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

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

APPLICATION FOR PIERCE MILLS
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 FERC for relicensure of the Pierce Mills Hydroelectric Project located at river mile 15.2 on the Passumpsic River in the Town of St. Johnsbury, two miles upstream of the village of St. Johnsbury Center.

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 below the Pierce Mills Project. The applicant operates five projects in succession on the mainstem of the Passumpsic River. Pierce Mills is the most upstream facility of the five. Downriver of the project are the Arnold Falls, Gage, Passumpsic, and East Barnet projects. 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 wildland 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. Prior to the November 3-4, 1927 flood, a hydroelectric plant, which had a 150 KV turbine/generator unit, was operated by Twin State Gas and Electric Company at the project site. After the 1927 flood, the present hydroelectric plant was constructed.

II. Project and Civil Works

7. The existing dam is a concrete gravity structure founded on rock. The rock face of the river channel serves as the right abutment. The intake structure forms the left abutment and is approximately 37 feet long. The spillway section which makes up the dam has a total length of 93 feet. The crest elevation is 603.5 feet. The dam is fitted with 1.5 feet of flashboards. The normal headwater elevation is 605.0 feet (msl), and the normal tailwater elevation is 586.7 feet (msl), providing a gross head of 18 feet.

8. The dam creates an impoundment with a surface area of 24.7 acres; a usable storage of 1,075,000 cubic feet; and a backwater influence of 8,500 feet.

9. Flashboards are always removed by winter ice and normally reinstalled in mid-May. Summer storm events cause flashboard failure, at most, once during the summer. Flashboards fail when surcharged by 1.5 to 2.0 feet of water. Reinstallation is normally scheduled for mid-May.

10. The maximum height of the dam above the foundation is approximately 18 feet. A trash rack with intermediate support beams is located between concrete training walls extending directly upstream from the penstock entrance. A manually operated, 10-foot wide by 10-foot high, bulkhead gate used to close off and dewater the penstock is located directly upstream from the penstock entrance. The penstock connecting the intake structure with the powerhouse is approximately 246 feet long and is supported by concrete cradles founded on rock. The steel constructed penstock is six feet in diameter.

11. The powerhouse contains a single S. Morgan Smith vertical Francis turbine with a 250 kw generating capacity. The average annual generation for the twenty year period through 1990 was 1,610,000 kwh. (applicant's response to FERC AIR No. 9) Except for routine monitoring, inspection and maintenance, the plant operates semi-automatically and unattended. The turbine's wicket gates and runner blades can be adjusted through use of a headwater float or by remote control from the applicant's dispatch center in Rutland.

12. A powerhouse substation is located south and approximately 35 feet upstream from the powerhouse. A 12.5 kv transmission line carries output from the facility to the Bay Street Substation in St. Johnsbury.

III. River Hydrology and Streamflow Regulation

13. The drainage area of the river at the dam is 237 square miles. Gaging stations have been operated by the U.S. Geological Survey on the mainstem below Passumpsic Dam since October 1928; on

the East Branch near East Haven from water years 1940 to 1979; and on the Moose River at St. Johnsbury from water years 1929 to 1984. The drainage area at these gages are 436 square miles, 53.8 square miles, and 128 square miles, respectively. Several of the flow parameters for the project have been estimated by Department staff based on gage data and are shown in the following table. All three gages were used in estimating these parameters. Some of the parameters may be influenced by the artificial flow regulation caused by upstream hydroelectric facilities.

Table 1. Hydrologic Parameters at Project.

Parameter	Value
Mean runoff	460 cfs (26.20 in/yr)
7Q10	61 cfs
95% Exceedance	86 cfs
50% Exceedance	240 cfs
10% Exceedance	895 cfs

14. The hydraulic capacity of the single turbine is 90 to 200 cfs.

15. Present operation of the project is as a daily peaking plant with a headpond drawdown from storage of 1.5 feet. Currently, when water is being placed in storage, 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.

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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.

18. The applicant proposes to maintain a bypass flow of 13 cfs. (Response to AIR No. 3 and pers. com. with John Mullen, February 9, 1994) To provide this flow, the applicant intends to adjust the project headwater sensors so that about 1.0 inch of water will spill at all times over the flashboards. The targeted minimum headwater elevation would be 605.08 feet. (AIR No. 9) 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 automation (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 level of 2.0 inches above the top of the flashboards, providing a spillage range of 1.0 inch to 3.0 inches. This would result in a variable bypass flow of about 7.5 cfs to 38 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 100 cfs, downstream during the refill period of about four hours. In cases when the inflows are substantially less than 200 cfs, the refill time would become more extended.

21. A release of 100 cfs (0.42 csm) is less than the summer aquatic base flow of 0.5 csm and the spring aquatic base flow of 4.0 csm prescribed by the U.S. Fish and Wildlife Service Flow Recommendation Policy for the New England Area (USF&WS Flow Policy) and the Agency of Natural Resources Interim Procedure for Determining Acceptable Minimum Stream Flows, July 1993 (Agency Flow Procedure). Brook, brown and rainbow trout may spawn in the mainstem of the Passumpsic River below the project. The USF&WS Flow Policy and the Agency Flow Procedure prescribe 1.0 csm for the fall/winter period and 4.0 csm for the spring period to protect spawning and incubation.

22. The applicant has not proposed a method for maintaining bypass flows during flashboard replacement.

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

IV. Bypass

24. The river reach bypassed by the project is approximately 350 feet long. The bypass width varies but is at least 100 feet wide. The bypass contains a pool at the base of the dam connected to a larger pool above the tailrace by a steep-gradient riffle. When flows are sufficient, water that cascades through the riffle becomes highly entrained with air bubbles and then discharges into the lower pool with sufficient energy to provide strong currents. The project tailrace discharges into the lower pool near the pool's outlet. Given the orientation of the tailrace discharge, the existence of a depositional berm located on the upstream side of the tailrace, and the large size of the pool, very little in the way of circulation currents is created by the tailrace discharge.

25. Except for standing water in the pools, the bypass is virtually dewatered for much of the year by the present operating mode of the project, receiving only leakage from the dam and local drainage except during periods when flows spill at the dam. No dam leakage estimates have been made available.

26. The predominant substrate throughout the bypass is ledge, but the deep run section does have areas of sand and gravel substrates. The shallow run section has ledge, rock, boulder and cobble substrate. The riffle section has a moderate gradient and is characterized by small, shallow pocket pools in ledge substrate with scattered rock, boulder and cobble.

V. Standards Designation

27. The Passumpsic River in the project-affected reach is designated by the Water Resources Board as Class B waters. Above the project is the Lyndonville wastewater treatment facility discharge; the waste management zone for the municipal discharge extends from the upstream limits of the village of Lyndonville to the Great Falls Dam, which is located two miles upstream of Pierce Mills.

Below the project, EHV Weidman Industries is permitted for an industrial discharge with an average daily flow of 0.200 mgd.

The 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. The Agency plans to reset waste management zones for streams at the time discharge permits for treatment facilities located on those streams come up for renewal. The existing discharge permit for the Lyndonville facility is up for renewal in 1997.

28. 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.

29. 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)

30. The dissolved oxygen standards for cold water 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 3-01 (B)(5))

31. 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))

32. Section 2-02 Hydrology of the Vermont Water Quality Standards requires that "[the] 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

33. The Town of St. Johnsbury wastewater treatment facility, with a design capacity of 1.6 mgd has the largest discharge on the river. The discharge is about five miles below the project. The wastewater plant is at about 68% of its capacity, based on 1993 records.

34. The application includes a supplemental report for a 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, only two samples were less than 90% saturation; substantial algal influence was apparent, however, as two-thirds of the samples collected at Pierce Mills were supersaturated.

35. Aquatec's analysis of reaeration coefficients demonstrated a significant aeration efficiency for spillage at the Pierce Mills Dam. Spillage at Pierce Mills removed 75% of the dissolved oxygen deficit from saturation. (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

36. 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.

37. 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

38. A free-flowing reach of about two miles exists between the project tailrace and the Arnold Falls impoundment.

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

40. Artificial flow regulation below the tailrace is only anticipated to occur during impoundment refilling following flashboard reinstallation. The applicant proposes to release 100 cfs (0.42 csm) during the refill period.

Bypass

41. 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 juvenile Atlantic salmon, all life stages of resident salmonids (brown and rainbow trout) and a variety of non-game fishes.

42. Adequate flows through the two pools in the bypass would create quality habitat for adult brown and rainbow trout. Bypass flows

are necessary to provide pool currents for both pools. The lower pool provides habitat with deep, well-aerated water, thereby offering fish a refuge from summer water temperature extremes. This may be the only such refugia available to trout between the Arnold Falls and Pierce Mills dams.

43. The riffle reach is valuable as habitat for resident trout species and as nursery habitat for Atlantic salmon. This riffle contains a good variety of cobbles and boulders of varying sizes and appears to be of high quality for salmon rearing. In addition to these habitat roles and the aeration of water entering the lower pool, this riffle can provide habitat for invertebrate production. Since fish are anticipated to utilize the pools as temperature refugia, invertebrate production in the riffle reach may be important as a food source for fish utilizing the bypass.

44. 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 study approach is patterned after the U.S. Fish and Wildlife Service Instream Flow Incremental Methodology, which quantifies physical habitat based on organism preference for certain conditions of stream depth, velocity, substrate, and cover.

45. The bypass, as described in this study, includes three separate habitat types in addition to pools: an approximately 100 foot long and 40 to 80 foot wide section of deep run (represented by study transect 1); an approximately 40 foot long and 45 foot wide section of shallow run (represented by study transect 2); and an approximately 100 foot long and 75 to 140 foot wide section of wide shallow riffle extending to the project tailrace (represented by study transects 3 and 4).

46. The original scope of the AIR No. 3 study was to conduct assessments of habitat for the Atlantic salmon juvenile and rainbow trout adult life stages at target flows of 8 cfs, 35 cfs, 63 cfs, 99 cfs, and 135 cfs.

47. The study transects were selected in September 1992 and initial data collection done in October 1992. By letter dated March 24,

1993, the Agency requested that flows be measured in the bypass using wading measurements where physically possible. Estimation of flow using the weir formula for dam spillage is imprecise and fails to account for leakage, which can be highly significant at dams.

48. The applicant indicated that it would be difficult to measure flows as requested by the Agency due to transect placement; irregular characteristics of the bypass; and the nature of the substrate with its outcrops and boulders. However, the applicant calibrated the weir equation using three flow measurements (71 cfs, 116 cfs, and 140 cfs) and then adjusted its estimates of study flows. The revised estimates are 13, 49, 88, 135, and 171 cfs.

49. Weighted usable area (WUA) was used as the measurement unit to describe the habitat/flow relationships for juvenile salmon and adult rainbow trout. WUA is expressed in units of square feet. The results are shown in the following table, with WUA combined for the three habitat types.

Table 2. Results of habitat study in bypass.

Flow (cfs)	Wetted Area (s.f.)	Habitat (s.f.)	
		Juvenile Salmon	Adult Rainbow Tr.
13	12,720	6,260	4,420
49	16,620	10,950	9,360
88	18,210	13,440	11,920
135	18,760	13,880	12,070
171	19,200	14,260	12,880

50. As shown in the above table, the habitat availability for both target organisms increases substantially when bypass flows are increased from 13 cfs to 88 cfs. In large part, this change is due to enhanced quality of the habitat; while the area of streambed wetted increases by 43%, the total habitat increases by 115% for juvenile salmon and 170% adult rainbow trout.

51. The applicant argues that, although bypass habitat can be substantially enhanced by increased minimum flows, the potential production or support of fish is not warranted by the cost in lost energy production. The applicant estimates that the salmon smolt production capability of the bypass would provide virtually no sea returns to the Connecticut River and that the production capacity for rainbow trout adults are only 13 fish for 49 cfs and 17 fish for 88 cfs. The applicant also states that competition between the trout and salmon would further limit the value of the bypass. Sea returns are low primarily due to the assumed marine mortality of 99.5%.

Impoundment

52. Fisheries habitat 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.

53. 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 major drawdowns occur.

Fish passage

54. A Strategic Plan for the Restoration of Atlantic Salmon to the Connecticut River Basin (1982) identified the Passumpsic River as potential non-natal smolt production habitat for stocking consideration at such time as the program's hatchery fry production capacity expanded 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. However, 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 about 41% of the habitat above Pierce Mills.

55. 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 a tributary of the Passumpsic River downstream of Pierce Mills and was selected for

salmon stocking because it has excellent physical habitat conditions and because its warmer-than-average temperature regime is 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.

56. Impingement of trout and salmon may not occur at Pierce Mills; however, the 1 3/4" bar spacing allows fish to pass through the rack and into the turbine. Prevention of entrainment is one of the principal objectives of downstream passage arrangements.

57. 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-46). The restoration plan was last revised in September 1982 and is once again under revision.

58. 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.

59. Upstream passage facilities are not needed as part of the current restoration plan, as the Passumpsic River is not 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 (U.S. Fish and Wildlife Service) reviews. Expansion of and/or changes in the plans for the river may necessitate upstream passage facilities in the future. (U.S. Department of Interior letter to FERC, December 23, 1993)

VIII. Water Quality - Wildlife and Wetlands

60. 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.

61. 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.

62. A 0.7 acre remnant floodplain forest is on the outside of curve of the river on the left (east) bank upstream of the dam. Massive erosion and slumping of an embankment along a nearby town highway has filled in much of this depression and has compromised the floodplain characteristics of the site. The applicant does not anticipate that the proposed project will affect this remaining community. This area was likely inundated during high water events and spring flows, but with the erosional filling, the potential for flooding of the forest area has diminished. (AIR No. 5)

63. 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

64. A 1,000 square foot calcareous river-bank seep is located on the right (north) bank of the river below the dam and opposite the powerhouse. This seep location is outside the normal operation area of the project. Two minor component species, spikemoss (Selaginella apoda) and shining ladys tresses (Spiranthes lucida) occur here. The spikemoss is otherwise unknown from Caledonia County, and the ladys tresses is on the Vermont Heritage Program's watch list. As a natural community type, river-bank seeps such as the one found at the project are rare. With large, well developed seep communities, plant communities found within are generally unique compared to typical river-bank flora. A number of rare or uncommon species can be found at these sites. (Pers. comm. Chris Fichtel, Vermont Natural Heritage Program)

65. The applicant states that since the Pierce Mills project has historically operated in a mode that closely emulated run-of-river operation, the proposed true run-of-river operating mode will not affect this community; and that the site is protected from major river fluctuations for most of the year by the hydroelectric operation. (Response to AIR No. 5)

66. No endangered or threatened plants or animals are known to inhabit the project reach.

X. Water Quality - Shoreline Erosion and Impoundment Desilting

67. Shoreline erosion occurs along the margin of the impoundment at least in part as the result of elevated water levels in the impoundment. (Appendix F, FERC license application) The river banks within the impoundment area generally are stable with the exception of a scar possibly caused by a river meander 0.7 mile north of the Pierce Mills Station. Immediately below the dam on the left (south) bank, an eroded cutbank exists along the river shoreline. The applicant's archeological consultant considers this erosion to be moderate and judges it to be a natural phenomenon, unrelated to project operation. Use of this location as a canoe landing/recreational facility does not appear to be contributing to this erosion according to the consultant. The applicant's proposed operating mode will minimize the potential for new problems to develop in the future.

68. Impoundment desilting can result in significant degradation of water quality if not executed properly. The applicant states that desilting of the project's impoundment has never been required. Development of a desilting plan is, therefore, unnecessary at this time. Should the need to desilt arise in the future, the applicant should seek review by and approval from the Agency. This has been proposed by the applicant.

XI. Recreation and Aesthetics

69. 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)

70. Observations by operating personnel indicate the site is used for fishing, primarily below the dam. Occasional picnickers and canoeists are seen during the summer.

71. 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 are attained.

72. 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.

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

74. 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. Referencing the Appalachian Mountain Club River Guide - New Hampshire/Vermont, 2cd ed., 1989, the Passumpsic River has suffered in the past from industrial pollution and consequent bad press in earlier canoeing guides. It does have an excessive number of dams, but it is an attractive river in a rural area. The dams are easier to deal with at low water.

75. A canoe portage has been constructed at the project site. The take out is located on the left (south) bank upstream of the dam, and the portage uses a drive extension and a newly created path through the woods south of the substation to access the river below the dam.

76. Referencing the applicant's March 1991 Site Assessment concept proposal (Appendix G, license application), a proposed reconfiguration of the access drive and parking area will allow for screening of the substation while accommodating visitors as well as plantings to screen the substation. Proposed plantings will

screen the substation and the penstock to modify the view. In addition to the use of existing on-site plants, plantings will include privet, lilac, and forsythia. A play and picnic area is proposed near the substation for visitors and canoeists. Screened to mitigate impacts from the facility, this site allows for viewing the bypass and access to surrounding wooded areas. A proposed stile will allow access over the penstock to the river's edge.

77. Bank fishing areas will be provided near the portage take-out. Disabled visitors to the project will be enabled access to picnic and parking areas. Grades along walkways will not be in excess of 8% slope.

78. Recent vehicular vandalism (summer 1991) has resulted in the closing of a gate at the head of the project's entrance road. The applicant states that when recreational facilities are developed, the gate will either be moved towards the facilities with parking provided outside the gate, or the gate will be tended by an operator and closed every evening.

79. The adjacent lands and remote location of the project lends itself to an overnight camping area for canoeists. It most likely would be for camping near a put-in and not for an enroute camping site due to the close proximity of the other dams upstream. The applicant does not propose to provide overnight camping at this time, citing limited land ownership and a lack of personnel to administer such a facility.

80. The applicant proposes to develop and maintain its proposed recreational facilities. However, the applicant states that it will remove improved recreational facilities and may restrict open access if vandalism becomes a problem. Arbitrary removal of improved facilities and restriction of public access to the river would impair recreational use and enjoyment of the resource.

81. The project boundary is very limited, encompassing the project civil works, tailrace, dam, and the impoundment flowage.

82. The Pierce Mills project is located in a wooded area secluded from highway noise and development. The site is not readily visible from any public location off the property. The project is in a natural setting interrupted only by the hydroelectric facility. The

dam and powerhouse fit with the character of the area, and the site has been well maintained making it attractive to the visitor. The substation needs landscaping to soften its visual impact, but with care taken not to reduce or eliminate available views of the powerhouse.

83. Spillage over the dam is a key element in the project's aesthetics. Falling water has a strong visual appeal, and without sufficient spillage over the dam the site lacks context and its attractiveness suffers. 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

84. 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)

85. 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." Disturbance of an endangered plant is considered a taking. (Title 10, Section 4001)

86. The applicant states that since the Pierce Mills project has historically operated in a mode that closely emulated run-of-river operation, the proposed true run-of-river operating mode will not affect the calcareous river-bank seep community identified in Finding 64; and that for most of the year the site is protected from major river fluctuations by the hydroelectric operation. (AIR No. 5)

87. No endangered or threatened plants or animals are known to inhabit the project reach.

Agency Regulatory Powers over Fish and Wildlife

88. 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."

89. 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

90. The Department's 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.

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

Passumpsic River Watershed Comprehensive River Plan

91. 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

92. 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.

93. 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.

94. Enhancement of access, and improved flow management would be compatible with this policy and balance competing uses of the river for recreation and hydropower. Nonassurance of access would exacerbate a critical state recreational problem.

95. 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."

96. 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.

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

Vermont Comprehensive Energy Plan

98. 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.

99. Prescription of an appropriate minimum flow for the bypass is important to project economics. The applicant's response to AIR No. 11 (September 1993) provides the energy output losses for a range of minimum bypass flows from 8 to 135 cfs. A continuous special release of 13 cfs would reduce project output by about 70 mwh, or 4% of the average annual energy output, for the 30-year term of the federal license; a special release of 88 cfs year round, would result in about a 460 mwh, or 29%, reduction in output.

100. 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)

101. 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

102. The conversion of Pierce Mills 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 by 1.5 feet, but should not significantly impair the upstream aquatic biota in this riverine impoundment. Major drawdowns for construction or repair would have to be reviewed case specifically to insure protection of the upstream resource.

Bypassed reach

103. 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.

104. The applicant proposes to maintain a 13 cfs bypass release, which is only 21% of the 7Q10 drought flow condition (61 cfs, or 0.26 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 90 cfs, which with the applicant's proposed operating mode would require about 0.41 csm in order to operate.

105. 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.

106. 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 bypass flow of 13 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.

107. A spillage flow in the bypass reach of 88 cfs, or instantaneous inflow, if less, would be sufficient to provide valuable habitat for juvenile Atlantic salmon, all life stages of resident salmonids (brown and rainbow trout) and for a variety of non-games fishes and provide habitat for macroinvertebrates.

108. Based on the video assessment completed by the applicant, the proposed spillage of 17 cfs (one inch) 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

109. 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.

110. 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

111. During special events when water must be placed in storage, the applicant proposes to release 100 cfs (0.42 csm) 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 Pierce Mills Project,

these aquatic base flows are 948 cfs (4.0 csm), 237 cfs (1.0 csm), and 118 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.

112. 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 fall, winter and spring periods, the aquatic base flows are higher than project capacity; flashboard replacement will only be possible during lower inflows. The 90% requirement would apply during these periods. For the summer period, the 90% requirement would apply to inflow conditions less than the 118 cfs standard.

Fish Passage

113. Operational passage facilities will be needed for outmigration in 1995 at Pierce Mills. 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.

114. 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.

115. 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)

116. Any passage facilities at Pierce Mills Dam must be provided and operated consistent with the most current restoration plan.

Recreation

117. The existing portage and 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.

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 88 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. Within 90 days of the issuance of this certification, the applicant shall furnish 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 flashboards in place, including conditions when the impoundment is 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 118 cfs from June 1 to September 30. During the periods October 1 to March 31 and April 1 to May 31 or under circumstances during the summer period when the natural inflow to the project is insufficient to permit both passage of 118 cfs 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 certification, a plan for monitoring 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 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 flow monitoring at this project provided the applicant satisfactorily demonstrates that the required flow 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 beginning with the spring 1995 passage period. 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 certification.

I. 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.

J. 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.

K. The applicant shall maintain the portage in good, useable condition.

L. The applicant shall allow continued public access to the river for utilization of the 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.

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

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.

/s/
Barbara Ripley
Secretary
Agency of Natural Resources

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

cc: distribution list