Water Quality Certificate
(P.L. 92-500, Section 401)

In the matter of: Central Vermont Public Service Corporation
77 Grove Street
Rutland, Vermont 05701

APPLICATION FOR THE PASSUMPSIC HYDROELECTRIC PROJECT

The Water Quality Division of the Vermont Department of Environmental Conservation (the Department) has reviewed a water quality certification application filed by Central Vermont Public Service Corporation (the applicant) and dated June 21, 1993. This application has been supplemented by a copy of the Federal Energy Regulatory Commission (FERC) license application filed with the FERC on December 31, 1991; an October 1992 certification application; and subsequent submittals from the applicant, including a September 1993 FERC Additional Information Request (AIR) response to FERC. The Department held a public hearing on April 26, 1994 under the rules governing certification and received testimony during the hearing and, as written filings, until May 13, 1994; attached is a copy of the Department's responsiveness summary, which shall be incorporated into this certification as findings by reference. The Department, based on the application and record before it, makes the following findings and conclusions:

I. Background/General Setting

1. The applicant has applied to the FERC for relicensure of the Passumpsic Hydroelectric Project located at river mile 5.5 on the Passumpsic River in the village of Passumpsic.

2. The Passumpsic River drains 507 square miles of area, including the major portion of Caledonia County and minor portions of Essex, Orleans, and Washington Counties. The mainstem of the river begins at the confluence of the West and East branches just north of Lyndonville, and the river flows south to the Connecticut River in Barnet. The West Branch headwater is the south slope of Mt. Pisgah east of Lake Willoughby. The East Branch originates in Brighton, south of Island Pond. The topography of the basin is most rugged in the area of the eastern headwaters and less so in the western portion of the basin. The length of the mainstem is 22.6

miles with an approximate total fall of 230 feet. The average gradient is 13.8 feet per mile from Lyndonville to the river's mouth in the Town of Barnet.

3. Two of the major tributaries of the Passumpsic River, the Moose and Sleepers rivers, enter upstream of the Passumpsic Project. The applicant operates five projects in succession on the mainstem of the Passumpsic River. Upstream of the Passumpsic Project are the Pierce Mills, Arnold Falls, and Gage projects. The East Barnet Project, recently reactivated, is located downstream and is the only dam between Passumpsic Dam and the river's confluence with the Connecticut River. The Village of Lyndonville operates two facilities upstream of the applicant's projects; these facilities are located at Vail Dam and Great Falls Dam.

4. Half of the river length, or almost ten miles, is impounded from the head of the Vail Project to the Connecticut River. Of the 230 foot drop in the river from Vail to the Connecticut River, 81% is harnessed for electrical generation.

5. The headwaters of the Passumpsic comprise pristine streams that flow through wilderness areas that are predominantly woodlands and wetlands with only sparse settlements. The village centers of Lyndonville and St. Johnsbury are located in the central part of the basin, along the mainstem, and are the commercial and industrial centers for village residents and the surrounding rural population. The lower portion of the basin is again rural with small villages such as Passumpsic and East Barnet along the main stem.

6. The site was first developed for hydroelectric generation in 1905. After damage during the 1927 flood, the facilities were repaired and returned to service by the Twin State Gas and Electric Company.

II. Project and Civil Works

7. The dam is founded on rock and consists of two sections defined by a change in alignment. The south section is 122 feet long, and the north section is 126 feet long. The crest elevation is 519.98 feet (msl), and varies in height from two to ten feet above the foundation. The dam is fitted with one foot high hinged flashboard panels on both the north and south crest sections. The normal

headwater elevation is 521.0 feet (msl), and the normal tailwater elevation is 497.0 feet (msl), providing a gross head of 24 feet.

8. The impoundment has a surface area of 18.3 acres, a useable storage capacity of 18 acre-feet, and a backwater influence of 4,500 feet.

9. Flashboards are maintained in place from mid-May through mid-March. The boards fail from winter ice and are normally repaired in mid-May. Debris or a summer storm event can also cause flashboard failure, which normally occurs no more than once a season.

10. The integral intake powerhouse is located at the downstream end of a power canal. Two manually operated timber bulkhead gates control flow to the 87 foot long power canal, which contains an overflow spillway in the outboard wall. This overflow discharges into a channel between the side of the powerhouse and an island which separates the channel from the falls. An inclined trashrack with intermediate support beams is located directly in front of the entrance to the turbine water passage.

11. The powerhouse contains a single James Leffel, vertical shaft, Francis-type turbine coupled to a 700 kw generator. The unit has adjustable wicket gates operated by headwater float control. The average annual generation for the twenty year period through 1990 was 3,869,000 kwh. (applicant's response to FERC AIR No. 9) Except for routine monitoring, inspection, and maintenance, the plant is operated automatically and unattended.

12. The powerhouse substation is located north and adjacent to the power canal. A 12.5 kv transmission line carries output from the facility to the Bay Street Substation located in St. Johnsbury.

III. River Hydrology and Streamflow Regulation

13. The drainage area at the dam is 428 square miles. A gaging station has been operated by the U.S. Geological Survey below Passumpsic Dam since October 1928. The drainage area at the gage is 436 square miles. Several of the flow parameters for the project have been estimated using the gage data and are shown in the following

table. Some of the parameters may be influenced by the artificial flow regulation caused by upstream hydroelectric projects.

Table 1. Hydrologic Parameters at Project.

Parameter	Value
Mean runoff	731 cfs (23.20 in/yr)
7Q10	86 cfs
95% Exceedance	128 cfs
50% Exceedance	398 cfs
10% Exceedance	1670 cfs

14. The project hydraulic capacity is 195 cfs to 460 cfs.

15. Present operation of the project is as a daily peaking plant with headpond drawdown from storage of one foot. Currently, when there is no spillage at the dam and when the powerhouse is shut down, the only flow downstream of the powerhouse is leakage and local drainage.

16. The project as described in the application will operate in a true run-of-the-river mode.[1]

17. Routine monitoring, inspection and maintenance will continue as in the past. The plant will operate in a semi-automatic and unattended mode.

18. The applicant originally proposed to maintain a continuous spillage of 1.0 inch of water over the 248-foot dam crest. Using a standard weir equation, the applicant had estimated this flow to be about 20 cfs. Upon the completion of FERC AIR No. 3 bypass habitat study, the applicant proposed to increase the spillage to 0.1 feet, or 26 cfs. The corresponding target minimum headpond elevation would be 521.08 feet.

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[1]A true run-of-river project is one which does not operate out of storage and, therefore, does not artificially regulate streamflows below the project's tailrace. Outflow from the project is equal to inflow to the project's impoundment on an instantaneous basis. The flow regime below the project is essentially the river's natural regime, except in special circumstances, such as following the reinstallation of flashboards and project shutdowns. Under those circumstances, a change in storage contents is necessary, and outflow is reduced below inflow for a period.

The flow sensor will automatically and continually adjust the generator load so that the spillage is prerequisite to generation. As river flows diminish, the flow sensors will reduce generation slowly to keep the required amount of water spilling over the flashboards. As the flow continues to diminish, the flow sensors will remove the unit from the line and all water will spill over the dam.

19. The project automated (SCADA) system has an accuracy of ± 1.0 inch. To provide the applicant's targeted minimum headwater elevation, the SCADA system would have to be set to a fixed level one inch above the target headpond elevation, or 0.18 foot above the top of the flashboards. It is important to note that this would result in a variable bypass flow of about 26 cfs to 114 cfs, plus leakage.

20. To allow workers access for the reinstallation or repair of flashboards, the impoundment is drawn just below the crest using the plant turbine. When the work is complete, the plant discharge is reduced to refill the impoundment; the applicant proposes to release about half of inflows, or 230 cfs, downstream during the refill period which would last for about one hour. In cases when the inflows are substantially less than 230 cfs, the refill time would become more extended.

21. Flashboard leakage would not be sealed until after the impoundment refills. However, no provision is made for maintaining the proposed bypass flow during flashboard replacement.

22. The project will not be cycled for audits nor for emergency energy demands.

IV. Bypass

23. The project bypasses 350 feet of river. The upper third consists of a cascade over bedrock. The lower two-thirds consists of deep pool-like runs over a substrate of very irregular bedrock, boulders, cobble, and some gravel. There is a pronounced gravel bar on the north side of the bypass at the base of the falls.

24. The bypass is virtually dewatered for much of the year by the present operating mode of the project, receiving only leakage from

the dam. No leakage estimates from the dam have not been made available.

V. Standards Designation

25. The Passumpsic River in the project-affected reach is designated by the Water Resources Board as Class B waters. The project impoundment comprises the lower end of a waste management zone that receives the discharge from the St. Johnsbury municipal wastewater treatment facility. The Water Resources Board has designated the entire Passumpsic River as cold water fisheries habitat.

    The lengths of waste management zones are being reviewed by the Department and will be reset based on rules to be promulgated by the Water Resources Board.

26. Class B stream reaches are managed to achieve and maintain a high level of quality compatible with certain beneficial values and uses. Values are high quality habitat for aquatic biota, fish and wildlife and a water quality that consistently exhibits good aesthetic value; uses are public water supply with filtration and disinfection, irrigation and other agricultural uses, swimming, and recreation. (Standards, Section 3-03)

27. Waste management zones, although Class B waters, present an increased level of health risk to contact recreational users due to the discharge of treated sanitary wastewater.

28. The dissolved oxygen standards for cold water habitat streams are 6 mg/l or 70 percent saturation unless higher concentrations are imposed for areas that serve as salmonid spawning or nursery areas important to the establishment or maintenance of the fishery resource. The temperature standard limits increases from background to 1.0°F. (Standards, Section 3-01(B)) The turbidity standard is 10 ntu. (Standards, Section 3-03(B))

29. Under the general water quality criteria, all waters, except mixing zones, are managed to achieve, as in-stream conditions, aquatic habitat with "[n]o change from background conditions that would have an undue adverse effect on the composition of the aquatic biota, the physical or chemical nature of the substrate or the species

composition or propagation of fishes." (Standards, Section 3-01(B)(5))

30. Section 2-02 Hydrology of the Vermont Water Quality Standards requires that "[t]he flow of waters shall not be controlled or substantially influenced by man-made structures or devices in a manner that would result in an undue adverse effect on any existing use, beneficial value or use or result in a level of water quality that does not comply with these rules." The project dam is a man-made structure that artificially regulates streamflow.

VI. Water Quality - Water Chemistry

31. The application presents data from limited water quality sampling done by the applicant in 1986 and 1988. Subsequent to these sampling periods, the Town of St. Johnsbury upgraded its wastewater treatment facility from primary to secondary. The earlier data cannot, therefore, be used in assessing the project's impact on river's dissolved oxygen regime.

32. The Town of St. Johnsbury wastewater treatment facility, with a design capacity of 1.6 mgd has the largest discharge on the river and is an important influence on the river's dissolved oxygen regime. Based on 1993 records, the facility is at 68% of its design capacity.

33. The application includes a supplemental report for the 1991 water quality sampling and analysis done by Aquatec, Inc. The report concludes that the project under the proposed configuration will not violate the minimum water quality standards for dissolved oxygen.

    Data for the 1991 study was collected from July 16-19. Of the 15 sampling sets for the three-day summer study, no samples at the Passumpsic Project stations were less than 90% saturation; however, substantial algal influence was apparent. All samples in the impoundment just upstream of the dam were at or above saturation. Algal respiration will become an important influence on dissolved oxygen levels as the St. Johnsbury wastewater plant loading increases in the future.

34. Aquatec's analysis of reaeration coefficients demonstrated a significant aeration efficiency for spillage at the Passumpsic Dam. According to Aquatec's study report, 60% of a dissolved oxygen

deficit is eliminated through spillage and bypass-reach reaeration. (Diurnal Dissolved Oxygen and Temperature Study, Passumpsic River from St. Johnsbury Center to East Barnet, Vermont, July 16-19, 1991, September 1991, page 5)

VII. Water Quality - Aquatic Biota and Habitat

35. Aquatic biota are defined in Standards Section 1-01(B) as "organisms that spend all or part of their life cycle in or on the water." Included, for example, are fish, aquatic insects, amphibians, and some reptiles, such as turtles.

36. Wild and hatchery-origin brook, brown and rainbow trout occur in the Passumpsic basin. Vermont Department of Fish and Wildlife studies conducted in the early 1970's indicate the Passumpsic River drainage basin contained a higher percentage of brook trout than any other drainage basin studied throughout the state. The Department of Fish and Wildlife currently supplements natural populations by stocking one or more of the three species in reaches of the mainstem and tributaries. Also occurring in the Passumpsic basin are sucker and minnow species, sculpins, darters, yellow perch, sunfish species, and brown bullhead. The latter three are mostly found in mainstem impoundments.

Below Project

37. A free-flowing reach of about three miles exists between the project tailrace and the East Barnet Hydroelectric Project impoundment. Joes Brook enters the river in this reach.

38. Flows below the tailrace will essentially be unregulated. This proposed flow regime will optimize conditions for fish life downstream of the project powerhouse.

39. Artificial flow regulation below the tailrace is anticipated to occur during impoundment refilling following flashboard reinstallation. The applicant proposes to release 230 cfs (0.54 csm) or half of inflows during the refill period.

Bypass

40. The Agency's management goal for the bypasses at the Passumpsic River projects is to establish and maintain cold water aquatic habitat, including deep aerated pools that are well circulated and serve as adult fish refugia, steeper gradient areas with high macroinvertebrate production, and fish spawning and nursery areas (Comprehensive River Plan for the Passumpsic River Watershed, Vermont Department of Environmental Conservation, August 1992). The project bypass provides valuable habitat for resident adult resident salmonids (brown and rainbow trout) and limited habitat for juvenile Atlantic salmon and the other life stages of resident salmonids and a variety of non-game fishes.

41. The project bypass will continue to be subject to artificial flow regulation. It contains excellent habitat ("pocket water") for adult salmonids. Cover and velocity refuges, in the form of large substrate objects and pockets of deep water, are abundant. (Memorandum from Leonard Gerardi, District Fisheries Biologist, to Department, October 21, 1991)

42. With sufficient flows, the Passumpsic bypass also constitutes an area of macroinvertebrate production. Aquatic insects are a primary food source for fish and an important component of the food chain.

43. During fall 1992 and summer 1993, the applicant, in consultation with the Agency and the U.S. Fish and Wildlife Service, conducted a study to determine how much habitat is available at alternate minimum bypass flows. The results of this study are presented in the applicant's response to FERC AIR No. 3 (September 1993). The original scope of the study was to conduct assessments of habitat for the rainbow trout adult life stage at study plan target flows of 20 cfs, 55 cfs, 90 cfs, 150 cfs, and 211 cfs. The actual flows assessed were determined to be 26 cfs, 74 cfs, 110 cfs, 165 cfs, and 211 cfs.

44. By letter dated March 24, 1993 the Agency requested that flows be measured in the bypass using wading measurements where physically possible and that the head on the dam be monitored but not be used as the exclusive means of estimating flow. Estimation of flow using the weir formula is imprecise and fails to account for leakage.

45. The applicant claims that it was not possible to measure flows as requested by the Agency due to the irregular characteristics of the bypass, the nature of the substrate with its ledge and large boulders, and the lack of opportunity to measure laminar flow regardless of where a transect is located. No attempt made to calibrate the weir equation coefficient.

46. The habitat/flow relationship for the rainbow trout adult life stage was qualitatively described by estimating the cell-width-weighted mean habitat suitability index for each of the two transects at each of the study flows. The areal extent of available habitat was not quantified. The results are contained in the following table.

Table 2. Results of habitat study in bypass.

Flow (cfs)	Rainbow Tr. Adult Habitat HSI	
	Transect 1	Transect 2
26	0.48	0.56
74	0.57	0.60
110	0.76	0.71
165	0.81	0.78
211	0.80	0.35

47. Over the range of flows from 26 cfs to 165 cfs, wetted width increased only 8% (Transect 1) and 12% (Transect 2). The values shown in Table 2 could be adjusted by the ratios of wetted width to the wetted width at the lowest flow, 26 cfs, in order to provide more quantitative representations of habitat, but the relatively small change in wetted widths do not warrant such an adjustment in this case.

48. Based on the weighted average HSI available for each transect at each of the target flows, a flow of 165 cfs provides the best habitat conditions in the bypass, displaying improvements of 69% (Transect 1) and 39% (Transect 2) over the 26 cfs. Table 3 displays the percentage of rainbow trout habitat lost in reducing bypass flows below 165 cfs. A flow of 86 cfs (7Q10) is included, using an interpolation of the data in Table 2.

Table 3. Habitat loss from reducing flows below 165 cfs.

Flow (cfs)	Percentage of habitat lost	
	Transect 1	Transect 2
26	41	28
74	30	23
86	22	18
110	6	9

Impoundment

49. Fisheries habitat in the project impoundment area that was formerly riverine (lotic) has been transformed into lacustrine habitat due to the impounding of water by the dam. The quality of the impoundment as lacustrine habitat is marginal as depths are shallow relative to lakes and ponds and retention times short.

50. Flashboard loss and major drawdowns below the dam crest can cause dewatering of the riparian-zone habitat. Fish and other aquatic organisms that use the impoundment would be subject to stranding or freezing when such drawdowns occur.

Fish Passage

51. A Strategic Plan for the Restoration of Atlantic Salmon to the Connecticut River Basin (1982) identifies the Passumpsic River as potential non-natal smolt production habitat for stocking consideration at such time in the future that the program's hatchery fry production capacity expands to meet the needs of non-natal streams. The plan estimates that there are 6,000 units (one unit = 100 sq. yards) of salmon nursery habitat in the Passumpsic basin. Subsequent to the 1982 restoration plan, the Department of Fish and Wildlife has revised the estimate of available habitat in the Passumpsic basin. The estimated total habitat is about 20,000 units, with 97% of the habitat above Passumpsic Dam.

52. The Department of Fish and Wildlife stocked 15,000 age 0+ Atlantic salmon parr in the Moose River between St. Johnsbury to Concord in fall of 1991. The Moose River is an upstream tributary of the Passumpsic River and was selected for salmon stocking

because it has excellent physical habitat conditions and because its warmer than average temperature regime is likely to be very favorable for salmon development. Subsequently, parr have been stocked in both 1992 and 1993, and fry have been stocked in spring 1993 in the Moose River and in the East Branch, which is upstream of Pierce Mills. More extensive basin-wide stocking of fry is planned for spring of 1994. Passage is an existing need at the Passumpsic Project and the Gage Project and will be needed for outmigration in 1995 at Arnold Falls and Pierce Mills as well.

53. The applicant has agreed to provide downstream passage when and if the Passumpsic River becomes an integral part of the salmon restoration effort supported by a detailed plan documenting location of habitat units, an annual release schedule supported by hatchery capability, and a monitoring plan (license application, Page E-48). The restoration plan was last revised in September 1982 and is once again under revision. For the life of the project, any passage facilities at Passumpsic Dam should be provided and operated consistent with the most current restoration plan.

54. Upstream fish passage for returning adult salmon is now provided up to the dam at Dodge Falls on the Connecticut River at East Ryegate (Dodge Falls Hydroelectric Project, FERC No. 8011). When a threshold number of returning adult salmon is reached at the now-operational fishway at Wilder Dam, construction of a passage facility (either a fish trap-and-truck facility or a fish ladder) at Dodge Falls will be triggered. Salmon will then have access to the Passumpsic River.

55. Upstream passage facilities are currently not needed as part of the restoration plan, as the Passumpsic River is not currently targeted for natural reproduction of salmon. However, the status of all passage needs may be reviewed as part of the revision of the Strategic Plan or annual program (USF&WS) reviews. Expansion of and/or changes in the plans for the river may necessitate upstream passage facilities in the future. (USF&WS December 23, 1993 comment letter to FERC)

56. Resident populations of trout occur both above and below Passumpsic Dam and would benefit from fish passage facilities that would help accommodate their movements within the river system.

VIII. Water Quality - Wildlife and Wetlands

57. Vermont Water Quality Standards requires the Agency Secretary to identify and protect existing uses of state waters. Existing uses to be considered include wetland habitats and wildlife that utilize the waterbody.

58. No Class I or Class II wetlands exist within the influence of the dam backwater zone. Institution of a run-of-the-river operating mode will protect any downstream wetlands that may exist and Class III wetlands present in the backwater zone.

59. Wildlife that use the riparian zone and river will be better supported by the improved operating regime. Typical wildlife would include furbearers such as otter, beaver, muskrat, mink, and deer and birds such as kingfisher, herons, ducks, and osprey.

IX. Water Quality - Rare and Endangered Plants and Animals; Outstanding Natural Communities

60. A population of Garber's sedge (Carex garberi) is located below the dam in sandy pockets on ledges on the left (south) side of the river at the lower end of the bypass. Garber's sedge is on the Vermont threatened species list. The species is found in moderate abundance and about 50 fruiting culms were observed in June 1991. The population covers a relatively small area of two or three square yards. The plants are in an area that is covered by high water each spring. The applicant does not propose any construction or operational activities at the site that would be incompatible with the protection of the habitat for the Garber's sedge plant.

X. Water Quality - Shoreline Erosion and Impoundment Desilting

61. The impounded reach of the Passumpsic River above the project dam forms a meander pattern as the river cuts through flat, broad floodplain deposits. The river is actively eroding its banks in this reach. There are many locations where the riverbanks show fresh, unvegetated scars with trees toppling into the river.

62. The applicant retained a geotechnical engineer to evaluate the streambank erosion in the impounded reach. The consultant was of

the opinion that the erosion is a natural process not accelerated by the project.

63. Impoundment desilting can result in significant degradation of water quality if not executed properly. Desilting has never been required at this project according to the applicant. Development of a desilting plan is, therefore, unnecessary at this time. The applicant proposes to consult with the Agency should a need to desilt arise in the future.

XI. Water Quality - Recreation and Aesthetics

64. The river in the project vicinity is popular for several recreational uses, including fishing, swimming, picnicking, boating, photography and viewing. (Comprehensive River Plan for the Passumpsic River Watershed and staff observations)

65. Vermont Water Quality Standards require the protection of existing water uses, including the use of the water for recreation. The Standards also require the management of the waters of the State to improve and protect water quality in such manner that the beneficial values and uses associated with a water's classification is attained.

66. Beneficial values and uses of Class B waters include water that exhibits good aesthetic value and swimming and recreation. Section 2-02 of the Standards prohibits regulation of river flows in a manner that would result in an undue adverse effect on any existing use, beneficial value or use.

67. The river is a navigable and boatable water of the State.

68. As a result of extensive impounding by utility dams along the length of the Passumpsic River, flatwater boating opportunities are created that enable extension of the boating season well into low water periods when other rivers are not canoeable. Access to the river is limited, however. The applicant's lands have always been open to such recreational endeavors.

69. One of the most limiting factors to boating the river is the lack of provisions for portaging the applicant's dam. The dam impairs boating on a navigable river. Recreation is a designated use for the Passumpsic River. Where designated uses have been impaired or

eliminated, all reasonable steps should be taken to restore such uses.

70. The Appalachian Mountain Club publication River Guide - New Hampshire/Vermont, 2cd ed., 1989 describes canoeing the river in the project area. According to the guide, the river is quickwater from below Gage Station to the Passumpsic Dam. "An easy portage starts under the bridge, then through the power station parking lot. In the next 2½ miles there are four ledges. The first one, under the railraod bridge within sight of the dam, is the most difficult and can be lined if desired. The others are easily run. The third is immediately below the confluence on the right where the Water Andric drops over a scenic waterfall framed by the arch of a railroad bridge. This section of the river is very lovely."

71. Referencing the applicant's March 1991 Site Assessment concept proposal (Appendix G, License application), portage facilities are depicted on river right, with a put in off of the railroad right-of-way. However, the siting has not yet been finalized.

72. A small picnic/day-use area is to be developed between the dam and the bridge on the right (west) side of the river will allow visitors to view the river and head of the falls. Improved parking is planned for the existing parking area next to the substation. Landscaping is proposed to enhance the visual appearance of the entrance to the facility.

73. Bank fishing will be provided near the portage take-out location. Disabled visitors to the project will be enabled access to the parking facilities only. Grades within the parking area are not in excess of 8% slope.

74. The applicant proposes to develop and maintain its proposed recreational facilities. However, it states that it will remove improved recreational facilities and may restrict open access if vandalism becomes a problem.

75. The project boundary is very limited, encompassing the project civil works, tailrace, dam, and the impoundment flowage. A path for river access exists over this land and provides the only route for reaching the falls area, but is not within the project boundary.

76. The Passumpsic powerhouse and project lands are attractive river-related features in the Passumpsic village area.

77. Spillage over the dam is important to the appearance of the site and will contribute to the public recreational enjoyment. Falling water has a strong visual appeal, and without sufficient spillage over the dam the site would context and its attractiveness would suffer. The amount of spillage needs to be in scale with the size of the project. The applicant conducted a flow demonstration to document on video-cassette tape existing spillage conditions as well as with the proposed one inch spillage.

XII. Existing Uses

78. No existing uses, other than those discussed above, have been identified. Existing uses, as defined in the Standards, are provided special protection under the anti-degradation provisions of the Standards (Section 1-03 (B) Protection of Existing Uses).

XIII. Other Applicable State Laws

Vermont Endangered Species Law (Title 10, Sections 5401 to 5403)

79. The Vermont Endangered Species Law (Title 10, Sections 5401 to 5403) governs activities related to the protection of endangered and threatened species. Generally, a person shall not "take, possess or transport wildlife or plants that are members of an endangered or threatened species." (Title 10, Section 5403(a)) Disturbance of a endangered or threatened species is considered a taking. (Title 10, Section 4001)

80. The applicant does not propose any construction or operational activities at the site that would be incompatible with the protection of the habitat for the Garber's sedge plant.

Agency Regulatory Powers over Fish and Wildlife

81. Under 10 V.S.A. Chapter 103, "[i]t is the policy of the state that the protection, propagation control, management and conservation of fish, wildlife and fur-bearing animals in this state is in the interest of the public welfare, and that safeguarding of this valuable resource

for the people of the state requires constant and continual vigilance."

82. The water use as proposed, with the conditions imposed below, will be consistent with this state policy.

XIV. State Comprehensive River Plans

The Agency, pursuant to 10 V.S.A. Chapter 49, is mandated to create plans and policies by which Vermont's water resources are managed and uses of these resources are defined. These plans implement the Agency policy. The Agency must, under Chapter 49 and general principles of administrative law, act, when possible, consistently with these plans and policies.

Hydropower in Vermont, An Assessment of Environmental Problems and Opportunities

83. The Department publication Hydropower in Vermont, An Assessment of Environmental Problems and Opportunities is a state comprehensive river plan. The hydropower study, which was initiated in 1982, indicated that hydroelectric development has a tremendous impact on Vermont streams. Artificial regulation of natural stream flows and the lack of adequate minimum flows at the sites were found to have reduced to a large extent the success of the state's initiatives to restore the beneficial values and uses for which the affected waters are managed.

    Two specific recommendations of the plan are that minimum flow requirements be established for this project in order to improve the downstream fishery, water quality, and aesthetics, and that impoundment water levels be stabilized to protect upstream fisheries resources.

Passumpsic River Watershed Comprehensive River Plan

84. The Agency, with extensive public involvement, has completed a comprehensive river plan for the Passumpsic River Watershed. The plan, entitled Passumpsic River Watershed Comprehensive River Plan (August 1992) defines a balance of river uses and values including state hydropower management goals and actions. The state management goals and actions contained in the plan are

derived from state law, written state policies, and the public interest as determined through a three-year public participation process. River basin citizens who participated in the planning process expressed as major issues of concern the restoration of the river's water quality and the fishery.

State hydropower management goals from this report include:

> Goal 1 Continue to use the Passumpsic River, Sleepers River, and Joes Brook for the generation of electricity and permit other legitimate commercial uses of river water but make these uses compatible with other river uses and values.
> Goal 2 Wherever possible, establish and maintain natural river flows to improve and maintain aquatic habitat, water quality, recreation, and aesthetics.
> Goal 3 Establish and maintain minimum flows in the bypass segments of the hydropower facilities to maintain water quality, aesthetic and recreational values, and aquatic habitat, including: deep-aerated pools that are well circulated and serve as adult fish refugia, steeper gradient areas with high macroinvertebrate production, and fish spawning and nursery areas, all of which are limited habitat types, especially in the mostly impounded waters of the Passumpsic River mainstem.
> Goal 4 Maintain riverbank stability and enhance river water clarity, aesthetics, and habitat for fish, wildlife, and other aquatic biota by minimizing river flow and pond height fluctuations.
> Goal 5 Enhance the ability of fish to negotiate passage of hydro dams. Create downstream passage facilities for resident trout species and Atlantic salmon smolts (from both natal and non-natal production). Create upstream passage facilities when sufficient numbers of adult salmon have returned to the Passumpsic River.
> Goal 9 Enhance the Passumpsic River's role in as recreation/tourism based economy, preserve historic and archeological resources, and restore the aesthetics and productivity of local rivers by permitting a continuous vegetation buffer to grow on and near the banks of the river and its tributaries.
> Goal 12 Enhance the desirability to live and conduct business in Lyndonville and St. Johnsbury by conserving and beautifying open spaces along the rivers as accessible recreational, cultural, scenic, and educational amenities in the urban corridor.
> Goal 13 Maintain existing boating runs, for car-top boats and create a Passumpsic River boating trail where boaters can portage around dams and put-in and take-out at hydroelectric facilities on the mainstem river.
> Goal 14 Increase watershed awareness and stewardship and local interest to maintain clean water, safe for swimming and compatible with other existing stream uses and values.

The project as proposed, and with the conditions imposed below, will be in compliance with the plan.

1988 Vermont Recreation Plan

85. The 1988 Vermont Recreation Plan (Department of Forests, Parks and Recreation), through extensive public involvement, identified water resources and access as top priority issues. The planning process disclosed that, while Vermonters and visitors focus much of their recreational activities on surface waters, growing loss of public visual and recreational access to those waters causes substantial concern to the users. The plan projects that access is "likely to become the critical river recreational issue of the 1990s." The need for development of portage trails and canoe access sites is cited as among the major issues relative to canoe trails in Vermont.

86. The Water Resources and Access Policy is:

> It is the policy of the State of Vermont to protect the quality of the rivers, streams, lakes, and ponds with scenic, recreational, and natural values and to increase efforts and programs that strive to balance competing uses. It is also the policy of the State of Vermont to provide improved public access through the acquisition and development of sites that meet the needs for a variety of water-based recreational opportunities.

87. Enhancement of access, provision of a portage, and improved flow management would be compatible with this policy and balance competing uses of the river for recreation and hydropower. Nonassurance of access or failure to provide a convenient portage trail would exacerbate a critical state recreational problem.

88. Another priority issue identified in the Recreation Plan is the loss or mismanagement of scenic resources. The plan notes "[few] recreational activities in Vermont would be the same without the visual resources of the landscape," and that protection of those resources is "necessary if the state is to remain a desirable place to live, work, and visit."

89. The Scenic Resources Protection and Enhancement Policy is:

> It is the policy of the State of Vermont to initiate and support programs that identify, enhance, plan for, and protect the scenic character and charm of Vermont.

90. Landscaping, provision of dam spillage, and maintenance of bypass and downstream flows will protect the scenic characteristics of project area and river.

Vermont Comprehensive Energy Plan

91. Pursuant to Executive Order No. 79 (1989), the Department of Public Service produced the Vermont Comprehensive Energy Plan, January 1991. This plan sets out an integrated strategy for controlling energy use and developing sources of energy. Several goals of the plan are to reduce global warming gases and acid rain precursors by 15% by the year 2000 through modified energy usage; to reduce by 20% by the year 2000 the per capita consumption of energy generated using non-renewable energy sources; and to maintain the affordability of energy.

92. Prescription of an appropriate minimum flow for the bypass is important to project economics. The response to AIR No. 8 (September 1993) provides the energy output losses for a range of minimum bypass flows from 20 to 211 cfs. A continuous special release of 26 cfs would reduce project output by about 210 mwh, or 5% of the average annual energy output, for the 30-year term of the federal license; a special release of 110 cfs year round, would result in about a 860 mwh, or a 22%, reduction in output.

93. The loss of electrical power production associated with mitigation needed to meet water quality standards will have a negligible effect on overall power availability and rates.

    The expected regional power surplus from the New England and New York power pools is 13,389 megawatts for Winter 2002-2003. Because the facility would be operated in a base-load fashion (run-of-the-river), no operating reserve (storage function) is available. The applicant has large amounts of base-load power at its disposal. (testimony of Robert Howland, Central Vermont Power's Manager of Power Supply, before the State Public Service Board in Docket No. 5171)

94. Continued availability of electricity generated by this renewable source, with proper environmental constraints in place, is consistent with the State energy plan.

XV. Analysis

Operations

Impoundment

95. The conversion of the Passumpsic Project to a run-of-the-river station will result in a more stable impoundment. Occasional loss or removal of flashboards will cause a lowering of the impoundment. As the flashboards are only one foot in height, significant impacts on the upstream habitat and water quality is not expected.

96. Major drawdowns for construction or repair would have to be reviewed case specifically to insure protection of the upstream resource.

Bypassed reach

97. The Agency Procedure for Determining Acceptable Minimum Stream Flows (July 14, 1993) provides guidance to the Department in setting minimum stream flows at hydroelectric projects. With regard to project bypasses, the procedure states:

> Bypasses shall be analysed case-by-case. Generally, the Agency shall recommend bypass flows of at least 7Q10 in order to protect aquatic habitat and maintain dissolved oxygen concentration in the bypass and below the project. In assessing values, consideration shall be given to the length of the bypass; wildlife and fish habitat potential; the aesthetic and recreational values; the relative supply of the bypass resource values in the project area; the public demand for these resources; and any additional impacts of such flows upon citizens of the State of Vermont. Bypass flows shall be at least sufficient to maintain dissolved oxygen standards and wastewater assimilative capacity. Where there are exceptional values in need of restoration or protection, the general procedure shall be followed. In most cases, a portion or all of the bypass flows must be spilled over the crest of the dam to reoxygenate water, provide aquatic habitat at the base of the dam and assure aesthetics are maintained.

98. The applicant proposes to maintain a 26 cfs bypass release during the summer period; 26 cfs is only 30% of the 7Q10 drought flow condition (86 cfs, or 0.20 csm) at the project. This will have limited value for reaeration as it represents only a small fraction of the total flow of the river during operation. However, the project will be spilling all inflows during the period of greatest concern, providing

full reaeration potential. The project's low-end capacity is 195 cfs, which with the applicant's proposed operating mode would require about 0.52 csm in order to operate.

99. There is no present need for a special bypass-flow release to meet dissolved oxygen standards downstream. However, algal respiration will become an important influence on dissolved oxygen levels as the St. Johnsbury wastewater plant loading increases in the future. Use of the dam spillage as a point source of reaeration may become necessary at some point in the future to maintain dissolved oxygen standards as wastewater loadings become more significant. However, the spillage required to serve aquatic habitat needs in the bypass is in excess of 7Q10, and will preclude the need to monitor water quality to assure that dissolved oxygen standards are met.

100. The Passumpsic River is heavily dammed and the large majority of its length is under impounded conditions. The bypasses represent a disproportionate amount of the high quality habitat for salmonids on the river mainstem. The Department considers the maintenance of habitat values within the bypasses as very important. The applicant's proposed minimum bypass flow of 26 cfs would cause an undue adverse effect on the composition of the aquatic biota and the species composition and propagation of fish, and would not support Agency management goals for this reach.

101. A spillage flow in the bypass reach of 86 cfs would be sufficient to provide a moderate level of habitat for adult salmonids; about 80% of the habitat achieved at the optimum flow of 165 cfs would remain. When flows recede below 281 cfs, or 0.66 cfs (86 cfs plus 195 cfs, the minimum station hydraulic capacity), all flows would be discharged into the bypass.

102. Based on the video assessment completed by the applicant, the proposed spillage flow of 26 cfs would be adequate to support good aesthetic value, a Class B management objective. Higher flows as required for habitat support would further enhance conditions.

Below Project

103. The conversion of the project to a true run-of-river facility is expected to improve water quality below the project, as downstream flows will no longer be subject to artificial drought conditions and

concomitant poor water quality. The project as proposed and with Department conditions below related to bypass flows and impoundment refilling will meet dissolved oxygen and temperature standards and the anti-degradation provisions of the water quality regulations.

104. Because natural river flows will be continuously available downstream, the impact of the project on concentrations or levels of the following parameters will not be significant:

Phosphorus
Nitrates
Settleable, floating or suspended solids
Oil, grease, and scum
Alkalinity
pH
Toxics
Turbidity
Escherichia coli
Color
Taste and odor

Flashboard Replacement

105. During special events when water must be placed in storage, the applicant proposes to release 230 cfs (0.54 csm) or half of inflows below the project. The USF&WS Flow Policy and the Agency Flow Procedure prescribe certain minimum flows for the perpetuation of indigenous fish species. The base flows are 4.0 csm for spring spawning and incubation, 1.0 for fall/winter spawning and incubation, and 0.5 csm for the remaining period and for cases where there is no use for spawning and incubation. When instantaneous inflows are less than these values, the inflow must be passed on an instantaneous basis. At the Passumpsic Project, these aquatic base flows are 1712 cfs (4.0 csm), 428 cfs (1.0 csm), and 214 cfs (0.5 csm). Reduction of flows substantially below these minimums for the purpose of refilling the impoundment may imperil fish below the project. Mainstem spawning in the spring and fall is believed to occur downstream.

106. A continuous release of the U.S. Fish and Wildlife Service aquatic base flows or 90% of inflows, depending on inflow circumstances,

will adequately protect downstream fish and other aquatic organisms during the occasional refill periods. During the spring period, the aquatic base flow is substantially higher than project capacity; flashboard replacement will only be possible during lower inflows. The 90% requirement would apply during this period. For the summer and fall/winter periods, the 90% requirement would apply to inflow conditions less than the 214 cfs and 428 cfs standards, respectively.

Fish Passage

107. Because of past stocking, operational passage facilities for outmigration is a present need at Passumpsic Dam. Passage facilities should include structures or devices to safely convey fish downstream of the dam and may include screening to minimize entrainment and impingement and a conveyance conduit.

108. Adequate flows to operate these facilities will also be required. Passage facilities will also benefit resident trout species. Standard design for downstream passage facilities utilize operating flows equivalent to 2% of the plant hydraulic capacity, or the flow through a 3x2 foot rectangular weir, whichever is greater. For this project, the flow need would equate to about 20 to 25 cfs. It will be necessary to operate these facilities continuously during the periods April 1 through June 15 and September 15 through November 15. These periods are subject to adjustment based on knowledge gained about migration periods for salmon in the Connecticut River basin.

109. Changes to the salmon restoration plan may require the provision of upstream passage facilities within the term of the new license, although such facilities are not envisioned in the existing plan. The U.S. Fish and Wildlife Service has reserved a general passage prescription right under Section 18 of the Federal Power Act. (U.S. Department of Interior letter to FERC, December 23, 1993)

110. Any passage facilities at Passumpsic Dam must be provided and operated consistent with the most current restoration plan.

Streambank erosion

111. The applicant's proposed operating mode will reduce the potential for erosion problems to develop in the future.

Recreation

112. Provision of a portage and continued access, with the improvements proposed by the applicant will provide support of the recreation management objectives for Class B waters, as well as the use of the river at the project for fishing, boating, and other existing uses.

113. Although the applicant proposes to develop and maintain its proposed recreational facilities, it states that it may restrict open access if vandalism becomes a problem. Arbitrary restriction of public access to the river would impair recreational use and enjoyment of the resource.

114. The applicant's spillage proposal of 26 cfs is satisfactory for aesthetics.

ACTION OF THE DEPARTMENT

Based on its review of the applicant's proposal and the above findings, the Department concludes that there is reasonable assurance that operation of this project as proposed by the applicant and in accordance with the following conditions will not cause a violation of Vermont Water Quality Standards and will be in compliance with sections 301, 302, 303, 306, and 307 of the Federal Clean Water Act, P.L. 92-500, as amended, and other appropriate requirements of state law:

A. The applicant shall operate and maintain this project as set forth in the findings of fact and conclusions above and these conditions.

B. Except as allowed in Condition D below, the facility shall be operated in a true run-of-the-river mode where instantaneous flows below the tailrace shall equal instantaneous inflow to the impoundment at all times. When the facility is not operating, all flows shall be spilled at the dam.

   The applicant shall, within 90 days of issuance of this certification, furnish a description, hydraulic design calculations, and plans for the measure to be used to maintain true run-of-river flows below the project tailrace.

C. When available from inflow, a minimum instantaneous flow of 86 cfs shall be released at the dam at all times. If the instantaneous inflow falls below the hydraulic capacity of the turbine unit plus this spillage requirement, all flows shall be spilled at the dam.

   The applicant shall file for review and approval, within 90 days of the issuance of this certificate, a description, hydraulic design calculations, and plans for the measure to be used to pass this minimum flow. The filing shall address conditions with and without the flashboards in place, including conditions when the impoundment is being drawn for flashboard replacement and subsequent refilling.

D. Following the reinstallation of flashboards or an approved special maintenance operation necessitating a drawdown, the impoundment shall be refilled by reducing downstream flows, but to no less than 214 cfs from June 1 to September 30 and 428 from October 1 to May 31. During the period April 1 to May 31 or under

circumstances during the summer and fall/winter periods when the natural inflow to the project is insufficient to permit both passage of these minimum flows and refilling of the impoundment, the impoundment shall be refilled while releasing 90% of instantaneous inflow downstream at all times.

E. The applicant shall file for review and approval, within 90 days of the issuance of this certificate, a plan for monitoring impoundment levels and instantaneous flow releases at the project, both in the bypass and below the tailrace. Following approval of the monitoring plan, the applicant shall then measure impoundment levels and instantaneous flows and provide records of discharges at the project on a regular basis as per specifications of the Department. Upon receiving a written request from the applicant, the Department may waive, all or in part, this requirement for monitoring provided the applicant satisfactorily demonstrates that the required flows will be discharged at all times.

F. Within six months of the issuance date of the license, the applicant shall submit a plan for downstream fish passage to the Department of Fish and Wildlife for review and written approval. Downstream passage shall be provided April 1 - June 15 and September 15 - November 15 and shall be functional with and without flashboards in place, with the period subject to adjustment by the Department based on knowledge gained about migration periods for migratory salmonids. The approved plan shall be fully implemented within two years of license issuance and shall include provisions to:

1. minimize passage of fish into the generating unit(s);

2. minimize impingement of fish on trashracks or on devices or structures used to prevent entrainment; and

3. convey fish safely and effectively downstream of the project, including flows as necessary to operate conveyance facilities.

The plan shall include an implementation/construction schedule and a proposal for an interim fish bypass method for use until permanent facilities are completed; the interim method shall be utilized no later than six months from license issuance. The U.S. Fish and Wildlife Service and the Department of Fish and Wildlife shall be consulted during plan development. The plan shall include

an erosion control and water management plan designed to assure compliance with water quality standards during construction.

G. Within two years of a written request by the Agency, the applicant shall provide for upstream fish passage, subject to plan approval by the Department of Fish and Wildlife. The U.S. Fish and Wildlife Service and the Department of Fish and Wildlife shall be consulted during plan development. The plan shall include an erosion control and water management plan designed to assure compliance with water quality standards during construction.

H. 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 this certificate.

I. The applicant shall provide a canoe portage around Passumpsic Dam by October 1, 1995. The applicant shall consult with the Recreation Section of the Department of Forests, Parks and Recreation and the Department of Environmental Conservation in the planning, siting, and design of the portage. Design and maintenance plans for the portage shall be filed with the Department of Environmental Conservation and the Department of Forests, Parks and Recreation for review and approval before construction of the portage.

J. The applicant shall allow continued public access to the project area for utilization of public resources, subject to reasonable safety and liability limitations. Any proposed limitations of access to State waters to be imposed by the applicant shall first be subject to written approval by the Department.

K. Within 90 days of the issuance of this certification, the applicant shall submit a plan for proper disposal of debris associated with project operation, including trashrack debris, for written approval by the Department. The plan shall include the method used for flashboard construction, including materials used and means of sealing to prevent leakage. The plan shall be designed to prevent or minimize the discharge of debris or trash downstream.

L. Any proposals for project maintenance or repair work involving the river, including desilting of the dam impoundment, impoundment

drawdowns to facilitate repair/maintenance work, and tailrace dredging, shall be filed with the Department for prior review and approval.

M. The applicant shall allow the Department to inspect the project area at any time to monitor compliance with the conditions of this certification.

N. A copy of this certification shall be prominently posted within the facility.

O. Any change 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.

P. The Department may request, at any time, that FERC reopen the license to consider modifications to the license necessary to assure compliance with Vermont Water Quality Standards.

Barbara Ripley

Barbara Ripley
Secretary
Agency of Natural Resources

Dated at Waterbury, Vermont this 16th day of June, 1994.

cc: distribution list

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