

WATER QUALITY CERTIFICATION
(P.L. 92-500, Section 401)

In the matter of: Vermont Marble Company
61 Main Street
Proctor, VT 05765
Application for Expansion of
the Beldens and Huntington
Falls Hydroelectric Projects

The Water Quality Division of the Vermont Department of Water Resources and Environmental Engineering (the Department) has reviewed a Water Quality Certification application dated September 6, 1985 and filed by Morrison-Knudsen Engineers, Inc. on behalf of Vermont Marble Company (the applicant). A copy of the Federal Energy Regulatory Commission (FERC) License amendment application and the results of a water quality survey conducted in 1985 were submitted in support of the certification application. The applicant has also provided the Department with supplemental information in a letter dated January 21, 1986. The Department has made the following findings:

1. The applicant proposes to install additional generating capacity at the Beldens and Huntington Falls hydroelectric projects on the Otter Creek. The Beldens Dam is located in the Town of New Haven at River Mile 23.3, 2.3 miles upstream of the Huntington Falls Dam in the Town of Weybridge. The existing hydroelectric facilities for both projects are included as part of this application.
2. The existing Beldens project was constructed in 1913. Project works include a concrete dam in two sections

separated by an island. The dam has a crest elevation of 280.5' (datum unknown) and is fitted with 2 1/2 foot flashboards. Other features include a gated forebay - intake structure; a 50 foot long steel penstock bifurcated in two sections, each 30 feet long and leading to the powerhouse; a powerhouse containing two generating units rated at 800 kw each and each having a hydraulic capacity of 100 to 330 cfs; and other appurtenant facilities. The project's reservoir at elevation 283.0' extends upstream 1.8 miles and has a surface area of 22 acres. The project operates with a gross head of 42 feet and bypasses approximately 500 feet of stream.

3. The existing Huntington Falls development was constructed in 1910. Project works consist of a concrete dam with a crest elevation of 215.3' and topped with 2 1/2 foot flashboards; a gated canal 170 feet long to an intake structure; two steel penstocks about 30 feet long each extending to a powerhouse; a powerhouse housing two generating units, one rated at 600 kw and one at 800 kw, and each having a hydraulic capacity of 100 to 330 cfs; and appurtenant facilities.

The project's reservoir at elevation 217.8', is about 1.3 miles long with a surface area of 23 acres. The project operates with a gross head of 43 feet and bypasses about 300 feet of stream.

4. The proposed expansion of the Beldens project will include modifications to the existing headgate and intake

structures, and replacing the existing sluiceway and forebay retaining wall; and the construction of an intake structure at the north wall of the existing forebay, a penstock measuring 12 feet in diameter and 45 feet in length, a powerhouse located on the northwest side of the existing powerhouse and a tailrace channel. A bridge will be built across the existing tailrace to provide access to the new facility during both construction and subsequent operation. The proposed tailrace will measure approximately 35 feet wide by 120 feet long, and will be excavated on the northwesterly side of the existing tailrace channel. The tailrace will discharge at a point adjacent to the existing tailrace channel and will not change the existing tailwater pool surface elevation (241.1') or area. There will be no increase in the existing impoundment surface elevation or area.

5. The proposed expansion of the Huntington Falls project will include removal of the existing intake channel and sluiceway; and the construction of an expanded intake channel, an intake structure, a penstock 12 feet in diameter and 75 feet in length, a powerhouse, and a tailrace channel. A new road will be built to provide access to the new and existing facility during construction and subsequent operation. The proposed tailrace measuring 120 feet long by 50 feet wide will be excavated on the southwesterly side of the existing tailrace channel. The tailrace will discharge just downstream of the existing tailrace and has been designed to maintain existing flow patterns, circulation

currents and tailwater pool surface elevation and area. There will be no increase in the existing impoundment surface elevation or area.

6. At both the Beldens and Huntington Falls projects, the proposed powerhouses will each house a horizontal tubular turbine-generator unit with a rated capacity of 4100 kw. The turbine will have adjustable runner blades and wicket gates and a rated capacity of 4270 kw at a discharge of 1350 cfs (maximum capacity) and a net head of 42 feet. The minimum discharge from the turbine will be 300 cfs. The total installed capacity at Beldens will increase from 1600 kw to 5700 kw and from 1400 kw to 5500 kw at Huntington Falls. The maximum hydraulic capacity for both projects will increase from 660 cfs to 2010 cfs.

7. The applicant states that both projects are presently operated on a run-of-the-river basis. The Department finds, however, that based on the results of a study of existing hydroelectric projects in Vermont conducted by the Department in 1982, the projects may not operate as true run-of-the-river facilities. The Department defines a true run-of-the-river facility as one which maintains outflows below the project equal to instantaneous inflow to the project's impoundment at all times. According to a questionnaire completed by a Vermont Marble Company employee in 1982, under low and moderate flow conditions, the impoundments of both projects are normally kept full for maximum generation and generation continues for 24 hours a day, seven days a week. During summer low flows, the

impoundments may be drawn down to prevent spilling if increased flows are anticipated.

8. The applicant states that both redeveloped projects would operate as run-of-the-river facilities where outflows equal inflows on an instantaneous basis. During periods of low flow, an existing generating unit would be placed on line. During periods of flow within the operating range of the proposed generating unit, it would be placed on line and the old unit taken off line. During periods of higher flows, both the proposed and existing units would be placed on line.

The existing units would continue to be manually placed on line by an operator but once running, would be remotely monitored and controlled from the applicant's Proctor Station on the Otter Creek in Proctor. The new units would be automated with provisions for remote monitoring and control from Proctor Station. They would initially be placed on line by an operator under local control. When only the new units are operating, the control of these units would normally be automatically controlled to maintain a specified headwater elevation. This would occur more than 70 percent of the time at both projects. During high flows when both the proposed and existing units are operating together, all units would be manually controlled.

9. Under automatic control, the impoundment elevation of both projects would be maintained within 1 to 1 1/2 inches or less from the top of the flashboards when in place, or of the dam crest when the flashboards are down. Under manual

control, the impoundment elevation of both projects would be maintained within three inches or less from the top of the flashboards when in place, or of the dam crest when the flashboards are down. The only exception to this would be when the flashboards or crest are surcharged during high flows.

10. The Department is concerned that lag times could occur between project shutdown and spillage at the dam because the impoundment elevation of both projects will be maintained within the ranges described in Finding 9. Should a project shutdown occur with the impoundment elevation below the top of the flashboards when in place, or below the dam crest when the boards are removed, the only flow maintained below the project would be the project's bypass minimum flow requirements plus any project leakage.

The Department discussed this concern with the applicant during a phone conversation on March 24, 1986. The applicant agreed that, prior to any scheduled project shutdowns at either project, the impoundment elevation of that project would be maintained such that spillage at the dam would be occurring. Under this particular operating mode, no lag time would occur between turbine shutdown and spillage at the dam.

11. The U.S. Geological Survey (U.S.G.S.) operates a surface water gaging station (#4282500) on the Otter Creek in Middlebury. The station was established in 1911. Flow values for the Beldens project (drainage area 632 square miles) and the Huntington Falls project (drainage area 749

square miles, including the New Haven River whose confluence with Otter Creek is about 1.2 miles upstream of the dam) may be estimated based on the gage (drainage area 628 square miles) using a direct proration by drainage area:

<u>Parameter</u>	<u>Beldens</u>	<u>Huntington Falls</u>
Mean runoff	986 cfs (21.26 in/yr)	1168 cfs (21.26 in/yr)
7Q10	158 cfs	187 cfs
95% Exceedance	213 cfs	252 cfs
50% Exceedance	612 cfs	725 cfs
10% Exceedance	2338 cfs	2771 cfs

12. The Otter Creek from Middlebury Village to the New Haven River is designated Class C by the State of Vermont Water Resources Board. From the New Haven River to Vergennes it is designated Class B. Class C waters provide habitat suitable for aquatic biota, fish and wildlife, and are compatible with recreational boating and any recreational or other water uses in which contact with the water is minimal and when ingestion of the water is not probable; irrigation of crops not used for human consumption without cooking; and compatible industrial uses. Class B waters are waters which are of a quality which consistently exhibits good aesthetic value and provides high quality habitat for aquatic biota, fish and wildlife; and are compatible with public water supply with filtration and disinfection; irrigation and other agricultural uses; swimming, and recreation.

The Otter Creek from the outfall of the Proctor Wastewater Treatment Facility to its confluence with Lake Champlain is warmwater fish habitat except that portion between Beldens Dam and Huntington Falls Dam which is coldwater fish habitat. Dissolved oxygen (D.O.) content of warmwater fish habitat shall not be less than 5 mg/l or 60 percent saturation at all times. D.O. content of coldwater fish habitat shall not be less than 7 mg/l or 75 percent saturation at all times, nor less than 95 percent saturation during late egg maturation and larval development of salmonids in areas which the Secretary determines are salmonid spawning or nursery areas important to the establishment or maintenance of the fishery resource. The D.O. content shall not be less than 6 mg/l or 70 percent saturation at all times in all other waters designated as a coldwater fish habitat.

13. The tailwater at both projects backs up to the downstream end of the natural falls on which the dams are constructed. The tailrace of each project discharges into Otter Creek a short distance downstream. Thus, the tailwater pools are constantly affected by the tailrace discharges and the resulting circulation currents.

At the Beldens station, the bypass includes an island near midstream. The channel on the western side of this island contains two intermediate pools, the lower of which has a surface elevation about eight feet above the normal tailwater elevation (241.1').

The applicant proposes to maintain existing leakage flows at the Beldens project. This flow has been measured by the applicant and totals approximately 5 cfs. The 5 cfs would be maintained in the west channel of the bypass. The applicant also proposes to modify the existing rock configuration in this channel to ensure that the existing isolated pools are continually refreshed.

At the Huntington Falls project, the applicant had originally proposed to maintain existing leakage flows which were estimated by the applicant to be 5 cfs. Based upon the results of a water quality study conducted by the applicant in 1985 (see Finding 14) and discussions the applicant has had with the Department in January, 1986, the applicant has increased the minimum flow proposal at Huntington Falls to 15 cfs.

14. At the Department's recommendation, a water quality study was conducted August 14-16, 1985 to determine the impact of the proposed projects on the water quality of Otter Creek. Of particular concern was whether or not the leakage flow would be sufficient to maintain Vermont Water Quality Standards in the pools of the west channel in the bypass at the Beldens project.

From 5:55 p.m. on August 14, 1985 to 1:45 p.m. on August 16, 1985, samples were collected from 13 stations and analyzed for D.O. and temperature. The two projects operated in run-of-the-river modes with leakage flows of approximately 5 cfs maintained at both dams. Streamflows during this study approached 7Q10 conditions. The mean

daily flow over the study period as recorded at the U.S.G.S. gaging station at Middlebury (#4282500) was approximately 165 cfs. Prorating based on drainage area, this results in a flow of 166 cfs at Beldens and 197 cfs at Huntington Falls.

All samples collected during the study contained D.O. concentrations above the minimum standard for coldwater fish habitat (between Beldens Dam and Huntington Falls Dam) and warmwater fish habitat (above Beldens Dam and below Huntington Falls Dam). D.O. concentrations of the Beldens impoundment (Station 1), below the Beldens turbine discharge (Station 4) and the west channel of the Beldens bypass (Station 7) were all well above the standards, being at or near saturation throughout the study period.

D.O. concentrations of the Huntington impoundment (Station 3) were not found to be at or near saturation at all times. Measurements indicated that benthic respiration is having a significant effect on the D.O. regime of the impoundment. Supersaturated conditions were measured as well as reduced percent saturations. Measurements at Station 3 were taken at depths of 1/2, 5, 10 and 15 feet. An average D.O. concentration of 7.0 mg/l at 73.9°F (82% saturation) was measured at 8:30 a.m. on August 15th. On August 16th at 8:20 a.m., an average D.O. concentration was measured of 6.8 mg/l at 78.3°F (82% saturation). These were the lowest percent saturation levels measured at this station.

D.O. concentrations measured at Station 1 located below the turbine discharge at Huntington reflect the respiration activity of the Huntington impoundment. In comparison, D.O. concentrations measured at Station 2 located in the bypass at Huntington were either at or near saturation at all times. For example, on August 16th at 8:00 a.m. at Station 2, a D.O. concentration of 8.30 mg/l at 78.6°F (101% saturation) was measured at a depth of 1/2 foot, compared to a D.O. concentration of 6.70 mg/l at 79.3°F (82% saturation) measured at the same depth at 7:45 a.m. on the same day at Station 1.

The data obtained from the study demonstrates the significance of Huntington Dam and the cascade on which the dam is constructed for reaeration during the evening and early morning hours. At the same time it demonstrates the impact the existing project has on water quality when the majority of stream flows are diverted through the project's turbine rather than over the dam.

Based on the results of the water quality study the Department finds that the applicant's proposed minimum flow of 5 cfs at Beldens should be adequate for water quality. At the Huntington project, however, the Department finds that the applicant's original minimum flow proposal of 5.0 cfs is not adequate. As stated in the Vermont Water Quality Standards Section 1-03, Subsection B. Protecting High Quality Waters, "For all...waters where the existing quality generally exceeds...applicable water quality criteria...(for) dissolved oxygen,...that high quality shall

be maintained and protected in the public interest to the fullest extent possible." In order to achieve the goals as stated in this subsection, the Department shall require a minimum flow in the project's bypass of 15 cfs. The applicant proposes to maintain this flow by installing a one foot diameter valved pipe as near as possible to the base of the northernmost flashboard in order to augment existing leakage flows such that a combined flow of 15 cfs results. This flow requirement should improve downstream D.O. concentrations because of the higher streamflow being aerated by the dam and cascade.

The Department shall also require additional water quality monitoring during the first summer of project operation to verify that standards will be met below the Huntington Falls project in the impoundment of the Weybridge Hydroelectric project owned by Central Vermont Public Service Corporation. The tailrace of the Huntington Falls project discharges into the upstream end of the Weybridge impoundment.

15. The Vermont Fish and Wildlife Department (Fish and Wildlife) reports that significant game fish populations of brown trout, rainbow trout, northern pike, smallmouth bass and associated fisheries are found upstream and downstream of both projects. Additionally, Fish and Wildlife stocks, or intends to stock, migratory salmonids (steelhead rainbow trout and/or landlocked Atlantic Salmon) in the Otter Creek drainage in the future as part of its Lake Champlain

coldwater fishery development program. Outmigrant fish will have to pass the Huntington Falls project (and possibly the Beldens project at some future time, contingent upon expansion of the migratory salmonid program).

Fish and Wildlife has determined that fish passage provisions are necessary and has requested that the applicant develop and implement a plan for downstream fish passage that embodies provisions to:

- 1) minimize passage of fish into the generating unit(s) if and when injury or mortality is likely to result;
- 2) minimize impingement of fish on trashracks or screens used to accomplish 1); and
- 3) convey migrating fish safely and effectively downstream of the facility.

The applicant, in conjunction with Fish and Wildlife and the U.S. Fish and Wildlife Service has developed a passage plan approved by Fish and Wildlife March 27, 1986. This approved plan is titled "Plan for Downstream Fish Passage at the Beldens and Huntington Falls Stations (FERC 2558)".

Conditions

The Department certifies that both projects will meet Vermont Water Quality Standards provided the following conditions are met:

A. At the Beldens project, the applicant shall release a minimum instantaneous flow of 5 cfs at all times over the dam. This flow shall be directed through the west channel of the project's bypass. At the Huntington Falls project, the applicant shall release a minimum instantaneous flow of 15 cfs at all times over the dam.

The applicant shall provide the Department with a description, hydraulic calculations, and plans for the method to be used to pass minimum flows at both dams, for the Department's review and approval.

B. The two facilities shall be operated in strict run-of-the-river modes where instantaneous flows below each project shall equal instantaneous inflows to each impoundment at all times. When the facilities are not operating, all flows shall be spilled at the dams.

Prior to any scheduled shutdowns at either project, the applicant shall insure that spillage is occurring over the flashboards when in place, or over the dam crest when the flashboards are removed.

C. When the flashboards are in place at each project, each impoundment shall not be drawn down more than 1 1/2 inches under automatic control and three inches under manual

control, from the top of the flashboards. When the flashboards are out, each project shall be operated such that the drawdown does not exceed 1 1/2 inches under automatic control and three inches under manual control, below each dam crest. Drawdown in excess of those specified are subject to prior written approval by the Department.

D. In the first year of operation, weekly during the months of July and August, the applicant shall sample water quality at three separate stations. These stations shall be located in Huntington Falls impoundment, just below the tailrace discharge at Huntington Falls, and in the Weybridge impoundment midway between the Huntington Falls dam and the Weybridge dam. Testing shall be done by a qualified laboratory, and the results shall include the date, time, both air and water temperature, D.O. concentration, pool levels, estimated stream flow, spillage flows and flows through the units. Samples should be collected in the early morning to reflect the algal influence on D.O. levels. Mid-day samples should be collected as well. Each sample run shall include a duplicate. Results of the testing shall be reported to the Department on or before September 15th of the sampling year. The Department may require further testing if necessary in assessing the impact of the Huntington Falls project on downstream water quality and if standards are not being met, may order mitigative measures.

E. The applicant shall file for review and written approval, prior to the start of construction, a

comprehensive erosion control and water management plan to cover construction activities. This plan shall address the maintenance of stream flow during construction and measures taken to prevent the discharge of sediment, wet concrete, and other debris into State Waters to limit adverse impacts on water quality, aquatic habitat and biota. It may be beneficial to consult with the Department during the development of this plan.

F. The applicant shall implement the plan for downstream fish passage approved by Fish and Wildlife and described in Finding 15. The applicant shall file a copy of any appropriate engineering designs with the Department prior to construction.

G. Debris associated with the construction and operation of each project, including trashrack debris, shall be disposed of properly.

H. Any desilting of the projects' impoundments shall be done in accordance with the Agency of Environmental Conservation's Desilting Policy, a copy of which is attached. The Department shall be contacted prior to any desilting activity.

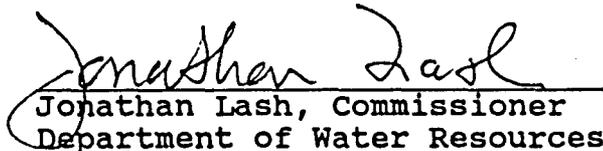
I. Any significant changes to either project must be submitted to the Department for prior review and written approval.

J. The applicant shall notify the Department when project construction has been completed. This shall be done in writing within two weeks of completion.

K. The applicant shall provide the Department with an as-built set of plans for both facilities and a copy of the turbine rating curves for the record within one year of the completion of construction.

L. No construction may commence until after the Department issues written approval under conditions A, E and I and after appropriate engineering designs are submitted to the Department under Condition F. Operational changes made after the completion of each project are subject to Condition I and must be approved prior to effecting the change.

Dated at Montpelier, Vermont this 27 day of May, 1986.


Jonathan Lash, Commissioner
Department of Water Resources
and Environmental Conservation