Middlebury Lower Project.

c. Unavoidable adverse effects: Continued operation of the Weybridge Project in a cycling mode would result in continued reservoir level fluctuations and flow fluctuations downstream of the project. These fluctuations, however, would be reduced from current levels due to imposition of additional restrictions on reservoir levels and higher minimum flow releases. The continued operation of the Middlebury Lower Project would produce no unavoidable adverse effects on water quality.

3. Aquatic Resources

a. Affected environment:

Fisheries Resources

Weybridge

The VANR manages the section of Otter Creek that extends from the Weybridge Project upstream to the Huntington Falls dam (immediately upstream of the project) primarily as a warmwater fishery. The reach below the project is managed as a mixed warmwater and coolwater fishery. The principle gamefish species found in the project impoundment are northern pike and smallmouth bass; other gamefish that are present include largemouth bass, brown trout, and rainbow trout. Other species that occur upstream of the project include rock bass, bluegill, pumpkinseed, yellow perch, brown bullhead, white sucker, and fallfish. Fish species found downstream of the Weybridge project are similar to those occurring upstream, with the exception of mirror carp, which is only found downstream of Weybridge Dam.

The section of Otter Creek located downstream of Weybridge Dam, including the tailrace, consists of ledge and coarse substrates with riffle and quickwater habitats.

Rainbow and brown trout occur primarily downstream of the project and upstream of the Huntington Falls dam. The trout sport fisheries are supported, in part, by stocking of rainbow trout in the New Haven River (which enters Otter Creek upstream of the Huntington Falls dam; see figure 1) and stocking of rainbow and brown trout in the mainstem Otter Creek in the town of Middlebury (also upstream of Huntington Falls and two other hydro projects). In addition to stocked fish, naturally occurring rainbow trout are present in Otter Creek from Huntington Gorge upstream to the Beldens Project (FERC No. 2558), which is located at RM 23, about 3.5 miles upstream of the Weybridge Project. Brown trout occur naturally downstream of Weybridge, including in the project tailrace.

The VANR stocked steelhead trout in tributaries to the New Haven River in the early 1980s as part of a coldwater fishery program for Lake Champlain. Stocking of steelhead trout has not occurred since these earlier efforts, however, and the VANR has no plans to introduce this species or any other migratory fish (e.g., Atlantic salmon) upstream of the lowermost dam on Otter Creek, the Vergennes Project. The VANR also stocked muskellunge downstream of the project in past years, but these efforts have also been discontinued for several years. Future management activities may include introduction of walleye below the project for the purpose of establishing a recreational fishery. Natural reproduction of walleye in tailwater areas would be expected to occur if this species is introduced.

Middlebury Lower

The VANR manages the reaches of Otter Creek upstream and downstream of the Middlebury Lower Project primarily as a warmwater fishery. The project impoundment is narrow and extends about 1 mile upstream. The river below the project consists of gently sloped shorelines bounded by farmlands. The impoundment of the Beldens Project, the next downstream dam, extends to the tailwater of the Middlebury Lower Project. Substrates upstream and downstream of the Middlebury Lower Project consist mostly of mud and silts, sand, broken ledge, and bedrock.

Fish species occurring in the impoundment and tailwaters of the project include northern pike, smallmouth bass, largemouth bass, rock bass, sunfish species, brown trout, rainbow trout, yellow perch, white sucker, brown bullhead, fallfish, and several minnow and shiner species. The VANR annually stocks rainbow and brown trout in the project impoundment for an early spring put-and-take fishery. Trout found below the project most likely are stocked fish that have passed downstream over the dam or through the powerhouse turbines. As stated earlier, the VANR does not plan to introduce any migratory species (e.g., steelhead trout, Atlantic salmon) above the lowermost project on Otter Creek.

Mussel Populations

Weybridge and Middlebury Lower

Mussel surveys have not been conducted recently in the vicinity of either project. Visual observations by VANR staff, however, noted the presence of several species downstream of the Weybridge Project, including an uncommon species, the giant floater mussel, which has been proposed for state listing. Two rare species of mussels, the flutedshell and creek heelsplitter mussel, were observed in 1978 in the vicinity of the Middlebury Lower Project (CVPS, 1998b). None of the mussel species that occur in the Otter Creek basin, however, are state or federally listed as threatened or endangered.

b. Environmental effects:

Proposed Action

Weybridge

Instream Flows. Instream flow conditions associated with the operation of Weybridge have the potential to affect fishery resources in the project impoundment and

tailwaters. Impoundment fluctuations from peaking operations may negatively affect fish populations during spawning periods by exposing eggs in nearshore areas. Effects on fishery resources downstream of the project are related to habitat availability associated with bypassed reach flows and minimum flow levels in the East and West Channels of Wyman Island (this island splits the main Otter Creek channel immediately downstream from the terminus of the bypassed reach). Daily peaking operations also influence fisheries habitat downstream of the project.

CVPS proposed several operational modifications to alleviate instream flow-related effects on fishery resources upstream and downstream of the project. CVPS also proposed to install a physical diversion designed to increase flow through the West Channel of Wyman Island to increase usable habitat for the fish community downstream of the project. CVPS and the agencies conclude that, with appropriate flow levels, the West Channel has greater potential than the East Channel to provide quality habitat for local fish populations. The East Channel has steep sides and a lack of instream structure, which has resulted in less available habitat for fish, even at low flows (i.e., there is limited velocity refuge and cover for fish both along the stream margins and in the channel). The East Channel was altered to this configuration during project redevelopment in 1951.

The 600-foot-long bypassed reach at Weybridge is comprised mostly of riffle and run habitat with large boulder and ledge substrate. Currently, it does not receive any flow during periods of generation, but receives a 140-cfs minimum flow release from a Taintor gate on the west side of the dam during non-generation periods.

Based on an instream flow study and consultations with the agencies, CVPS proposed to release 125 cfs into the bypassed reach when the project is generating, and to increase this release to 250 cfs during walleye spawning and incubation periods in April and May. The increased bypass flow during these months would be deferred until walleye are successfully introduced into Otter Creek. The minimum flow would continue to be released into the bypassed reach from the Taintor gate on the west side of the dam. As previously discussed, CVPS has proposed to install a diversion structure that would increase the amount of flow that the West Channel of Wyman Island would receive during both generation and non-generation periods (see figure 2). The proposed configuration for the diversion structure has it extending from the southern tip of the island that the dam sits on (Rock Island) to the northern tip of the downstream small island at the mouth of the West Channel. The height and design of the structure would be such that all of the 125-cfs flow released into the bypassed reach during generation would be diverted into the West Channel. During non-generation periods when a minimum flow of 250 cfs would be released, the structure would allow for 125 cfs to

enter the East Channel and 125 cfs to be diverted to the West Channel. The diversion structure would be designed to allow fish movement between the tailrace channel and the bypassed reach.

To reduce effects on downstream aquatic habitat associated with peaking operations, CVPS proposed to limit the peaking ratio of generation flow to minimum flow to 4.5:1 within any given 24-hour period. CVPS also proposes to maintain the current downramping and upramping procedures.[10] Downramping procedures include the following steps:

- generation is reduced to the minimum efficient turbine capacity (450 cfs) at the end of a generation period;
- the Taintor gate is opened 18 inches as generation is ceased; and
- discharge through the Taintor gate is decreased through gradual closing of the gate over a 30 minute period until the gate opening is at 6 inches (this corresponds to a minimum flow release of 140 cfs; we assume this gate opening will be changed to meet the proposed minimum flow of 250 cfs).

Upramping is completed in two stages: (1) the Taintor gate is closed while generation begins at the minimum efficient turbine capacity of 450 cfs; and (2) generation remains at the minimum efficient capacity for 20 minutes, after which a gradual increase up to the desired flow level and corresponding generation load is initiated. CVPS concludes that the downramping and upramping procedures are adequate for minimizing fish stranding and effects on aquatic habitat.

To minimize effects on fishery resources upstream of the project within the impoundment, CVPS proposed to eliminate drawdowns between April 1 and June 15 of each year. This would help to protect fish spawning activities and egg depositions in nearshore areas that might become exposed during a drawdown. If high spring flows require the removal of flashboards, they would be reinstalled as soon as the river stabilizes. Drawdowns during the remainder of the year would be limited to 2 feet or less under normal operating conditions. Drawdowns greater than 2 feet are expected to be required for planned maintenance activities. CVPS states that at least one 6-foot drawdown is needed each year to conduct project safety inspection. However, such

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[10] Current upramping and downramping procedures were approved by the Commission on September 30, 1997, following studies completed in 1992 and 1994.

drawdowns may be less frequent because of the new inflatable rubber dam that was installed in 1996. CVPS proposes to consult with the VANR prior to conducting any maintenance drawdowns greater than 2 feet so that they can be scheduled during non-biologically critical time periods (e.g., spawning periods). Drawdowns greater than 2 feet also may be required under emergency situations (e.g., damage to project facilities). In such instances, CVPS proposes to notify the VANR of emergency drawdowns in a timely manner.

The operational and physical modifications proposed by CVPS to enhance fishery resources upstream and downstream of the Weybridge Project have been developed from site studies (e.g., instream flow evaluations) and through extensive negotiations with the agencies. The agencies have provided significant input during relicensing and generally concur that the proposed enhancements are adequate and will benefit the fishery resources in the project area (VANR letter of May 25, 1999; Interior letter of May 24, 1999).

Our Analysis

The instream flow study conducted by CVPS demonstrated the benefits of several flow release levels to aquatic habitat downstream of the Weybridge Project in the bypassed reach and main river channels (GSE, 1997). Habitat measurements were recorded at four different flow levels in the bypassed reach, the main river channel upstream of Wyman Island, and in the East and West Channels of Wyman Island. The flow levels for which data were collected ranged from 140 cfs (current minimum flow release) to 800 cfs. The data were evaluated for several representative species and life stages that were selected by CVPS in consultation with the VANR and USFWS.

Based on the results of the instream flow study and negotiations with the VANR and USFWS, CVPS proposed to release a minimum flow of 250 cfs from the Taintor gate on the west side of the dam during non-generation periods. The increase in the minimum flow to 250 cfs from the current minimum of 140 cfs provides considerable increases in the available habitat in the bypassed reach. Additionally, the proposed diversion structure will redirect 125 cfs into the West Channel of Wyman Island, which presently receives limited flow even at higher generation and river discharge levels. The assessment of instream flows and visual observations made by CVPS and the agencies demonstrated that the West Channel has better quality habitat than the East Channel. Because the quality of aquatic habitat in the East Channel appears to be sub-optimal for most species and size classes, a reduction of minimum flows (i.e., from about 140 to 125 cfs) should not result in a net negative effect on the fishery resources downstream of the project. Although 125 cfs in each of the Wyman Island channels does not maximize the

usable habitat for all of the representative species and life stages, it does strike a balance that will result in enhancements for the downstream fish community. Mussel populations downstream of Weybridge also will be protected and enhanced by increases in the wetted area in the West Channel of Wyman Island.

The implementation of a minimum flow to the bypassed reach during generation periods, regardless of the amount, would be an improvement over current conditions, in which no flow is released into the reach during generation periods, resulting in little habitat value. Additionally, with the diversion structure in place, the minimum bypass flow would increase flow levels in the West Channel during generation periods. The results of the instream flow study indicated that a flow of 125 cfs in the bypassed reach would provide near maximum usable habitat for rainbow trout and about 65 percent of maximum habitat for macroinvertebrates. Walleye spawning and incubation usable habitat was maximized at a flow of 300 cfs. The wetted width was similar among the different flow levels that were evaluated, thus there is considerable improvement for mussel populations over the current condition of no minimum release into the bypass reach. Based on the above information, CVPS has proposed to release a minimum flow of 125 cfs into the bypassed reach when the project is generating. This minimum would be increased to 250 cfs during April and May during walleye spawning and incubation periods. Flow releases for walleye, however, would be deferred until this species is successfully introduced downstream of the project. The VANR and USFWS have accepted these proposals for bypassed reach minimum flows as adequate.

As previously mentioned, CVPS proposes to install a physical structure to divert flows from the bypassed reach into the West Channel of Wyman Island. The agencies and CVPS have agreed that the structure should meet the following guidelines: (1) distribute flows as designed (i.e., 125 cfs to each channel during non-generation and 125 cfs to the West Channel during generation); (2) have a high degree of permanence and require limited maintenance; (3) allow for upstream fish movement through the structure; (4) have the ability to adjust flow distributions; (5) does not create a safety hazard; (6) does not result in unplanned channel or bank erosion; and (7) blends in with the surrounding environment as much as possible.

Impoundment drawdowns have the potential to affect fish populations. Spawning fish may have to move from nests or preferred habitats, and eggs that have been deposited in nests may become exposed and dessicate. Loss of shoreline habitat also may affect some species and life stages that use these areas for feeding or avoiding predators. Eliminating drawdowns between April 1 and June 15, as proposed by CVPS, would protect shoreline areas in the project impoundment during critical spawning and egg incubation periods for centrarchids (smallmouth and largemouth bass, rock bass,

bluegill) and yellow perch. CVPS also has proposed to limit the number of drawdowns that are greater than 2 feet during the remainder of the year. Larger drawdowns would only be conducted for required maintenance activities and under emergency conditions (e.g., rubber dam failure). Reducing the number of drawdowns greater than 2 feet would also minimize effects on species, such as burrowing amphibians, that utilize shoreline habitats for non-spawning purposes.

Based on our analysis of the available information and data, we concur with CVPS and the agencies that the proposed minimum flows for the bypassed reach during generation periods and East and West Channels of Wyman Island during non-generation periods are adequate for protecting and enhancing downstream fishery resources (see section V. C. 2.b. for a discussion of the flow monitoring plan). In addition to these minimum flow releases, we concur that the proposed diversion structure is an appropriate means for distributing minimum flows between the two Wyman Island channels, and we recommend CVPS consult with the resource agencies to design an instream diversion structure that meets the seven guidelines outlined above . We also agree that the proposed peaking ratio and down- and upramping procedures would minimize fisheries impacts associated with peaking operations. With respect to impoundment level fluctuations, we concur that eliminating drawdowns from April 1 through June 15 and restricting them to 2 feet or less during other times of the year, except for planned maintenance activities or in the event of dam repair emergencies, would protect and enhance the upstream fishery and other aquatic resources.

In its April 7, 2000 comments on the draft EA, VANR states that although the agency and CVPS have agreed on minimum flow standards for the East and West Channels around Wyman Island, they recommend that any related license article should specify both the volume and applicable location for the minimum flow standards. VANR also recommends that the approximately 5-cfs flow requirement for fish passage through the diversion structure should be provided through the Taintor gate, in addition to the agreed-to 125-cfs minimum flow in the bypassed reach. CVPS has agreed to specifying the volume and locations for the minimum flow standards, but disagrees that an additional 5 cfs should be released through the Taintor gate, to provide for fish passage flows through the diversion structure.

We also agree that the volume and location for the minimum flows should be specified in the new license requirements, but do not believe that it would be necessary to require the release of an additional 5 cfs for fish passage through the diversion structure. The 5 cfs mentioned as the flow requirement for fish passage is at this time only a "best guess" of the volume that may be required. The diversion structure and the provisions for fish movement through the structure have not yet been designed, so the actual flow

requirements are not yet known. In addition, assuming that 5 cfs may be the flow required for fish movement, this is within the general range of "error" typically associated with field flow measurements (i.e., determining the difference between 125 and 130 cfs would be difficult). We believe that this issue can best be addressed by designing a flow monitoring plan that considers the flow requirement for fish passage (once that is known), and includes provisions for adjusting flows to meet the minimum flow requirements for the West Channel, as well as for fish movement through the diversion structure, once operational experience and monitoring has occurred.

Fish Passage. CVPS has not proposed to implement upstream or downstream fish passage measures at the Weybridge Project, and the VANR and USFWS have not requested any such enhancement measures. The USFWS, however, has requested reservation of authority to prescribe upstream fish passage facilities if future management plans for Otter Creek warrant such measures.

Our Analysis

We conclude that fish passage facilities at the Weybridge Project are not warranted at this time, based on current fishery management activities and the status of upstream and downstream fisheries. The VANR does not plan to introduce any migratory species (e.g., steelhead trout, Atlantic salmon) that would require access to upstream areas for spawning and juvenile rearing. Existing riverine species appear to be abundant upstream and downstream of the project, and, although upstream movement is restricted, downstream dispersal is facilitated by spillway, Taintor gate, or turbine passage. Although there is no need for fish passage measures based on current management activities, Interior has requested that any license issued for the Weybridge Project include a reservation of authority to prescribe future fish passage facilities at the project under Section 18 of the FPA. Section 18 of the FPA provides the Secretary of the Interior the authority to prescribe fishways. We recognize that future fish passage needs and management objectives cannot always be predicted when a license is issued. Under these circumstances, and upon receiving a specific request from Interior, the Commission would reserve Interior's authority to prescribe fishways.

Middlebury Lower

Instream Flows. The Middlebury Lower project is currently operated as a ROR facility. Consequently, there are minimal effects to impoundment and tailwater fishery resources with respect to instream flow changes associated with the operation of the project. However, the 750-ft-long bypassed reach does not now receive continuous flow other than leakage, which provides limited pool habitat. The bypassed reach receives

larger amounts of flow during spring run-off and periods of heavy rains, when river discharge exceeds project generation capacity. Tailwater flows may fluctuate, but because the impoundment of the Beldens Project backs up to the Middlebury Lower Project tailrace, these fluctuations generally are not the result of operations at Middlebury Lower. The Middlebury Lower impoundment extends about one mile upstream and generally remains stable due to ROR operation. Minor increases in the impoundment level occur in the spring during periods of high run-off from precipitation and snow-melt. Impoundment levels also are affected by the cycling operations of upstream projects.

CVPS has proposed to continue to operate the Middlebury Lower Project as a ROR facility and to provide a constant minimum flow of 157 cfs, or inflow if less, to the bypassed reach (there is no minimum bypassed reach flow requirement under the current license). The proposed minimum flow for the bypassed reach was determined from an instream flow Delphi study conducted cooperatively with the VANR and USFWS (CRA and MRM, 1997). The Delphi approach used for the Middlebury Lower bypassed reach involved a study team that developed a consensus agreement on the quantity of available habitat for target species and life stages at various flow levels. The quantity of available habitat was based on visual observations made by the study team members and on depth and velocity measurements made prior to and during the study team observations. The results of the Delphi study indicated that a flow of 157 cfs provided the maximum or a high percentage of the maximum habitat available for the species and life stages for which flows were evaluated. Both the VANR and USFWS have accepted the results of the study and concur with the proposed minimum bypass flow.

Our Analysis

The CVPS proposal to continue to operate the Middlebury Lower Project in a ROR mode and to release a minimum flow of 157 cfs into the bypassed reach will benefit the fishery resources upstream and downstream of the project. ROR operation produces stable flows within the impoundment that vary only to the extent necessary to accomplish outflows over the uncontrolled ogee spillways. Tailwater elevations are influenced by fluctuations in the Beldens Project impoundment, which backs up to the Middlebury Lower Project tailrace. The bypassed reach is comprised of mostly bedrock and ledge substrates, producing habitat that is marginal for most fish species that occur downstream of the project. Despite the poor quality of the bypassed reach habitat, the proposed minimum flow provides considerable improvement by increasing the usable habitat for aquatic species, compared to the current no-flow conditions under which all inflow (except leakage) is diverted to the powerhouse. Based on these observations, we concur

with CVPS and the agencies that continued ROR operation and the proposed 157-cfs minimum bypass flow would protect and enhance the fish communities in the vicinity of the Middlebury Lower Project. ROR operation and the proposed minimum flow are also consistent with the mandatory conditions of the WQC (see sections IV.C.1 and V.C.2.).

Fish Passage. CVPS has not proposed to implement upstream or downstream fish passage measures at the Middlebury Lower Project, and the VANR and USFWS have not requested such enhancement measures. The USFWS, however, has requested reservation of authority to prescribe upstream fish passage facilities if future management of Otter Creek warrants such measures (Interior letter of March 30, 1999).

Our Analysis

We conclude that fish passage facilities at the Middlebury Lower Project are not warranted based on current fishery management activities and the status of upstream and downstream fisheries. The VANR does not plan to introduce any migratory species (e.g., steelhead trout, Atlantic salmon) that would require access to upstream areas for spawning and juvenile rearing. Existing riverine species appear to be abundant upstream and downstream of the project, and, although upstream movement is restricted, downstream dispersal is facilitated by spillway Taintor gate or turbine passage. Although there is no need for fish passage measures based on current management activities, Interior has requested that any license issued for the Middlebury Lower Project include a reservation of authority to prescribe future fish passage facilities at the project under Section 18 of the FPA. Section 18 of the FPA provides the Secretary of the Interior the authority to prescribe fishways. We recognize that future fish passage needs and management objectives cannot always be determined at the time of project licensing. Under these circumstances, and upon receiving a specific request from Interior, the Commission would reserve its authority to require such fishways as may be prescribed by the Secretary of the Interior.

Trashracks. The VANR, through Condition F of the WQC (see section IV.C.1), requires that CVPS consult with the VANR prior to the next replacement of the intake trashracks, to determine the appropriate bar clear spacing and rack location to prevent fish entrainment at the intake. CVPS would also be required to file the trashrack design information with VANR for approval, prior to installation of the new trashracks.

Our Analysis

In regard to the WQC condition to require consideration of future trashrack designs to prevent fish entrainment, we concur that this is a reasonable requirement that

should be made a condition of the license. Although there is no evidence of significant entrainment or fish mortality at the project, it would be prudent to consider trashrack designs that would reduce any fish entrainment that may be occurring, when the existing trashracks have reached the end of their service life. CVPS should consult with the VANR in the development of the design of the future trashracks, and file the proposed designs with the Commission for approval prior to the replacement of the existing trashracks.

No Action

Weybridge

Under no action for the Weybridge Project, the project would continue to operate under the current license conditions. Included in these conditions is a minimum flow release of 140 cfs into the bypassed reach during periods of non-generation. There are no current requirements for a minimum bypassed reach flow during generation periods or for limitations on the timing and amount of drawdowns. CVPS's proposed enhancements to project operations, including minimum flows during periods of generation and non-generation and modifications to drawdown timing and amounts would not occur under no action.

Middlebury Lower

No action for operating the Middlebury Lower Project would be similar to the proposed alternative, except for CVPS's proposal to implement a minimum bypassed reach flow of 157 cfs. This minimum flow would improve the quality of aquatic habitat within the bypassed reach, because no minimum flow is currently required. No action would result in no improvement to aquatic habitat in Otter Creek.

c. Cumulative effects: We selected the 64 miles of the Otter Creek mainstem that extends from its mouth at Lake Champlain upstream to the Sutherland Falls Project (Project No. 2558) as the geographic scope for assessment of cumulative effects associated with the operation of the Weybridge and Middlebury Lower Projects (see figure 1). Instream flow fluctuations in the vicinity of Weybridge and Middlebury Lower, and at other projects on the river, could have cumulative effects that may be adversely affecting Otter Creek fisheries. Other cumulative effects that may be occurring associated with the dams on Otter Creek are related to blockage of fish movement, and the potential mortality of fish attempting to move downstream through the projects.

At Weybridge, CVPS's proposals to provide increased minimum flows and modify the current drawdown levels would enhance upstream and downstream fish populations in the project vicinity. The operation of the Middlebury Lower Project as a ROR facility and the implementation of a minimum bypass flow would also enhance fish populations in the vicinity of the project. Together, the operational measures proposed by CVPS at the two projects considered in this final EA, would provide significant enhancement to the fish populations in this section of Otter Creek.

There are no anadromous or migratory species (such as Atlantic salmon or steelhead trout) upstream of the most downstream dam, the Vergennes Project, and the agencies have no active plans to introduce such species to Otter Creek. Thus, there are no species that must pass upstream to complete their life cycle. All the species that occur throughout the mainstem and tributaries to Otter Creek are "resident," and can complete their life cycles within the areas where they now reside. Although even "resident" species may move some distance within a river system, and may pass through one or more dams and be exposed to entrainment mortality, recent entrainment studies conducted at other projects in the Northeast and Midwest have seldom demonstrated significant adverse effects on these species. Recent reviews of these studies (EPRI, 1992; FERC, 1995) indicate that at projects with warmwater/coolwater species assemblages, similar to those on Otter Creek, large-scale fish movements were uncommon, resulting in low entrainment rates. In addition, EPRI (1992) reported that the mortality rate of naturally entrained resident fish was relatively low, averaging 5.8 percent for sites with Francis turbines, such as those at the Middlebury Lower Project, and 6.3 percent for sites with Kaplan turbines, such as the unit at the Weybridge Project.

Based on the above information, continued operation of the Weybridge and Middlebury Lower Projects with the enhancement measures recommended herein, in conjunction with other hydroelectric projects and other development on Otter Creek, would have beneficial cumulative effects on fish populations in the basin.

d. Unavoidable adverse effects:

Weybridge

Some aquatic habitat and associated production may still be limited due to the flow regulation and reservoir level drawdowns related to the proposed cycling operations. Aquatic habitat would still be exposed to periods of inundation and dessication, but at a reduced level from existing operations. Fish would also continue to be exposed to a low level of entrainment mortality.

Middlebury Lower

Although strict ROR operation would benefit aquatic resources, fish would continue to be exposed to a low level of entrainment mortality.

4. Terrestrial Resources

a. Affected environment:

Vegetation

Weybridge

The predominant overstory in the Weybridge Project area consists of both hardwood forest and mixed hardwood forest, dominated by sugar maple, consistent with the Northern Hardwoods Ecoregion in which the project area is situated. The dominant species include quaking and bigtooth aspen, balsam fir, red spruce, white pine, yellow birch, and eastern hemlock. Typical understory species include striped maple, witch-hazel, and hobblebush (De Graaf 1992, cited in CVPS, 1998a).

The terrain in the uplands adjacent to the project area is moderate to very steep, with upland communities of sugar maple, basswood, black locust, yellow birch, black cherry, beech, and various species of oak. Eastern hemlock and white pine are distributed throughout. Transitional habitats between the upland and the wetland areas occur along the impoundment and tailrace near the steep sloped banks of the river. These areas are dominated by shrubs such as beaked hazelnut, tartarian honeysuckle, barberry, and red osier dogwood. Maple and beech saplings are interspersed throughout the area (CVPS, 1998a).

Middlebury Lower

Cover types typical of the Middlebury Lower Project area include open fields, shrub uplands, residential areas, and forest in various stages of succession. The upland banks within the project area, which were dominated by cropland in the past, are now in a young forest stage of succession. Typical species in these post-agricultural forests include white pine, red maple, paper birch, bigtooth and quaking aspen, white ash, and black cherry. The herbaceous layer in post-agricultural forests is typically dense in this region, and includes such species as poison ivy, bracken fern, twinflower, wild sarsaparilla, teaberry, spotted touch-me-not, butter-and-eggs, and Japanese knotweed. The more mature, second growth forests in the area are dominated by species such as

basswood, sugar maple, eastern hemlock, red oak, and shagbark hickory. The shrub/sapling layer is mostly composed of saplings of the dominant tree species. Many weedy trees and shrubs also occur within the project area. These include box-elder, common locust, tartarian honeysuckle, buckthorn, and barberry (CVPS, 1998b).

The terrain associated with the project area is generally moderately to steeply sloped. A transitional habitat occurs along the project impoundment and tailrace near the banks of the river. This area is dominated by tree and shrub species such as staghorn sumac, quaking aspen, white birch, white pine, and red maple, with an understory of raspberry, sweet fern, goldenrod, aster, strawberry, cinquefoil, and redtop (CVPS, 1998b).

Wetlands

Weybridge

Three wetland areas occupy approximately 6 acres of the project area (Countryman, 1996). The first wetland area is located approximately 400 feet upstream of the powerhouse and consists of 1 acre of palustrine emergent marsh with a fringe of palustrine forested deciduous wetlands. Dominant vegetation in the emergent area include species such as soft rush, bur-reed, arrowhead, and rice cutgrass. The forested area is dominated by red maple and silver maple. The second wetland area is located along the north side of the curve in the river, approximately 1,100 feet upstream of the powerhouse, and incorporates both palustrine emergent marsh and active pastureland. The dominant species in this area is narrow-leaf cattail which gives way to reed canary grass and bulrush in the pastured area. Sweetflag dominates the ditches in this area. The third wetland area is located approximately 200 feet downstream of the Huntington Falls Project, in the upper portion of the Weybridge impoundment, and consists of palustrine emergent marsh. Dominant species include goldenrod, boneset, Joe-Pye weed, angelica, graminoids, with some purple loosestrife throughout (Countryman, 1996).

In addition, 13 wetland areas were identified downstream of the project area. Of these, four are within the Otter Creek floodplain, and are therefore directly influenced by the project. These four wetland areas are inundated or saturated during high flow periods. One area is classified as lower perennial riverine, another as palustrine, and the last two as lower perennial riverine with cobble/gravel bottoms (Countryman, 1996).

Middlebury Lower

Wetlands occur along the shoreline of the impoundment and on the western shoreline of its tailwater, as well as along the impoundment of the Beldens Project downstream from the project area. Five wetland areas occupy approximately 18 acres of the project area (CVPS, 1998b).

The first wetland area is located below the powerhouse, and is approximately 2 acres of palustrine emergent wetland. Dominant species include sensitive fern, cattail, rice cutgrass, spotted touch-me-not, sedges, beggar's ticks, smartweeds, tearthumb, bluejoint grass, and manna grass. Willows and red osier dogwood occur sporadically throughout the area. The second wetland area is located within the project impoundment and consist of 10 acres of palustrine emergent shrub/scrub wetlands. Dominant species include box-elder, honeysuckle, black willow, red osier dogwood and highbush cranberry. Herbaceous species include cattails, sedges, grasses, sensitive fern, nightshade, Joe-Pye weed, goldenrods, asters, and spotted touch-me-not. A study performed in 1986 by the Vermont Natural Heritage Program for the Otter Creek Audubon Society concluded that this wetland was the most interesting natural feature in the Middlebury Lower Project area due to its size and diversity. The third wetland area is approximately 4 acres, and it is also located in the project impoundment and is classified as palustrine forested wetland. Common species include red maple, American elm, and green ash. The fourth wetland area is located below the powerhouse and is classified as 1 acre of broad-leaved deciduous palustrine forested wetland consisting of northern white cedar, red maple, and spirea. The fifth wetland area is located far above the project and encompasses approximately 1 acre in area. This wetland is classified as a palustrine shrub/scrub, semi-permanently saturated wetland.

Wildlife

Weybridge and Middlebury Lower

Due to the variety of habitats available near the two project areas, a diversity of wildlife can occur in the area. Available habitats include hardwood forest, hardwood dominated mixed forest, deciduous shrub/scrub habitat, residential areas, agricultural areas, wetland, island and open water habitats. These habitat types occur in proximity to both the Weybridge and Middlebury Lower project sites, therefore wildlife are expected to be similar for both project areas.

Wildlife expected to occur within the project areas consist mostly of species common to the vicinity, including herptiles, birds, and various mammals. Herptiles common to Otter Creek area include the wood frog, grey tree frog, green frog, redback

salamander, eastern American toad, eastern garter snake, ringneck snake, and the northern redbelly snake.

Common woodland birds include chickadee, song sparrow, swamp sparrow, phoebe, blue jay, white breasted nuthatch, evening grosbeak, Swainson's thrush, wood thrush, pine siskin, warblers, red-eyed vireo, American redstart, veery, hairy woodpecker, eastern wood-peewee, ruffed grouse, cedar waxwing, and American woodcock.

Waterfowl observed in the openwater habitat near the Weybridge Project impoundment and tailrace include blue-winged teal, common merganser, mallard, black duck, wood duck, hooded merganser and common goldeneye (Andrews 1990, cited in CVPS, 1998a). Waterfowl observed near the Middlebury Lower Project include blue-winged teal, common merganser, mallard, black duck, and common goldeneye (Andrews 1990, cited in CVPS, 1998b).

Mammals that are common to the area include red squirrel, northern flying squirrel, grey squirrel, chipmunk, deer mouse, meadow jumping mouse, smoky shrew, southern red-backed vole, cottontail rabbit, woodchuck, coyote, red fox, porcupine, ermine, muskrat, beaver, mink, and white-tailed deer (De Graff and Rudis 1983, cited in CVPS, 1998a; 1998b).

Species of Special Concern

Weybridge

The USFWS confirmed that no federally listed threatened or endangered plant species are known to exist in the Otter Creek basin (CVPS, 1998a).

One state threatened plant, the green dragon, was identified about 1 mile upstream from the mouth of the Lemon Fair River and about 2.5 miles downstream from the Weybridge dam, along Otter Creek (Marshall Memorandum, 1995; Countryman, 1997, cited by CVPS, 1998a). The elevation of the green dragon population is above the influence of the flow regimes controlled by project operations. Several plant species that were rated as "uncommon" (S3) by the Vermont Nongame and Natural Heritage Program were found in the project area (Countryman, 1996; Countryman, 1997, cited in CVPS, 1998a). These include Kalm's broom-grass, Gray's sedge, Frank's love-grass, creeping love-grass, and hackberry. Both Kalm's broom grass and Gray's sedge are located above the project's area of influence, while Frank's love-grass and creeping love-grass are within the project's area of influence. The hackberry community is considered to be a significant ecological community by the state of Vermont and the Nature Conservancy

(CVPS, 1998a), and one of the best examples of a hackberry community in Vermont (Countryman, 1997, cited in CVPS, 1998a). Although the hackberry community is within the active floodplain of Otter Creek, it is located above the summer flow level and is therefore not influence by the project.

The USFWS also confirmed that no federally listed threatened or endangered species of wildlife are known to exist in the Otter Creek basin (CVPS, 1998a). Several osprey, listed as a threatened species in Vermont, were observed during a field survey, but no nesting sites were found (Countryman, 1997, cited in CVPS, 1998a). These individuals are assumed to represent a transitory population. No state listed wildlife species of special concern were identified for the Weybridge Project area.

Middlebury Lower

As noted above, the USFWS confirmed that no federally listed threatened or endangered plant or animal species are known to occur in the Otter Creek basin (CVPS, 1998a).

CVPS conducted a search for rare plant species in the Middlebury Lower Project area in 1996 (CVPS, 1998b). Three "uncommon" (S3) species listed by the Vermont Nongame and Natural Heritage Program have been identified within the project area. These include Frank's love-grass, cuckoo flower, and Gray's sedge.

Although there is the potential for transitory threatened or endangered wildlife species, such as the osprey, to use the project area, no threatened or endangered species have been reported in the area. No state listed wildlife species of special concern were identified for the Middlebury Lower Project area.

b. Environmental effects:

Proposed Action

Weybridge

The Weybridge Project operates in a cycling mode, whereby water is stored in the impoundment and used to generate power when required, resulting in reservoir and downstream water level fluctuations. CVPS proposes to continue operating the Weybridge Project in a cycling mode, although it proposes to reduce reservoir level fluctuations and to increase minimum flows below the project.

Vegetation. CVPS (1998a) states that the population of the state threatened green dragon is above the elevation under the influence of project operations, and therefore is not affected by the project (Countryman, 1997, cited in CVPS, 1998a). The population of hackberry, which is considered to be a significant plant community in Vermont, is within the active floodplain of the river. According to the U.S. Forest Service (USFS), periodic flooding is not detrimental to hackberry (USFS, 1965, cited in CVPS, 1998a). As with the green dragon, the community occurs 8 to10 feet above normal summer flows and is therefore not affected by project operations. Of the four "uncommon" graminoids found in the project area, Kalm's broom grass and Gray's sedge occur above the active floodplain and are not influenced by the project. Frank's love grass and creeping love-grass occur in a narrow bank along the river, downstream of the dam and within the zone affected by project operations. The populations were observed to be robust, however, under the current cycling mode, and both species appear well adapted to the project related water level fluctuations (Countryman, 1997, cited by CVPS, 1998a).

Our Analysis

Because the Weybridge Project has been operating in a cycling mode for decades, it is reasonable to assume that no species currently occurring in the project area will suffer any impacts from continuation of a cycling mode of operation that reduces flow and reservoir level fluctuations. Only two species of concern occur within the project's zone of influence, and both appear to be thriving under the current conditions. Any effects on vegetation in the area would be minor.

Wetlands. Due to the storage and release of water within the impoundment, water levels immediately upstream of the impoundment usually experience fluctuations of approximately 1.5 to 2 feet. These fluctuations, however, can be as little as 1 foot or as great as 4 feet. Additionally, maintenance activities can require drawdowns of up to 6 feet. Both peaking and ponding may affect wetland communities. Drawdowns during winter months can cause the roots or rhizomes of perennial emergent vegetation to freeze and die. Therefore, annual vegetation would be favored. Drawdowns during the growing season can subject wetland plants to dessication. These effects are minimized by performing maintenance drawdowns during late summer to coincide with natural water level cycles and limiting the time the drawdowns occur.

Periods of high flow have a greater potential effect within the Weybridge project area. Wetland species that are intolerant of even moderate flow velocity, such as water lily or paludal species like many sedges and grasses, are absent from the impoundment wetlands (Countryman 1997b, cited in CVPS, 1998a). Seasonal high flows in the

impoundment seem to favor perennial species such as bulrushes and bur-reeds, which can tolerate swift flows. Although an increase in minimum flows or a change to ROR operation is not expected to change the total area of wetlands in the project area, a change of vegetation could increase the density and diversity in the existing wetlands.

Our Analysis

Although the density and diversity of vegetation within the existing wetlands could potentially be increased by discontinuing the water fluctuations in the project area, the situation has existed for a long enough time to have established a community adapted to it. Modification of the cycling mode could affect the existing community composition, although it is unlikely that the amount of wetland area would be greatly influenced by changing operations. The potential effects on existing wetlands from the continuation of operations would be minimal.

Wildlife. It is not anticipated that the project would have any effects on osprey. This species seems to be a transitory population and should continue to find suitable open water habitat to hunt for fish when passing through the project area.

Our Analysis

The operation of the Weybridge Project in its current cycling mode should not have any effects on osprey or other wildlife.

Middlebury Lower

The Middlebury Lower Project operates in a ROR mode, and CVPS proposes to continue to operate the project in a ROR mode, which would result in no environmental effects on vegetation, wetlands, or wildlife in the project area. Because the impoundment maintains a constant water level, with only 1 inch of fluctuation, the project has a positive effect on the wetland areas associated with the project area.

Our Analysis

We conclude that continuation of current operations at the Middlebury Lower Project should not create any effects on vegetation, wetlands, or wildlife.

No Action

Under no action, both the Weybridge and Middlebury Lower Projects would continue to operate under the terms of the existing licenses. As noted previously, vegetation, wetlands, and wildlife have adapted to the decades of operation by these projects, so continued operation would not adversely affect these resources.

c. Cumulative effects: We selected the 64 miles of the Otter Creek mainstem that extends from its mouth at Lake Champlain upstream to the Sutherland Falls Project (Project No. 2558) as the geographic scope for assessment of cumulative effects associated with the operation of the Weybridge and Middlebury Lower Projects (see figure 1). Water level fluctuations and flow regulation in the vicinity of Weybridge and Middlebury Lower, and at other projects on the river, could have cumulative effects on vegetation, wetlands, and wildlife along the mainstem of Otter Creek.

Assessment of the terrestrial resources in the vicinity of the Weybridge and Middlebury Lower Projects, however, shows that these resources have adapted to the presence of these projects, and would not be adversely affected by their continued operation. It is expected that the other projects on the river, which also have been in place for several decades, have had similar effects on terrestrial resources in their vicinity. Thus, the mainstem Otter Creek, up to RM 64, now consists of a reach of river with several mainstem impoundments surrounded by vegetation and wetlands that have adapted many years ago to the existing flow and reservoir regulation regime.

The continued operation of both the Weybridge and Middlebury Lower Projects, with several enhancements in operations related to reduced reservoir fluctuations and improved flow releases, is not expected to cause any additional adverse environmental effects on terrestrial resources in the Otter Creek basin.

d. Unavoidable adverse effects: None.

5. Land Use and Aesthetic Resources

a. Affected environment:

Weybridge

The Weybridge Project impoundment shoreline is predominantly forested and undeveloped. The impoundment extends about 1.5 miles upstream from the dam, and varies in width from about 150 feet at the upstream end to greater than 600 feet at the lower end. The project structures, including the existing powerhouse and dam, are primarily visible from Quaker Village Road, which runs below and parallel to the project

dam. Rock Island, a small island located immediately below the dam, separates the tailrace channel and bypassed reach and contains a small recreation area. The recreation area provides views of the 600-foot-long bypassed reach and overhanging forest vegetation along the east and west river banks. The former powerhouse, a small, one-story structure located on the island, can be viewed from Rock Island and from Quaker Village Road.

CVPS currently operates the project in a cycling mode with typical drawdowns of 2 feet and up to three cycles a day, during normal (500 cfs to 1,200 cfs) to high (greater than 1,200 cfs) flow conditions. During normal operations, flow passes through the station and into the tailrace, and the bypassed reach receives only leakage flow. The bypassed reach receives flow during up-ramping, down-ramping, when inflows exceed the hydraulic capacity of the turbine (1,600 cfs), and when no generation is occurring (a minimum flow of 140 cfs).

Middlebury Lower

The Middlebury Lower Project is surrounded by residential, commercial, and agricultural uses, with predominantly forest cover along the reservoir shoreline. Most lands surrounding the project boundary are privately owned. The 16-acre project impoundment extends 1 mile upstream to a falls beneath the Battell Bridge in the city of Middlebury's civic and commercial center. Prominent aesthetic features of the project area includes water flow over the two dams, which have a combined length of 380 feet, and the historic Pulpmill covered bridge, located less than 150 feet upstream of the west dam. The fixed-crest concrete dams, located on either side of a small island, create falls approximately 15 feet high. Downstream of the east dam, a linear island and gated canal intake separate the power canal from the approximately 750-foot-long bypassed reach.

Shore-based views are most accessible from the recreation and upper parking area located along the west shoreline. Viewed from the picnic area, the east dam nearly parallels the river banks and presents viewers with a frontal view of the 260-foot-long crest, with the covered bridge in the background. Views of the flow over the dams, the powerhouse, the canal intake area, and the bypassed reach can be seen from the hiking trail located within the recreation area on the west side of the river. The Pulpmill bridge, because it is enclosed, does not allow views downstream to the project dams and bypassed reach or upstream to the project impoundment.

CVPS currently operates the Middlebury Lower Project as a ROR project. Historically, flows outside of the operating range of the three generating plants (minimum 100 cfs per unit, maximum 945 cfs for all three units) have been passed over

the dams or through a sluice gate in the east dam. The impoundment elevation typically fluctuates no more than 1 inch from the crest elevation and water generally spills over the dam.

b. Environmental effects:

Proposed Action

Weybridge

CVPS proposes to maintain a minimum flow of 125 cfs or inflow in the bypassed reach during periods of generation and to provide a flow of 250 cfs during April and May of each year for walleye spawning, at the time that walleye are successfully introduced into the lower Otter Creek. During periods when the project is not generating, CVPS proposes to maintain a minimum flow of 250 cfs or inflow into the bypassed reach. CVPS also proposes to install a diversion structure that would allow about 125 cfs of this flow to enter into the East Channel and about 125 cfs of this flow to enter into the West Channel around Wyman Island. The proposed diversion structure would be designed to maintain the natural appearance of the site to the extent possible. CVPS also proposes to eliminate reservoir drawdowns during April 1 to June 15 each year, and to limit drawdowns to 2 feet or less during the remainder of the year.

Interior stated that the proposed diversion structure should blend with the surrounding environment as much as possible and that CVPS design the structure in consultation with the VANR and USFWS (letter from Andrew Raddant, Interior, to Secretary Boergers, FERC, dated June 24, 1999).

The proposed minimum flows would provide beneficial aesthetic effects of more continuous water flow within the project's bypassed reach and would increase the amount of water flow in the West Channel, which under current project operations receives minimal flow. The most significant aesthetic benefits of the proposed flow measures would result from the increased flows in the bypassed reach, as this area is most easily viewed from the small recreation area on Rock Island.

CVPS's proposed recreation facility enhancements on Rock Island, installation of an interpretive sign on the downstream side of the old powerhouse and modification of one of the existing picnic tables at the Rock Island recreation area to provide Americans With Disabilities Act (ADA) accessibility, would have no significant effect on aesthetic and land use resources within the project area.

Middlebury Lower

CVPS proposes to continue operating the Middlebury Lower Project in ROR mode and to increase the minimum flow into the bypassed reach to 157 cfs (or inflow, whichever is less). CVPS also proposes to reestablish vegetation on the hillside in the recreation area.

The VANR recommended that the headgate frame at the canal entrance be painted with a darker, more receding color at the time of the next scheduled maintenance painting. The VANR also recommended that any re-vegetation include consideration of continued visual access from the recreation area. In addition, the VANR stated that the proposed minimum flow of 157 cfs be provided as a crest spillage rather than discharged through the gate or by other means, to provide the best visual effect of the minimum flow (letter from Jeffrey Cueto, VANR, to Secretary Boergers, FERC, dated March 23, 1999).

The proposed operations would not alter land use in the project area. Under the existing typical average minimum bypassed reach flow of 77 cfs, the dark concrete of the east spillway is visible behind a veil of water, as are the abutments of the upstream arm of the ell-shaped west spillway. At the downstream arm of the west spillway, approximately one-third of the crest is exposed, and the remaining two-thirds topped by a veiling flow. Exposed ledges dominate the viewshed of the bypassed reach, with little appearance of moving water. As illustrated in the aesthetic flows videotape submitted with the license application, the proposed 157 cfs flow would provide a veil of water flow over the east dam and the entire crest at the west dam (except for the sluice gate). Within the project's bypassed reach, the 157 cfs flow submerges some low-lying ledge, broadens pools, and enhances secondary falls over ledges, relative to the present flow in the bypassed reach. For these reasons, the proposed 157 cfs flow likely would enhance the aesthetic resources of the bypassed reach and foreground views to the Pulpmill covered bridge.

The proposed recreation enhancements, including the proposed canoe take-out, portage trail and signage, would have minimal visual effects on the project area. The proposed footbridge over the historic mill channel and the proposed portage trail would provide easier access to this area, and therefore, provide enhanced opportunities to view the bypassed reach area. Implementation of the proposed re-vegetation on the hillside in the existing recreation area, so as to maintain views provided of the bypassed reach area in this location, would ensure that aesthetic viewing opportunities from this area would remain. CVPS's proposed consultation with the VANR and other interested parties in the development of the proposed recreation enhancements would help ensure that the proposed portage trail and footbridge are constructed in a manner to provide beneficial,

rather than potential adverse effects, as a result of proper design and selective vegetative clearing.

c. Unavoidable adverse effects: None.

6. Recreation Resources

a. Affected environment: There are five state parks, the Green Mountain National Forest, and Lake Champlain within the general project vicinity. Outdoor recreation activities available in the area include camping, picnicking, hiking, boating, fishing, swimming, skiing, snowmobiling, and ice-skating.

Weybridge

Recreation activities within the Weybridge Project area include canoeing, picnicking, and fishing. Existing recreation facilities within the project area include: a canoe take-out located upstream of the project dam on the east bank of Otter Creek; a short portage trail that extends from the canoe take-out location along the roadway to Rock Island and along a path on the island to the canoe put-in location; a canoe put-in located at the tip of Rock Island; and a recreation area with picnic tables and a parking area located on Rock Island. CVPS estimates that 182 persons visited the project area in 1996 for recreation purposes.

Middlebury Lower

Recreation uses within the Middlebury Lower Project area include fishing, canoeing, boating, wildlife viewing and picnicking. Existing recreation facilities include a recreation area with a picnic table and parking area located on the west shoreline of the bypassed reach, immediately downstream of the west dam. A small parking area and short pathway to a canoe put-in is located on the west shore of the downstream impoundment, across the reservoir from the Middlebury Lower Project's powerhouse. An undeveloped trail located off the northern end of the existing recreation area extends downstream along portions of the shoreline. CVPS estimates that approximately 109 people visited the project area in 1996 for recreation purposes.

b. Environmental effects:

Weybridge

CVPS proposes to replace an existing information sign; install an interpretive sign on the downstream side of the old powerhouse, including information concerning the history of the project area, developed in consultation with the SHPO; and to modify one of the existing picnic tables to provide ADA accessibility.

The VANR commented that the take-out near the dam should be relocated a short distance upstream to where the bank is not as steep as the current location. The VANR also commented that further consultation should be conducted between CVPS and the VANR in the development of the final recreation plan, including the location of the canoe take-out (letter from Jeffrey Cueto, VANR, to Secretary Boergers, FERC, dated March 23, 1999).

CVPS's proposed recreation enhancements would provide some beneficial improvements to the existing recreation facilities within the project area, would be consistent with the undeveloped nature of the project area, and would fulfill the recreation needs in an area with a limited amount of current use. The relocation of the canoe take-out to a less steeply sloped bank would provide easier egress for canoeists. Consultation with the VANR during the development of the final recreation plan would allow for further refinement and resolution of the location of the canoe take-out. The proposed ADA picnic table would, along with proper grading and access to this area, provide enhanced ADA recreation access to recreation facilities within the picnic area.

Middlebury Lower

CVPS proposes recreation enhancements to include: a canoe take-out located directly upstream of the Pulpmill bridge on the west shoreline of Otter Creek; a portage trail with signs, extending from the canoe take-out along Horse Farm Road, to the parking area associated with the canoe put-in location; improved parking facilities and an ADA picnic table in the existing recreation area; a footbridge over the historic mill channel that bisects the hill on the west bank of the bypassed reach; and reestablishment of vegetation on the hillside in the existing recreation area.

The VANR indicated that CVPS should consult with the VANR on the details of the recreation plan, including: the design of the footbridge on the portage trail; selection of appropriate plantings for reestablishment of forested buffer along the west riverbank; parking details; and the design of interpretive signs (letter from Jeffrey Cueto, VANR to Secretary Boergers, FERC, dated March 23, 1999).

The project WQC issued by the VANR also includes two conditions related to recreation. Condition J (Public Access) requires CVPS to allow public access to project

lands subject to reasonable safety and liability limitations, and that any limitations of access to state waters must be approved by the VANR. Condition K (Recreation Facilities) requires development of a final recreation plan, prepared in consultation with the VANR, that includes details on erosion control.

CVPS's proposed recreation enhancements would provide beneficial enhancements to existing recreation facilities and improve recreation access to the project area. The proposed footbridge and trail along the west shoreline of the bypassed reach would provide easier access to the bypassed reach shoreline for both angling and scenic viewing activities. The proposed canoe take-out and portage route would provide enhanced canoeing access to this stretch of Otter Creek. The proposed ADA picnic table would help provide ADA accessibility, along with proper placement and grading around the picnic area. Proper design and placement of the proposed footbridge and placement of the re-vegetated areas, developed in consultation with the VANR in the development of the final recreation plan, would ensure that the proposed enhancements would provide an enhanced recreation and aesthetic experience. The recreation enhancements proposed by CVPS would be consistent with Conditions J and K of the WQC.

c. Cumulative effects: The proposed recreation enhancements at both the Weybridge Project and the Middlebury Lower Project would provide some beneficial cumulative recreation benefits to the project region as a result of the provision of canoe portages at both sites, thus enhancing the ability of recreationists to conduct a more continuous boating trip along Otter Creek.

d. Unavoidable adverse effects: None.

7. Cultural Resources

a. Affected environment:

Archeological Resources

Weybridge

In 1996, CVPS commissioned a Phase IA archeological investigation of project lands in association with relicensing (University of Maine at Farmington Archaeology Research Center [UMF-ARC], 1997a). The area of potential effect (APE) for the Weybridge Project encompasses the project facilities, the fluctuation zone around the margins of the impoundment, and archeologically sensitive locations above the full impoundment limit that the archeologists determined in the field to be experiencing

erosion or are susceptible to erosion or recreation impacts. This APE contains no archeological sites listed in or formally evaluated as eligible for listing in the National Register of Historic Places. The Phase IA study resulted in the identification of two previously unrecorded Euroamerican sites and one previously unrecorded prehistoric Native American site, all of which are inundated at normal impoundment levels. Further investigation would be necessary to determine whether these sites are eligible for the National Register. The study also identified at least 10 "potential sampling areas" around the margins of the project impoundment where prehistoric and/or historic period sites may be present. In 1997, a shoreline study commissioned by CVPS concluded that 8 of the 10 sampling areas were experiencing localized erosion (either lateral or undercutting of banks) that could potentially expose archeological resources (Knight Engineering, 1997). At the time of the License Application, Phase IB location and identification surveys were underway on these eight sampling areas.

Middlebury Lower

In 1996, CVPS also commissioned a Phase IA archeological investigation of project lands in association with relicensing (UMF-ARC, 1997b). The APE for the Middlebury Lower Project encompasses the project facilities and historically associated buildings and structures, the fluctuation zone around the margins of the impoundment, and archeologically sensitive locations above the full impoundment limit that the archeologists determined in the field to be experiencing erosion or are susceptible to erosion or recreation impacts. This APE contains no archeological sites listed in or formally evaluated as eligible for listing in the National Register of Historic Places. The Phase IA study identified four previously unrecorded sites and one previously known site. Four of the five sites are associated with Euroamerican occupation, the fifth with prehistoric Native American occupation. Further investigation would be necessary to determine whether these sites are eligible for the National Register. The Phase IA study also identified nine "potential sampling areas" that may preserve evidence of prehistoric and/or historic period remains between Paper Mill Falls and Middlebury Falls. The study concluded that none of the sites, nor the sampling areas, were being affected by current project operation.

Historical Resources

Weybridge

In association with relicensing, many of the Weybridge Project's facilities were evaluated as eligible for listing in the National Register as a historic district (Henry, 1996a). Elements contributing to the district's significance are: powerhouse, east dam,

west dam, electrical substation, and old powerhouse. Containing buildings and structures dating from circa 1922 to 1950-51, the Weybridge Project constitutes a virtually intact representative of the engineering design, structures, and operating equipment of a medium-scale hydroelectric generating station from the mid-20th century in Vermont.

Middlebury Lower

The circa 1820 Pulp Mill Covered Bridge, a three-span, two-lane timber structure crossing Otter Creek about 100 feet upstream from the project's west dam, was listed on the National Register in 1974.

In association with relicensing, many of the Middlebury Lower Project's facilities were evaluated as eligible for listing in the National Register as a historic district (Henry, 1996b). Elements contributing to the district's significance are: west dam, tool shed, power canal, powerhouse, penstock ruins, equipment shed, electrical substation, and long shed. Elements that do not contribute to the district's significance are the east dam, canal intake structure, and vehicle bridge. Containing buildings and structures that derive from a late 19th century pulp mill as well as an early 20th century hydroelectric power generating station, the Middlebury Lower Project facilities represent the transition from the hydromechanical power originally developed for internal industrial usage at this site, to the generation of electric power for long-distance transmission.

b. Environmental effects:

Proposed Action

CVPS proposes to continue operating and maintaining the Weybridge Project as a cycling facility. In addition to completing the Phase IB archeological investigations (landowners permitting), CVPS proposes to prepare a CRMP and to be a consulting party to a PA among the Commission, SHPO, and Advisory Council on Historic Preservation, for protection of resources (known and yet to be identified) potentially affected by the Weybridge Project. CVPS also proposes to include information on the history of the project and vicinity in the proposed recreation area interpretive signage. This information would be developed in consultation with the SHPO.

CVPS proposes to continue operation of the Middlebury Lower Project in a ROR mode that, by minimizing reservoir fluctuations, will minimize the already low potential for project operation to affect archeological resources. CVPS also proposes to contact the SHPO in the event that it decides to redevelop or conduct other ground-disturbing

activity at the project that may affect historical and archeological properties. Finally, CVPS proposes to continue to maintain project facilities.

Among CVPS's proposed recreation enhancements at the Middlebury Lower Project are a canoe portage takeout immediately upstream from the Pulp Mill Covered Bridge, and erection of a footbridge over a historic-period mill channel on the west side of the bypassed reach. The proximity of such improvements to known and potential Historic Properties could result in adverse effects on these properties due to disturbance or damage during construction, or to inadvertent damage from increased recreation activities in those locations.

No Action

Under this alternative, CVPS would maintain existing operations at both the Weybridge and Middlebury Lower Projects under the terms of the current licenses, and environmental conditions potentially affecting Historic Properties would remain unchanged. CVPS maintains project features in good condition. However, characteristics that may qualify the elements of the Weybridge Project (powerhouse, east dam, west dam, electrical substation, and old powerhouse) and Middlebury Lower Project (west dam, tool shed, power canal, powerhouse, penstock ruins, equipment shed, electrical substation, and long shed) for listing in the National Register, could be diminished by future repairs and alterations that could diminish the properties' integrities of design, workmanship and materials. Similarly, future actions on the part of CVPS involving ground disturbance at or near any of the known archeological sites or the potential sampling areas in the Middlebury Lower and Weybridge Projects could result in damage or destruction of significant archeological resources. Continued operation of the Weybridge Project as a cycling facility may contribute to continuing erosion of archeologically sensitive areas along that project's impoundment.

Proposed Action with Additional Staff-recommended Measures

The Weybridge and Middlebury Lower Projects have been generating electric power since the early 1920's. Continued operation of these projects would maintain their historic facilities in productive use for which they were originally designed and built, and would therefore be beneficial to these National Register-eligible resources.

The facilities of the Weybridge and Middlebury Lower Projects would require maintenance, repair, and possibly alteration to meet changing circumstances over the license period. A CRMP for each project, prepared by CVPS in consultation with the SHPO, should contain appropriate provisions to ensure that potential adverse effects on

Historic Properties arising from such future actions at each project would be avoided, minimized, or satisfactorily mitigated.

Archeological resources along the Weybridge impoundment are now experiencing erosional impacts principally attributable to natural processes (high spring flows), but that may also be influenced to a limited extent by the operation of this project as a cycling facility. At the Middlebury Lower Project, operation is not affecting either known archeological resources or areas of potential resource sensitivity. CVPS's proposed CRMP for the Weybridge Project would contain measures for continuing and future treatment of archeological resources at this project. Similar measures for treatment of archeological resources, known and yet to be discovered, at the Middlebury Lower Project should be included in the CRMP for that project.

Recreation enhancements yet to be finalized may also affect Historic Properties. Development of recreation plans in consultation with the SHPO would ensure that potential adverse effects on Historic Properties resulting from enhancement of recreation facilities would be avoided or satisfactorily mitigated.

PAs between the Commission and the Vermont SHPO, with CVPS as a concurring party, would document the Commission's consideration of the effects of relicensing the Weybridge and Middlebury Lower Hydroelectric Projects on Historic Properties. Each PA would contain stipulations requiring CVPS to prepare a CRMP addressing both short- and long-term management of Historic Properties within the boundaries of the projects.

c. Cumulative effects: We determined that cultural resources are not and would not be affected in a cumulative manner by the Weybridge and Middlebury Lower Projects and by other activities on Otter Creek. As discussed above, effects on cultural resources at these projects may be attributable chiefly to natural processes, to actions on the part of CVPS to provide or enhance recreation opportunities at each project, or to repair and maintenance of the projects for efficient operation.

d. Unavoidable adverse effects: None.

VI. DEVELOPMENTAL ANALYSIS

In this section, we analyze the projects' use of Otter Creek's available water resources to generate hydropower; estimate the economic benefits of the proposed projects; and estimate the cost of various environmental measures and the effects of these measures on project operations.

A. Power and Economic Benefits of the Projects

Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in Mead Corporation, Publishing Paper Division,[11] 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 basic purpose of the Commission's economic analysis is to provide a general estimate of the potential power benefits and the 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.

For our analysis, the value of the project power is equal to the cost of the cheapest, most reasonable generation resource available in the region. This resource is a natural gas-fueled combined-cycle electric plant. Our estimate of the fuel cost (based on fuel consumption at a heat rate of 6,200 Btu/kWh) is 18.23 mills/kWh. We estimated the 1999 fuel cost based on information in Energy Information Administration, Supplement to the Annual Energy Outlook, February 1997. We include the cost of alternative capacity in our power value computations and compute the cost of alternative combined-cycle-combustion-turbine capacity to be $109/kW-year (see table 7). Using the assumptions, values, and sources shown in table 7, and the estimated annual power production in GWh, we calculated the annual power value of the operation of the Weybridge and Middlebury Lower Projects with CVPS's proposed environmental and safety measures (tables 8 and 9). The power value, in mills/kWh, is calculated by dividing the annual power value by the annual power production in GWh. For the Weybridge and Middlebury Lower Projects, the alternative power value is 32.86 mills/kWh and 33.82 mills/kWh, respectively. This includes the alternative capacity costs of 14.63 mills/kWh and 15.59 mills/kWh, respectively, which are estimated by subtracting the estimated fuel cost of 18.23 mills/kWh, from the total power values.

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[11] 72 FERC ¶ 6,027 (July 13, 1995).

Based on the assumptions in table 7 and the costs of enhancements shown in table 8, we estimate that the annual cost of CVPS's proposed Weybridge Project would be $218,350 (18.32 mills/kWh). The annual power benefit would be $391,680 (32.86 mills/kWh) for the estimated annual generation of 11.919 GWh. The resulting annual net benefit would be $173,330 (14.54 mills/kWh).

Based on the assumptions in table 7 and the costs of enhancements shown in table 9, we estimate that the annual cost of CVPS's proposed Middlebury Lower Project would be $167,255 (25.18 mills/kWh). The annual power benefit would be $224,660 (33.82 mills/kWh) for the estimated annual generation of 6.643 GWh. The resulting annual net benefit would be $57,405 (8.64 mills/kWh).

Table 7. Summary of key parameters for economic analysis of CVPS's proposed Weybridge and Middlebury Lower Projects (Source: Staff)

Parameter	Value	Source
Period of analysis	30 years	Staff (Mead)
Term of financing	20 years	Staff
Interest/discount rate	10.0 percent[a]	Staff
Escalation rate	0 percent	Staff
Federal tax rate	34 percent	Staff
Local tax rate	3 percent	Staff
Insurance rate	0.25 percent of cost to construct	Staff
Operation and maintenance cost	–[b]	CVPS
Net investment	$0[c]	CVPS
Capacity value (1999)[d]	$109/kW-year	Staff
Energy value (1999)	18.23 mills/kWh	Staff
Application preparation cost	–[e]	CVPS

[a] The discount rate of 10 percent is typical for this type of analysis and reflects the cost of borrowing money.

[b] CVPS's application did not include a separate operation and maintenance (O&M) cost. It provided an average annual cost of power that included the O&M costs. The annual cost is presented in tables 11 and 12.

[c] CVPS's application did not provide a value for net investment. The staff assumes that the net investment is effectively $0.

[d] CVPS's creditable capacity was calculated using the estimated average annual generation given in the applications. The creditable capacity for Weybridge and Middlebury Lower was determined to be 1.60 MW and 0.95 MW, respectively.

[e] CVPS's application did not provide the cost of preparing the application. The staff assumes this cost was accounted for elsewhere.

Table 8. Summary of annual costs of CVPS's proposed measures for the Weybridge Project (Source: Staff).

Measures	Capital cost[a] (1999$)	Operation & maintenance (1999$)	Annual cost (1999$)
Continue to operate in cycling mode	0	0	0
Provide 125 cfs minimum flow in the bypassed reach[b]	0	$37,940	$37,940
Raise non-generation minimum flow to 250 cfs in the bypassed reach [c]	0	0	0
Impose peaking constraints under normal operations of no greater than a 4.5:1 ratio between maximum and minimum flow in a 24- hour period [c]	0	0	0
Eliminate all reservoir drawdowns between April 1 and June 15 to enhance fish spawning opportunities [c]	0	0	0
Eliminate 4-foot drawdowns between October 15 and April 1 (except for emergencies) [c]	0	0	0

Measures	Capital cost[a] (1999$)	Operation & maintenance (1999$)	Annual cost (1999$)
Drawdowns greater than 2 feet for annual maintenance to be scheduled in consultation with the agencies, and to target a biologically non-critical time period [c]	0	0	0
Restrict reservoir drawdowns to 2 feet or less during normal operations to enhance wetland development [c]	0	0	0
Maintain existing downramping and upramping procedures, except beginning and ending at the new proposed minimum flow of 250 cfs [c]	0	0	0
Recreation enhancements[d]	$1,500	$0	$230
Construct diversion wall at the entrance to the West Channel of Wyman Island	$125,000	$0	$19,060
Complete Phase IB archeology testing and execute a PA	$25,000	$0	$3,810

[a] Cost of enhancement estimated by staff.

[b] CVPS proposes to release flows that would result in a loss of 2.081 GWh of energy generation annually.

[c] CVPS provided no cost data for providing these operational enhancements. therefore we assume the costs for these proposals are either not predictable or are not significant.

[d] Recreation enhancements include an interpretive sign on the downstream side of the old powerhouse and modifying one of the existing picnic tables to provide ADA accessibility.

Table 9. Summary of annual costs of CVPS's proposed measures for the Middlebury Lower Project (Source: Staff)

Measures	Capital cost[a] (1999$)	Operation & maintenance (1999$)	Annual cost (1999$)
Continue to operate in ROR mode	0	0	0
Provide a continuous veiling flow over the dam which equates to 157 cfs minimum flow in the bypassed reach[b]	0	$30,200	$30,200
Recreation enhancements[c]	$12,000	$500	$2,330

[a] Cost of enhancement estimated by staff.

[b] CVPS proposes to release flows that would result in a loss of 1.657 GWh of energy generation annually.

[c] Recreation enhancements include canoe take-out and portage trail with signs, improved parking facilities, and a disabled-accessible picnic table in the existing recreation area; a footbridge over the historic mill channel that bisects the hill on the west bank of the bypassed reach; and re-establishing vegetation on the hillside in the existing recreation area.

B. Proposed Actions with Additional Staff-recommended Measures

In this section, we present the annual costs of the proposed action with additional staff-recommended measures. Table 10 shows the annual costs of enhancements for staff-recommended measures.

Based on the assumptions in table 7 and the costs of the enhancements shown in tables 8 and 10, we estimate that the annual cost of the Weybridge Project as proposed by CVPS with the additional staff-recommended measures would be $222,110 (18.63 mills/kWh). The annual power benefit would be $391,680 (32.86 mills/kWh) for the estimated average generation of 11.919 GWh. The resulting annual net benefit would be $169,570 (14.23 mills/kWh).

Based on the assumptions in table 7 and the costs of the enhancements shown in tables 9 and 10, we estimate that the annual cost of the Middlebury Lower Project as

proposed by CVPS with the additional staff-recommended measures would be $168,015 (25.29 mills/kWh). The annual power benefit would be $224,660 (33.82 mills/kWh) for the estimated average generation of 6.643 GWh. The resulting annual net benefit would be $56,645 (8.53 mills/kWh).

Table 10. Summary of annual costs of the staff-recommended measures for CVPS's proposed Weybridge and Middlebury Lower Projects (Source: Staff)

Measures	Capital cost (1999$)	Operation & maintenance (1999$)	Annual cost (1999$)
Reserve Interior's authority to prescribe fishways	0	0	0
Execute a PA providing for development of a CRMP	$5,000	0	$760
Weybridge tailrace DO monitoring	0	$3,000	$3,000

C. No Action

Under no action, the project would continue to operate under the current mode of operation, and no new environmental protection or enhancement measures would be implemented.

The annual cost of no action for the Weybridge Project would be $195,250 (13.95 mills/kWh)(see table 11). The annual power benefit would be $429,620 (30.69 mills/kWh) for the estimated average generation of 14.000 GWh. The resulting annual net benefit would be $234,370 (16.74 mills/kWh).

The annual cost of no action for the Middlebury Lower Project would be $164,925 (19.87 mills/kWh)(see table 12). The annual power benefit would be $254,860 (30.71 mills/kWh) for the estimated average generation of 8.300 GWh. The resulting annual net benefit would be $89,935 (10.84 mills/kWh).

D. Cost of Environmental Enhancements and Economic Comparison of Alternatives

Tables 11 and 12 present a summary of the current annual net benefits for CVPS's proposed action, the proposed action with additional staff-recommended measures, and no action.

The additional enhancements proposed by CVPS for the Weybridge Project would increase annual costs by $23,100 and decrease annual power benefits by $ 37,940 for a total decrease in annual net benefits of $61,040. The annual generation would decrease from 14.000 to 11.919 GWh.

The additional enhancements proposed by CVPS for the Middlebury Lower Project would increase annual costs by $2,330 and decrease annual power benefits by $30,200 for a total decrease in annual net benefits of $32,530. The annual generation would decrease from 8.300 to 6.643 GWh.

Our recommended enhancements for the Weybridge Project would increase annual costs by an additional amount of $3,760 above CVPS's proposal, and decrease annual net benefits by the same amount. The annual generation for the proposed project with additional staff recommendations would remain at 11.919 GWh.

Our recommended enhancements for the Middlebury Lower Project would increase annual costs by an additional amount of $760 above CVPS's proposal, and decrease the annual net benefits by the same amount. The annual generation for the proposed project with additional staff recommendations would remain at 6.643 GWh.

Table 11. Summary of the annual net benefits of CVPS's proposed action, the proposed action with staff-recommended measures and no action for Weybridge (Source: Staff)

Parameter	CVPS's proposed action	Proposed action with additional staff-recommended measures	No Action
Annual generation (GWh)	11.919	11.919	14.000
Installed capacity (MW)	3.0	3.0	3.0
Annual power benefit ($) (mills/kWh)	$391,680 (32.86)	$391,680 (32.86)	$429,620 (30.69)
Annual cost ($) (mills/kWh)	$218,350 (18.32)	$222,110 (18.38)	$195,250[a] (13.95)
Annual net benefit ($) (mills/kWh)	$173,330 (14.54)	$169,570 (14.23)	$234,370 (16.74)

[a] Annual cost of $188,370 was provided in CVPS's application and was calculated by averaging the costs for operation and maintenance and taxes over the 5 year period,

1992-1996. Staff escalated this cost to 1999$ using the gross domestic product implicit price deflator index.

Table 12. Summary of the annual net benefits of CVPS's proposed action, the proposed action with staff-recommended measures and no action for Middlebury Lower (Source: Staff)

Parameter	CVPS's proposed action	Proposed action with additional staff-recommended measures	No Action
Annual generation (GWh)	6.643	6.643	8.300
Installed capacity (MW)	2.25	2.25	2.25
Annual power benefit ($) (mills/kWh)	$224,660 (33.82)	$244,660 (33.82)	$254,860 (30.71)
Annual cost ($) (mills/kWh)	$167,255 (25.18)	$168,015 (25.29)	$164,925 [a] (19.87)
Annual net benefit ($) (mills/kWh)	$57,405 (8.64)	$56,645 (8.53)	$89,935 (10.84)

[a] Annual cost of $159,112 was provided in CVPS's application and was calculated by averaging the costs for operation and maintenance, taxes, insurance and depreciation over the 5 year period, 1992-1996. Staff escalated this cost to 1999$ using the gross domestic product implicit price deflator index.

E. Pollution Abatement

With the proposed environmental enhancement measures, the Weybridge and Middlebury Lower Projects would generate about 11.92 and 6.64 GWh, respectively, of electricity annually. This amount of hydropower generation, when contrasted with the generation of an equal amount of energy produced by fossil-fueled facilities, avoids the unnecessary emission of atmospheric pollutants. Assuming that the power produced by the projects would be replaced by an equal amount of power produced by natural gas-fueled generators, then generating electrical power equivalent to that produced by the Weybridge and Middlebury Lower Projects would require the annual combustion of about 123 million cubic feet (mmcf) and 69 mmcf, respectively, of natural gas. In addition, removal of pollutants (NOx and SOx) from the emissions produced by burning fossil fuels to those levels presently achievable by state-of-the-art technology would cost

about $5,900 (1999$) annually for the Weybridge Project and $3,300 (1999$) annually for the Middlebury Lower Project.

VII. COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVES

Sections 4(e) and 10(a) 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 hydropower project, we consider the water quality, fish and wildlife, recreation, cultural, and other nondevelopmental values of the involved waterway equally with its electric energy and other developmental values. In deciding whether, and under what conditions a hydropower project should be licensed, the Commission must weigh the various economic and environmental tradeoffs involved in its decision.

This section contains the basis for, and a summary of, our recommendations to the Commission for the licensing of the Weybridge and Middlebury Lower Projects. We weigh the costs and benefits of our staff-recommended alternatives against other proposed measures.

A. Recommended Alternatives

Based on our independent review and evaluation of the proposed action, the proposed action with the additional staff-recommended measures, and no action, we select the proposed action with additional staff-recommended measures as the recommended alternative.

We recommend this alternative because: (1) issuance of licenses would allow CVPS to continue to operate the projects as beneficial and dependable sources of electric energy; (2) the projects, with a total installed capacity of 5.25 MW, would eliminate the need for an equivalent amount of fossil-fuel-produced energy and capacity, which helps conserve these nonrenewable resources and limits atmospheric pollution; and (3) the recommended environmental protection and enhancement measures would protect water quality, enhance fish and wildlife resources, improve public use of project area recreation facilities and resources, improve multiple use of project lands, improve aesthetics, and maintain and protect historic and archeological resources within the areas affected by project operations.

We recommend including the following measures in any license issued by the Commission for the Weybridge Project:

- provide a constant minimum flow of 125 cfs into the project's bypassed reach when the project is generating, with the proviso that this minimum would be raised to 250 cfs for walleye spawning during April and May, once walleye are introduced to this reach of Otter Creek;

- provide a non-generation minimum flow in the bypassed reach of 250 cfs;

- construct an instream diversion structure that will ensure a minimum flow of 125 cfs is passed into both the East and West Channels around Wyman Island during non-generation periods;

- develop a plan to conduct DO monitoring in the tailrace during the months of July, August, and September, whenever project shutdowns exceed two consecutive days, with the requirement to release flows to the tailrace to maintain state water quality standards, if the monitoring indicates a violation of state standards;

- develop a flow monitoring plan in consultation with the resource agencies;

- reserve Interior's authority to prescribe the construction, operation, and maintenance of fishways under Section 18 of the FPA;

- impose peaking constraints under normal operations of no greater than a 4.5:1 ratio between maximum and minimum flow in a 24-hour period;

- eliminate all reservoir drawdowns between April 1 and June 15 to enhance fish spawning opportunities;

- eliminate 4-foot drawdowns (except in emergency situations) between October 15 and April 1;

- require that drawdowns greater than 2 feet for annual maintenance be scheduled in consultation with the agencies, and target a biologically non-critical time period;

- restrict reservoir drawdowns to 2 feet or less during normal operations to enhance wetland development and protect other shoreline aquatic resources;

- maintain existing downramping and upramping procedures, when reducing flows to, or increasing flows above, the new proposed minimum flow of 250 cfs;

- provide recreation enhancements to include relocating the canoe portage take-out, installing an interpretive sign on the downstream side of the old powerhouse, and modifying one of the existing picnic tables to provide access to persons with disabilities; and

- complete Phase 1B archeological testing and enter into a PA with the Vermont SHPO, the Commission, and the Advisory Council on Historic Preservation, that provides for the development of a CRMP.

We recommend including the following measures in any license issued by the Commission for the Middlebury Lower Project:

- continued operation of the project in a ROR mode;

- provide a minimum flow of approximately 157 cfs in the 750-foot-long bypassed reach, as a continuous veiling flow over the project dam;

- reserve Interior's authority to prescribe the construction, operation, and maintenance of fishways under Section 18 of the FPA;

- provide recreation enhancements to include: a canoe take-out and portage trail with signs, improved parking facilities, and a disabled-accessible picnic table in the existing recreation area; construction and maintenance of a footbridge over the historic mill channel that bisects the hill on the west bank of the bypassed reach; and reestablish vegetation on the hillside in the existing recreation area;

- require CVPS to develop, in consultation with appropriate agencies, a site-specific erosion and sedimentation control plan (ESCP) for any significant land-disturbing activities associated with the proposed action and enhancements; and

- enter into a PA with the Vermont SHPO, the Commission, and the Advisory Council on Historic Preservation, that provides for the development of a CRMP.

Implementation of these measures for the Weybridge and Middlebury Lower Projects would protect and enhance water quality, fisheries, wetlands, recreation, and cultural resources in the project areas and provide for the best use of the waterway.

The costs for some of these measures would reduce the net benefit of the projects. As discussed in section VI.D., we estimate that the projects as proposed by CVPS would cost less than currently available alternative power. Our staff-recommended additional

measures would decrease the economic benefits of the projects, although the projects would retain significant economic benefits. We discuss these recommendations and the impacts on project economics in the following section.

1. Execution of a PA and CRMP

CVPS proposes to develop a CRMP for the Weybridge Project, but not specifically for the Middlebury Lower Project. Execution of a PA is necessary to ensure that the historic character of the Weybridge and Middlebury Lower Projects would be protected during the term of the licenses. A PA would contain a stipulation requiring CVPS to prepare, and upon Commission approval, implement a CRMP in consultation with the SHPO, addressing the management of historic properties within the projects' APE, and consideration of the effects of recommended recreation enhancements, particularly at the Middlebury Lower Project. We estimate that the annual cost of preparing the CRMP would be $760 for each project, a relatively minor amount in relation to total project costs.

2. Weybridge Tailrace DO Monitoring

CVPS is proposing to increase the minimum flows at the project, and to provide other measures to enhance aquatic habitat downstream of the project. Under conditions of project shutdown, however, all the minimum flow would be released into the bypassed reach, and no flow would be released into the tailrace channel, upstream of the confluence with the bypassed reach. Under extended shutdown periods during low river flow and high water temperature conditions during the months of July, August, and possibly September, there would be the potential for DO depletion in the tailrace. Thus, we recommend that CVPS implement DO monitoring during July, August, and September, whenever project shutdown exceeds two consecutive days, with the requirement to release flows to the tailrace to maintain state water quality standards. We estimate that the annual cost to conduct this DO monitoring would be $3,000. Although we previously recommended that this monitoring occur for only two years following issuance of the license, to identify if there is a problem with reduced DO levels, we have included this monitoring as an annual cost. Additional flow releases into the tailrace (if required) would not result in any lost generation, because the project already would be shut down due to insufficient river flows.

3. Weybridge Flow Monitoring Plan

We agree with CVPS and the VANR that a flow monitoring program should be implemented at the project, because there are several components to CVPS's operations

to protect and enhance aquatic resources. We recommend that this flow monitoring program be included as part of a flow management plan for the project, which CVPS should develop in consultation with the VANR and the USFWS. The plan should describe how CVPS will implement all aspects of its instream flow release and reservoir management proposals under all levels of inflow (including drought conditions), as well as provisions for measuring and documenting flow releases from the project into the bypassed reach and East and West Channels, and through the diversion structure, along with the measurement of reservoir water surface elevations. We recommend the plan be filed with the Commission for approval.

B. Conclusions

Based on our review of the agency and public comments filed on the project and our independent analysis pursuant to sections 4(e), 10(a)(1), and 10(a)(2) of the FPA, we conclude that licensing the Weybridge and Middlebury Lower Projects as proposed by CVPS with the additional staff-recommended measures would provide for the best comprehensive development of Otter Creek.

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 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 finds that any fish and wildlife agency recommendation is inconsistent with the purposes and the 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 the agency.

For the Weybridge and Middlebury Lower Projects, both the VANR and Interior have had the opportunity to make comments and recommendations. Both agencies have provided recommendations, and all recommendations are evaluated and discussed in the water, aquatic, and recreation resources sections of this final EA.

Pursuant to Section 10(j) of the FPA, we are making a preliminary determination that none of the recommendations of the fish and wildlife agencies are inconsistent with the purposes and requirements of Part I of the FPA or other applicable laws. However, we conclude that the recommendations to relocate the canoe portage at Weybridge and to

consult with the VANR on the final recreation plan for the Middlebury Lower Project are not for the protection of fish and wildlife, and we are therefore recommending them under Section 10(a) of the Act, rather than Section 10(j) .

In tables 13 and 14 we summarize the VANR and Interior recommendations, show if they are within the scope of Section 10(j), and indicate whether we recommend adopting the measures under the proposed action with additional staff-recommended measures.

Table 13. Analysis of fish and wildlife agency recommendations for the Weybridge Project (Source: Staff).

Recommendation	Agency	Within scope of Section 10(j) ?	Annual cost	Recommend adopting?
1. Minimum bypass reach flow of 125 cfs when unit is operating, plus fish passage flow through diversion structure; minimum to be increased to 250 cfs when walleye are introduced to Otter Creek	Interior VANR	Yes	$37,940 [a]	Yes
2. Minimum bypass reach flow of 250 cfs when unit is not operating, unless higher flow is required to provide 125 cfs minimum in West Channel, plus fish passage flow through diversion structure	Interior VANR	Yes	0 [b]	Yes
3. Construct diversion structure below project to split flow between East and West Channel (125 cfs each)	Interior	Yes	$19,060 [c]	Yes

Recommendation	Agency	Within scope of Section 10(j) ?	Annual cost	Recommend adopting?
4. Structure should: be permanent with limited maintenance, provide upstream fish passage, not create safety hazard, blend with environment	Interior VANR	Yes	Noted above	Yes
5. Structure should be designed in consultation with VANR and USFWS	Interior	Yes	Noted above	Yes
6. Limit peaking to 4.5:1 ratio within 24 hours, plus maintain upramping and downramping procedures	Interior	Yes	0	Yes
7. Limit impoundment drawdowns to 2 feet, with stable pond from April 1 to June 15, and maintenance drawdowns greater than 2 feet coordinated with VANR	Interior	Yes	0	Yes
8. Reserve Interior's authority to prescribe fishways under Section 18 of the FPA	Interior	Yes	0	Yes
9. Develop a low flow management plan in consultation with VANR and USFWS	VANR	Yes	0	Yes
10. Provide for freshening flows into tailrace channel to prevent fish kills and maintain state water quality DO levels	VANR	Yes	0	Yes

Recommendation	Agency	Within scope of Section 10(j) ?	Annual cost	Recommend adopting?
11. Relocate the canoe portage take-out near the dam, to avoid the existing steep bank	VANR	Not a measure to protect fish and wildlife	$230[d]	Yes, considered under Section 10 (a)

[a] This minimum flow would result in an estimated loss of 2.081 GWh of energy generation annually.

[b] No additional loss of energy generation would occur because the project would be in shutdown mode.

[c] Cost for construction and annual maintenance estimated by staff.

[d] This is staff's estimated annual cost for all recreation enhancements at the project.

Table 14. Analysis of fish and wildlife agency recommendations for the Middlebury Lower Project (Source: Staff).

Recommendation	Agency	Within scope of Section 10(j) ?	Annual cost	Recommend adopting?
1. Operate the project in an instantaneous ROR mode, such that inflow equals outflow	Interior	Yes	0	Yes
2. Release a continuous minimum flow of 157 cfs into the bypassed reach, as a veiling flow over the dam	Interior VANR	Yes	$30,200[a]	Yes

Recommendation	Agency	Within scope of Section 10(j) ?	Annual cost	Recommend adopting?
3. Reserve Interior's authority to prescribe fishways under Section 18 of the FPA	Interior	Yes	0	Yes
4. Consult with the VANR in the development of the final recreation plan, including the design of the footbridge on the portage trail, revegetation plan for the west bank, parking details, design of interpretive signs, and painting of the headgate frame	VANR	Not a measure to protect fish and wildlife	$2,330[b]	Yes, considered under Section 10 (a)

[a] This minimum flow would result in an estimated loss of 1.657 GWh of energy generation annually.

[b] This is staff's estimated annual cost for all recreation enhancements at the project.

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 and state comprehensive plans for improving, developing, and conserving waterways affected by the projects. Under Section 10(a)(2), federal and state agencies filed 11 comprehensive plans that address various resources in Vermont. Of these, we identified three federal and eight state comprehensive plans that address resources relevant to the Weybridge and Middlebury Lower Projects.[9] No inconsistencies were found with any of these plans.

X. FINDING OF NO SIGNIFICANT IMPACT

If the Weybridge and Middlebury Lower Projects are relicensed as proposed with the additional staff-recommended measures, the projects would continue to operate while providing enhancements to fish and wildlife resources, improvements to recreation facilities, and protection of cultural resources in the project areas.

Based on our independent analysis, issuance of licenses for the projects, as proposed with the additional staff-recommended measures, would not constitute a major federal action significantly affecting the quality of the human environment.

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[9] (1) 1994 Update to the North American Waterfowl Management Plan (USFWS, 1994. (2) Fisheries USA: The Recreation Fisheries Policy of the U.S. Fish and Wildlife Service (USFWS, undated). (3) The Nationwide Rivers Inventory (National Park Service, 1982). (4) Vermont State Comprehensive Outdoor Recreation Plan (Vermont Department of Forests, Parks, and Recreation, 1988). (5) Vermont Rivers Study (Vermont Agency of Environmental Conservation, 1986). (6) Hydropower in Vermont (Vermont Agency of Natural Resources, Department of Environmental Conservation, 1988). (7) Vermont 1988 Recreation Plan (Vermont Department of Forests, Parks, and Recreation, Agency of Natural Resources, 1988). (8) Wetlands Component of the 1988 Vermont Recreation Plan (Vermont Department of Forests, Parks, and Recreation, Agency of Natural Resources, 1988). (9) Waterfalls, Cascades, and Gorges of Vermont (Vermont Agency of Natural Resources, 1988). (10) A Strategic Plan for Development of Salmonid Fisheries in Lake Champlain (Lake Champlain Fish and Wildlife Policy Committee and Technical Committee, 1981). (11) Keeping Vermont A Special World - The Vermont Historic Preservation Plan (Vermont Division for Historic Preservation, 1997).

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XII. LIST OF PREPARERS

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XIII. COMMENTS ON DEA AND RESPONSES

April 7, 2000 **VANR**

COMMENTS ON DRAFT ENVIRONMENTAL ASSESSMENT

WEYBRIDGE HYDROELECTRIC PRGJECT
FERC PROJECT NO. 2731-020

MIDDLEBURY LOWER HYDROELECTRIC PROJECT
FERC PROJECT NO. 2737-002

CENTRAL VERMONT PUBLIC SERVICE CORPORATION

David P. Boergers, Secretary
Federal Energy Regulatory Commission
888 First Street, NE, Room I-A
Washington, D.C. 20426

Dear Secretary Boergers:

The Vermont Agency of Natural Resources (Agency) herein files comments on the Draft Environmental Assessment (draft EA) for the Weybridge and Lower Middlebury hydroelectric projects, for which a "Notice of Availability, of Draft Environmental Assessment" was issued on March 9, 2000. The Agency is substantially in agreement with the conclusions reached by FERC staff in the draft EA. All of the comments provided relate to the Weybridge Project only.

1. The licensee's project proposal is to eliminate impoundment drawdowns from April I to June 15. In several locations throughout the text of the draft EA, the calendar date April 15 is instead used. This should be corrected.

1. The corrections have been made in the text of the final EA, to reflect the April 1 date.

Section IV.C. CONSULTATION AND COMPLIANCE - Mandatory Requirements

2. The licensee has reapplied for a water quality certification for the Weybridge Project, and the Agency expects to complete the processing by July.

2. On April 6, 2000, CVPS reapplied for a WQC, and we have noted as such in the final EA.

Section V.C. Enviromental Analysis of the Proposed Action and Alternatives

2. Water Resources

a. Affected Enviromment:

Water Quantity

The text indicates that flow values for the Weybridge Project were derived by transforming the Middlebury gage data using a multiplier equal to the drainage area ratio raised to the 0.8 power. In our comment letter of April 9, 1998 on the draft application, we raised a technical issue with this assumption (reference Footnote I of that letter):

3. It is our understanding that the flow statistics used for Weybridge were developed using the Middlebury gage data with a multiplier of 1.15. The multiplier is less than the drainage area ratio, which is 750/628 = 1.19. As a general practice, reduced ratios apply to peak flow analyses, but are not recommended for base flow comparison. The August median flow is more likely to be around 375 cfs (0.50 csm) at Weybridge.

We would recommend that this correction be made, although this problem should not alter the draft EA's conclusions.

Water Quality

4. The EA recommends monitoring the tailrace D.O. during the months of July and August any time that the plan is off line for more than two days. We agree that D.O. should be monitored under those conditions and freshening flows released as necessary to assure compliance with the D.O. criteria. We do not see the monitoring as being necessary for the full term of the license, however. Instead, the licensee should simply collect sufficient data to determine if and under what conditions violations may occur, propose remediation measures, and verify that the measures correct the problem. The monitoring program should extend

3. Staff understands VANR's comment regarding the ratio used to prorate the Middlebury gage data to the Weybridge site (1.15 vs. 1.19), but has decided not to change the ratio for the final EA. All of the previous analyses of flows and energy conducted by CVPS for the Weybridge Project, and upon which the staff's analysis is based, were based on the 1.15 ratio. In addition, as VANR notes, changing the ratio to 1.19, and revising all the previous analyses, would not alter the conclusions of the EA, nor the agreements reached between the agencies and CVPS on minimum flows for the project. Although VANR may be technically correct regarding the use of the 1.15 ratio, the difference between the two ratios would only result in a 3.5 percent difference in calculated river flows, which is within the typical range of accuracy for flow studies.

4. We agree with VANR that DO monitoring would not be required for the term of the license, and have revised the final EA to reflect this. We do not believe, however, based on a review of typical river flows, as shown on Table 6, that DO monitoring would be required in June or October, and we are recommending the licensee monitor the project in July, August, and September, if low-flow conditions occur.

from June I through October 15, which is the period the Agency normally associates with potential D.O. problems. Of course, as noted in the draft EA, the project will normally be operating throughout the month of June, so sampling may not occur during that month anyways.

3. Aquatic Resources

b. Environmental effects:

Proposed Action

Weybridge

5. The Agency and the licensee have agreed on conservation flow standards for the east and west channels at Wyman Island. It is Important, however, to note that the head of the West Channel, (see Figure 2 of the draft EA) has an unstable control (granular substrate) that actually was found to have shifted between the 1997 IFIM study and the 1998 diversion structure flow demonstration. The instability results in a level of unpredictability with respect to how the diversion structure will function over time; scour of the control may result in some of the West Channel flow "escaping" back to the East Channel, a condition that was observed during the demonstration study. As a result, an article that simply providing for diverting 125 cfs down the "diversion channel" may not assure

6. that all of that flow arrives at the critical West Channel reach where the habitat assessment work was done. To address this, the licensee has committed to ongoing monitoring of the hydraulics to assure that the flow standards will be met at the appropriate locations in both channels at all times by modifying the diversion structure or adjusting the bypass flows as necessary. Given this complication, the related license article should specify both the amount of and applicable location for the flow standards as

1) 125 cfs from the head of the East Channel (IFIM transect H-6) to the lower end of the East Channel as represented by IFIM transect H-1, and .

2) 125 cfs in the West Channel below the islands at its entrance (as represented by IFIM transects H-3, H-4, and H-5).

The draft EA language on pp. 82-83 related to the development of a project flow monitoring plan acknowledges that the monitoring must include the monitoring

5. Staff notes that the VANR and CVPS have agreed on minimum flow standards for the East and West Channels, and is aware of the unstable control at the head of the West Channel. The Flow Management Plan to be developed by the licensee in consultation with the resource agencies should assure that appropriate measures are taken to provide sufficient flows into the East and West Channels.

6. Staff agrees that the license articles suggested by VANR, which specify the volume and locations for the flow standards, are appropriate and will be included in the license articles accordingly.

of flows in the bypass and the East and West channels. Part of this will be monitoring the hydrodynamics of the control section at the head of the West
7. Channel. The language also mentions management under drought flow conditions, which was an issue raised in the Agency terms and conditions letter; the licensee, the Agency, and the USFWS will have to address how flows will be distributed when project inflows recede below 250 cfs, and this can be done as part of the flow management plan development.

To provide for fish movement past the diversion structure, a passage device
8. will be incorporated in the structure. The licensee has estimated that the device will require approximately 5 cfs. During generation, this would necessitate passing a small amount of additional flow through the Taintor gate.

Thank you for the opportunity to comment on the draft EA.

Sincerely yours,

Jeffrey R. Cueto, P. E.
Principal Hydrologist

7. This comment is noted

8. Staff does not agree that an additional 5-cfs flow release should be required, for fish passage through the diversion structure, at this time. The 5 cfs mentioned as the flow requirement for fish passage is at this time only a "best guess" of the volume that may be required. The diversion structure and the provisions for fish movement through the structure have not yet been designed, so the actual flow requirements are not yet known. In addition, assuming that 5 cfs may be the flow required for fish movement, this magnitude of additional flow should be available because it is within the general range of "error" typically associated with field flow measurements (i.e., determining the difference between 125 and 130 cfs would be difficult). We believe that this issue can best be addressed by designing a flow monitoring plan that considers the flow requirement for fish passage (once that is known), and includes provisions for adjusting flows to meet the minimum flow requirements for the West Channel, as well as for fish movement through the diversion structure, once operational experience and monitoring has occurred.

Central Vermont Public Service

April 7, 2000

David P. Boergers, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Room I-A
Washington, DC 20426

RE: Weybridge and Middlebury Lower Hydroelectric Projects No. 2731-020 and 2737-00Comments on the Draft Environmental Assessment

Dear Secretary Boergers:

On March 9, 2000, FERC issued the Notice of Availability of Draft Environmental Assessment for the above referenced projects. Please accept
1. this letter as Central Vermont Public Service Corporation's (CVPS's) official response to this assessment. Overall, CVPS is in agreement with FERC's analysis. However, as noted below, CVPS does have a few clarifications to the analysis that we would like to point out at this time. All of these clarifications relate to the Weybridge Project (No. 273 1).

Provision for a Minimum Flow Unit at Weybridge

CVPS indicated in our License Application (May 1998) that we would like to reserve the right to install a minimum flow unit in the Weybridge bypass to pass the new Project minimum flow, when it becomes economically feasible to do so (see pages iii of Executive Summary, A-5, E-3 1, and H-33). This request was also discussed with resource agencies during pre and post filing consultation (see attached April 22, 1999 letter) and they were in agreement with the concept of potentially providing a bypass minimum flow through a minimum flow
2.
turbine. However, FERC's EA makes no mention of a minimum flow turbine at Weybridge. The economics (i.e. market power rates,.turbine technology) don't currently support the installation of a minimum flow turbine. To avoid a possible license amendment in the future, CVPS would like to have an article placed in

1. Staff notes that CVPS is in general agreement with our analysis in the draft EA.

2. The draft EA did not mention a minimum flow unit at Weybridge because CVPS did not propose such a unit as part of its relicensing proposal. CVPS certainly has the right to study the feasibility of adding a minimum flow unit during the license term, but the Commission does not include articles that give Licensees the authority to install such a unit at any time during the license term. If CVPS decided it was economic to install a minimum flow unit in the future, CVPS would be required to file an application for amendment of the license. Commission staff would then be required to conduct a NEPA and engineering/economic analysis of the proposal, before a final decision by the Commission.

the final Project license for Weybridge that provides us with the opportunity to revisit the feasibility of installing a minimum flow unit at any time throughout the term of a new license.

Dissolved Oxygen Monitoring at Weybridge

FERC has requested in the EA that CVPS establish a D.O. monitoring program at Weybridge. We understand the intent and rationale behind this recommendation and are prepared to develop this program as a component of an overall flow management plan for the Weybridge Project. However, for clarity, we would like to confirm that this sampling would not be an annual event, but would instead **3.** be a one or two year event to determine if a problem exists. Depending on the results of this sampling, steps to institute "freshening flows", etc. would then be evaluated. We will work with the Vermont Agency of Natural Resources (VANR) and the U.S. Fish & Wildlife Service (USFWS) to develop this plan. Additionally, as noted in previous discussions with resource agencies, there is some continual leakage through the Project turbines that may prevent any D.O. problems from occurring in the tailrace during periods of extended shutdown.

3. We have revised this section of the EA to reflect staff's recommendation that DO monitoring occur over a two-year period, to identify when and if DO depletions occur, and to design and implement mitigative measures ("freshening flows"), should they be required.

Bypass Flows and Fish Passage Flows

The EA (page 35) discusses VANR's recommendation that " (2) the volume of flow released into the bypassed reach during project generation should equal the 125 cfs required for habitat in the West Channel, plus whatever flow is required for provision of fish passage through the diversion structure... As discussed in previous correspondence (see CVPS letter to Secretary Boergers dated June 23, 1999), CVPS anticipates that most fish movement in and out of the bypass will be by means of the flow down the diversion channel. The opening to allow for fish movement was added as a secondary means of movement. CVPS does not believe that more than 125 cfs is required to meet the stated objectives for the bypass flow. This belief is based on the fact that the opening to allow for fish movement that will be incorporated into the diversion structure will be of small pool and **4.** weir construction and allow fish to overcome an approximately two foot rise in elevation. Based on typical designs at similar facilities, five cfs should be more than enough water to pass through this opening, allowing 120 cfs to be diverted to the West Channel of Wyman Island. During generation,

4. Staff agrees that an additional 5-cfs flow release should not be required, for fish passage through the diversion structure, at this time (See VANR response 8). The 5 cfs mentioned as the flow requirement for fish passage is at this time only a "best guess" of the volume that may be required. The diversion structure and the provisions for fish movement through the structure have not yet been designed, so the actual flow requirements are not yet known. In addition, assuming that 5 cfs may be the flow required for fish movement, this magnitude of additional flow should be available because it is within the general range of "error" typically associated with field flow measurements (i.e., determining the difference between 125 and 130 cfs would be difficult). We believe that this issue can best be addressed by designing a flow monitoring plan that considers the flow requirement for fish passage (once that is known), and includes provisions for adjusting flows to meet the minimum flow requirements for the West Channel, as well as for fish movement through the diversion structure, once operational experience and monitoring has occurred.

additional flows will enter the West Channel through the primary channel entrance downstream of the proposed diversion structure. Furthermore, tile proposed 125 cfs release down the bypass will meet habitat needs in the bypass before even reaching the diversion structure or fish passage opening. Therefore, CVPS does not believe that additional flow in the bypass (above 125 cfs) during generation is warranted.

Again, with the exception of tile above points, the operational enhancements and recommendations made in the EA are supported by CVPS and have been arrived at through a series of cooperative discussions and meetings with the VANR, USFWS, and others. If you have any questions about tile above comments and clarifications, please call me at (802) 747-5207. Thank you for the opportunity to provide these comments.

Sincerely,

Michael J Scarzello, P.E.
Principal Generation Engineer
Central Vermont Public Service Corporation

cc: FERC Service List
Jack Duckworth, FERC-OHL
Tim Oakes, Kleinschmidt Assoc.