FINAL ENVIRONMENTAL ASSESSMENT

APPLICATION TO INSTALL DOWNSTREAM FISH PASSAGE FACILITIES AT THE COMTU FALLS PROJECT

COMTU FALLS PROJECT

FERC Project No. 7888
Vermont

(Issued June 1, 1995)

Federal Energy Regulatory Commission
Office of Hydropower Licensing
Division of Project Compliance and Administration

TABLE OF CONTENTS

LIST OF FIGURES

FINAL ENVIRONMENTAL ASSESSMENT

FEDERAL ENERGY REGULATORY COMMISSION
OFFICE OF HYDROPOWER LICENSING
DIVISION OF PROJECT COMPLIANCE AND ADMINISTRATION

Project Name: Comtu Falls Project

FERC No. 7888

A. APPLICATION

1. Application type: Proposed downstream fish passage plan
2. Date filed: October 24, 1994
3. Applicant: Comtu Falls Corporation
4. Water body: Black River
5. County and state: Windsor County, Vermont

B. PURPOSE AND NEED FOR ACTION

The licensee was required by Commission order issued September 22, 1994, to file a plan and schedule, for Commission approval, for installation of a downstream fish passage facility at the Comtu Falls Project. A downstream fish passage facility was deemed necessary to provide for downstream passage of emigrating salmon smolts stocked as fry upstream of the project.

The September 22, 1994, Commission order resulted from a November 5, 1993 letter from the U.S. Fish and Wildlife Service (FWS) that notified the Commission of the fry planting and requested assistance in the implementation of downstream fish passage measures at the project by Spring 1995.

The Commission initiated this proceeding pursuant to its authority to require the licensee to provide a fish passage plan under standard article 11 of the project license. Article 11 states that the licensee shall, for the conservation and development of fish resources, construct, maintain and operate, and comply with such reasonable modifications of project structures and operation as may be ordered by the Commission upon its own motion or upon the recommendation of the Secretary of the Interior, after notice and opportunity for hearing.

On January 20, 1995, a draft environmental assessment (EA) was issued, with comments requested. The draft EA has been modified as appropriate based on comments received.

On March 29, 1995, the Commission issued an order requiring the licensee to implement interim downstream fish passage measures by April 1, 1995, or as soon as practical thereafter. Interim facilities were installed on April 12, 1995.

C. PROPOSED PROJECT AND ALTERNATIVES

1. Description of the proposed action.

The Comtu Falls Project includes a powerhouse with a single vertical Kaplan turbine and a generator rated at 460 kilowatts, an intake with trashrack having 1.5-inch clear bar spacing and set at a 45 degree angle to the intake, and a dam approximately 128 feet long with 2-foot-high flashboards, situated on the top of a natural falls. The dam tapers from 5.5 feet high at its western end to nothing with irregular bedrock comprising the last 17 or 18 feet as it extends across the river from the intake to the east shore.

As part of incorporating changes at the project to provide downstream fish passage, the licensee proposes to replace about 33 feet of the 2-foot-high flashboards adjacent to the proposed discharge weir with a 2-foot-high fixed concrete crest. Downstream fish passage would occur through an opening created by a 2.5 foot wide by 2.0 foot high discharge weir in the concrete cap at the west abutment of the dam and trashrack. This size opening would produce a 20-cubic-foot-per-second (cfs) flow to attract/convey emigrating salmon smolts past the project (Figure 1.). To ensure safe transit for the smolts over the bedrock falls on which the dam is sits, the flow would discharge into a 3-foot-deep plunge pool to be constructed below the bypass discharge. No changes to the trashrack are proposed.

The licensee also proposes to cap 18 feet of the east edge of the dam the height of the flashboards to cover the exposed bedrock. The remaining 74 feet of the dam would retain the 2 foot-high flashboards. The licensee avers that, with flashboards on a straight smooth surface, repair time would be reduced to about one hour, aiding in operation of the fish passage facility. The licensee further states that the additional concrete capping would allow for the future installation of a pneumatically operated rubber dam to replace the remaining flashboards.

The downstream fish passage facility would be operated annually from April 1 through June 15, to encompass the period when smolt emigration occurs.

Figure at page 3 in hard copy

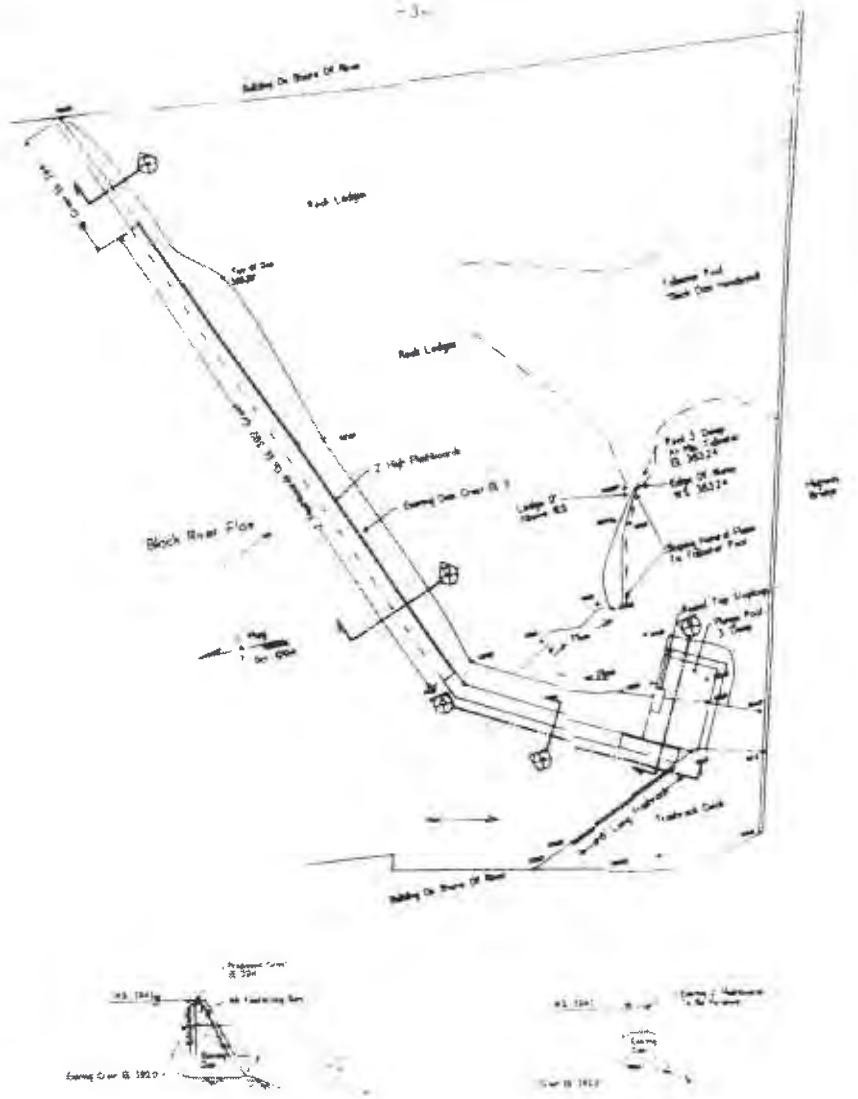

Figure 1. Licensee's proposed downstream fish passage facility (Source: Licensee as modified by staff).

Estimated cost of the facility ranges from $75,000 to $100,000.

2. Alternatives to the proposed action include the no-action alternative and two possible alternative passage schemes.

No-action alternative: The no action alternative would require no physical changes to the project. Emigrating salmon smolts would either traverse the project dam via spill, if sufficient flow exists, any available openings from collapsed flashboard sections, or would be subject to entrainment and the attendant mortality.

Alternative facility designs: The staff proposes a design to include an 18- to 24-inch-diameter PVC pipe that would be fitted into the flashboard section nearest the trashrack or into a collection box constructed in the same location and secured to the bedrock to convey emigrating salmon smolts to the tailwater pool. With this design, the smolts would pass downstream through the pipe in lieu of passing through the weir opening and into a plunge pool as proposed by the licensee. The facility would be designed to operate with a flow of at least 20 cfs. No changes or additions to the trashrack or remaining flashboard sections would be required.

Estimated cost of this alternative would be less than $10,000.

A second alternative design, requested to be considered by the U.S. Fish and Wildlife Service (FWS), would consist of a notch approximately 18 inches to 2 feet deep by 3 feet wide, with removable stoplogs that would allow for bypass depth adjustments as headpond levels change. While the FWS provided no drawings of their design, we assume that it would also require the construction of a plunge pool constructed on the bedrock falls below the bypass discharge.

The estimated cost of this alternative would be less than the licensee's proposed plan as the concrete cap would not be required, but would be replaced by the notch at an assumed cost of $4,000.

D. CONSULTATION/COMMENTS

By letter dated October 24, 1994, the licensee stated that it met at the project site with personnel from the FWS and the Vermont Department of Fish and Wildlife (VDFW) to review its conceptual plans for the passage facility. The licensee reported that the plan was well received by the agencies and that the FWS stated that the present intake design with angled trashrack was ideal for passing smolts through a weir. The licensee further

reported that the FWS stated that similar designs with trashracks with 2-inch bar spacing operated efficiently, although it is FWS' policy to recommend that spacing on the racks be reduced to 1 inch.

The following entities provided comments on the draft EA issued on January 20, 1995:

Agency	Letter Date
U.S. Fish and Wildlife Service	2/14/95
Vermont Agency of Natural Resources	2/15/95
State Historic Preservation Officer	3/21/95

The licensee commented on the draft EA and responded to agency comments in letters dated 2/21/95, 4/17/95, and 5/26/95

E. AFFECTED ENVIRONMENT

The Comtu Falls Project is located at a natural falls at river mile 4.3 on the Black River, a tributary to the Connecticut River, in Springfield, Vermont. The Comtu Falls Dam traverses the river in a v-shape and is located a short distance upstream of a highway bridge.

The project has a single vertical Kaplan turbine and an installed capacity of 460 kilowatts (Kw). Average generation is estimated at 2,367,700 kilowatt hours (Kwh) annually. The project operates at flows between 40 and 202 cfs.

Hydroelectric projects upstream from Comtu Falls and below the U.S. Army Corps of Engineers' (Corps) North Springfield Dam include Gilman Dam (FERC No. 9650) and Fellows (FERC No. 9648). Projects located downstream from Comtu Falls include Slack Dam (FERC No. 8014) and Lovejoy (FERC No. 9648). The Cavendish Project (FERC No. 2489) is located upstream of the Corps' North Springfield Dam.

Springfield, Vermont, is a small industrial town, with the Black River bordered by commercial buildings that house a bowling alley, light industry, as well as office space. Land use in the project vicinity primarily includes urban development of the town. Recreational use is described as limited fishing. The economy of the area is influenced by light industry and small retail businesses.

The project is located within the Springfield Downtown Historic District. The Comtu Falls dam is historically significant because its age and setting and is a contributing

element to the District.14/ The Historic District is listed on the National Register of Historic Places because of the significance to the town in the industrial development of the region. There are no known prehistoric sites in the area.

Significant visual features of the area include the Historic District and water falling over a series of small dams as it flows through downtown Springfield.

The Black River is classified as a class B coldwater habitat stream and supports an assemblage of warm and coldwater fish species such as stocked and wild populations of brown and brook trout, stocked rainbow trout, smallmouth bass, rock bass, suckers and various minnow species.

Since 1967, there has been a cooperative federal-state undertaking to restore Atlantic salmon to the Connecticut River and selected tributaries. As part of that endeavor, the Black River has been targeted as a tributary of the Connecticut River with suitable nursery habitat, which could be used to produce non-natal salmon smolts through a fry-release program. By letter dated November 5, 1993, the FWS reported that in 1993, 23,124 Atlantic salmon fry were stocked in a 4.6-mile reach of the Black River between Ludlow and Cavendish, Vermont as part of this interstate and federal program to restore Atlantic salmon to the Connecticut River basin. Additionally, 67,757 age 0+ parr were stocked in the fall of 1993. Of those, 43,204 were stocked between Cavendish and the North Springfield Dam, 12,000 were stocked between the North Springfield Dam and Fellows, and 12,533 were stocked downstream of Lovejoy Dam. The FWS further reports, in a letter dated February 14, 1995, that in 1994, 209,200 salmon fry were stocked in the Black River, with greater numbers expected to be stocked in 1995.

Most juvenile salmon spend two years in fresh water before emigrating to the ocean during April through June. Thus, smolts from the 1993 fry stocking can be expected to migrate to the ocean primarily in the spring of 1995. Adult salmon from the 1993 fry stocking are expected to return after two winters in the North Atlantic Ocean.

Currently at the Comtu Falls Project, interim fish passage measures are operating until permanent facilities are approved and constructed. These facilities consist of the existing angled trashrack and a section of flashboard removed at the juncture of

14/ The significance of the Comtu Falls dam as a contributing element to the District is an issue of dispute and is further discussed in section G.

the dam and intake. The interim facility began operation on April 12, 1995.

F. ENVIRONMENTAL IMPACTS

1. Licensee's proposed facility: Construction of the licensee's proposed facility would require drawdown of the impoundment and precautions taken to ensure that no concrete is allowed to enter project waters. Construction activities would increase noise levels and air-borne particulate matter in the immediate project area. The 4-cfs minimum flow, released as a 0.5-inch sheet flow over the dam would be stopped or rerouted during the estimated 2-month construction period, creating an adverse effect on the aesthetics of the falls. These impacts would be short term and minor.

Operation of the licensee's proposed downstream fish passage facility would not effect water quality of the Black River or wildlife resources. The facility would, though, benefit the federal-state Atlantic salmon restoration effort by decreasing entrainment and attendant mortality of emigrating smolts. The facility would provide emigrating smolts a safe egress past the project's intake. Further, the addition of the concrete cap to the dam as proposed would allow for more efficient operation of the facility and flashboard maintenance.

Since the project dam is a contributing element to the Springfield Historic District, which is listed on the National Register of Historic Places, the proposed facility's effect on the listed property must be considered. The licensee's proposal to physically alter the dam, specifically by constructing a 2 foot-high by 33-feet-long concrete cap on the west end of the dam and a similar cap 18 feet long on the east end of the dam, would have an impact on the historic and aesthetic resources by introducing an intrusive element into the setting. In response to our letter requesting comments under section 106 of the National Historic Preservation Act, the State Historic Preservation Officer (SHPO) found the licensee's proposed passage plan would result in an effect, but that the effect would not be adverse, as long as certain conditions are met. These conditions include documentation of the dam prior to project implementation (primarily ten to twelve 8-inch-by-10-inch photographs of the structure and a written narration) and ensuring that rehabilitation and alterations to the property meet the Secretary of Interior's Standards.

With respect to aesthetic resources, the licensee is required, via article 401 of the project license, to maintain a 4 cfs minimum flow over the dam to protect the water quality and aesthetic climate of the site, including the falls at the base of the dam. This requirement would not change during the 2.5-month

operation period of the fish passage facility. Review of flow conditions at the project site indicates that during the downstream smolt migration period, flows would exceed the maximum required for generation, fish passage, and to provide this veil of water over the dam crest more than 95 percent of the time in April, about 80 percent of the time in May and more than 35 percent of the time in June. Flows of 24 cfs (fish passage flow plus 4 cfs aesthetic flow) are exceeded over 99 percent of the time during the smolt migration period. Thus, no impacts to the visual character of the project site is expected during operation of the fish passage facility.

The licensee's proposal also requires construction of a plunge pool on the bedrock below the bottom of the dam, to provide safe transit for fish discharged through the bypass weir to the pool below the dam and falls. While this pool would not impact directly on historic structures, it may impact on the aesthetic resources. The plunge pool would be a concrete-walled pool which would be constructed less than 4 feet from the base of the dam on the west side. The pool would be approximately 4 feet high by 8 feet wide. The pool would be filled to a 3-foot depth with the 20 cfs flow discharged through the bypass weir. The pool, due to its location, proximity to the bridge at the corner of the dam, and the configuration of the intake and powerhouse, would not be readily visible from the bridge. In addition, from a position downstream looking towards the dam, the pool would not be readily visible because of the bridge structure. The pool would also not significantly affect the waterfall below the dam, which is a major aesthetic element of the Historic District. This is because flows would be available for operation of the bypass and release over the dam for most if not all of the period when the passage facility would be operating.

2. Staff's alternative design: Staff's design would consist of a collection device integrated into the flashboards and a transport pipe. Consequently, construction of the staff's alternative would not require the extensive concrete work as that of the licensee's with the attendant precautions required. The impoundment would have to be lowered to crest level or slightly below to allow workers to construct the entrance and secure the pipe to the bedrock in the dry. Construction activities would increase noise levels, but they would be of short duration and end with completion of construction.

In regards to aesthetic concerns, as would be the case for the licensee's proposal, implementation of staff's alternative would also introduce an intrusive element to the environmental setting. The downstream passage pipe, however, would be located at the extreme end of the dam and falls and, therefore, would not significantly detract from the aesthetic and historic value of the setting if the structure was colored to blend with the

surrounding structures. The pipe would also not adversely affect the waterfall below the dam, which, as stated previously, is a major aesthetic element of the Historic District, because, during the period when the passage facility is operating, sufficient flows should be available to operate the facility and provide for project operation and a minimum flow along the dam crest.

3. FWS alternative design: The FWS alternative would consist of a bypass weir notched in the existing dam crest. Construction of the FWS alternative would also not require the concrete cap on either end of the dam, estimated to entail about 9.4 cubic yards of material. The FWS alternative would operate with or without flashboards erected. The impoundment would, however, have to be lowered to allow workers to remove the concrete to create the notch in the dam and install the tracks for the stoplogs.

Since this alternative would also physically alter the project dam, the facility's effect on the Historic District and the dam itself must be considered. Although the magnitude of the change to the dam would be less extensive than that of the licensee's proposal, it would introduce an intrusive element into the setting. However, staff expects the FWS proposal would result in a no adverse effect decision on the dam.15/ Normally, the licensee would be required to document the dam prior to project implementation and ensure that rehabilitation and alterations to the property meet the Secretary of Interior's Standards. However, the licensee disputes the finding that the dam is a contributing element. Recommendations on how to resolve this dispute are discussed in section G.

4. No-action alternative: The no-action alternative would have no effect on the current historic or visual properties associated with the project. No impacts to project flows or water quality would occur. However, this alternative would provide no protection to emigrating smolts. Mortality of fish entrained could be expected to range from 7.6 to 13 percent (EPRI, 1992).

G. ISSUES

1. Need for permanent downstream fish passage facility

With respect to the need for a fish passage facility as a mitigative measure for project impacts, the facility's purpose is

---

15/ In a conversation between the SHPO and Commission staff on March 21, 1995, the SHPO stated that the FWS' proposal would also have a no adverse effect, provided documentation is completed prior to any construction activity.

to reduce entrainment and any attendant mortality to emigrating smolts, not as a mitigation measure for the construction of the dam itself. EPRI (1992) reports that, for Kaplan turbines, the type turbine installed at Comtu Falls, entrainment mortality of juvenile fish may range from 7.6 to 13 percent, averaging 11 percent. Since emigrating smolts must pass numerous dams in the Black River and the Connecticut River, downstream fish passage facilities are needed to ensure maximum survival of smolts. Therefore installation of downstream fish passage facilities at projects along the Black River to reduce passage of fish through the turbines at hydropower projects is appropriate and warranted in order to minimize smolt mortality.

Since 1987, the Connecticut River Atlantic Salmon Commission has been pursuing increasing its egg supplies and incubation capabilities so that a sufficient supply of fry is available for stocking all the identified salmon habitat in the Connecticut River basin in its attempt to increase adult returns. The restoration effort is increasing its focus on expanding fry stocking and stream-reared smolts because stream-reared smolts are estimated to return at a rate averaging seven times higher than hatchery reared smolts stocked in the same tributary (Meyers, 1994). By increasing exploitation of available rearing habitat, such as in the Black River, increased benefits to the salmon restoration effort for the Connecticut River basin should follow. Returning adult salmon would contribute to the salmon restoration goals by providing a source of eggs and contribute to fry production of Connecticut River stock. Therefore, it is important to ensure maximum survival of emigrating smolts by providing safe passage from rearing habitat to downstream of the Comtu Falls Project as well as the other hydroelectric projects on the river. Thus, construction of downstream fish passage facilities at the Comtu Falls dam should be required to facilitate safe passage.

2. Relative effectiveness of the fish passage plans

Licensee's proposed plan:

The FWS agreed that the licensee's proposed facility would be capable of providing increased survival of migrating smolts as we stated in our draft EA, but did not fully agree that entrainment mortality would be largely eliminated as we suggested since the licensee's design does not incorporate all the components that the FWS would normally recommend for such a facility. The FWS would prefer trashracks with 1-inch bar spacing, a wider bypass weir and greater ability of the facility to function when the flashboards are down and the headpond is lower.

The licensee requested that, if the Commission requires the construction of a downstream fish passage facility at the project, its proposal be approved. The licensee again stated that FWS engineers advised that the layout of the project's intake presented an ideal situation for passing smolts, that similarly designed projects with 2-inch bar spacing operate at high efficiency, and that the existing flow parallel to the trashrack for guiding smolts is substantial even without the bypass weir in place. The licensee says that replacement of the existing trashrack with 1.5-inch bar spacing with a trashrack with 1-inch bar spacing would result in substantial head loss and the creation of a vortex behind the trashrack. Further, as flow is restricted through the penstock, power production would be reduced to 117 kw. Further, reconstructing the trashrack to 1 inch bar spacing would cost an additional $12,000 and add to maintenance costs to keep the trashrack clean of debris. For headpond maintenance, the licensee's design would allow for repair of the flashboards within as little as one hour's time; currently it takes two persons 8 hours to replace the flashboards.

The licensee's downstream fish passage facility incorporates the preferred angled trashrack and bypass weir recommended by fishery resource agencies for improved passage of salmon smolts. While the trashrack spacing is larger than that typically recommended by the FWS, we conclude that the premise of the facility design is that by having the trashrack set at an angle to the flow, fish are guided to the bypass weir rather than through the trashrack, and subsequently through the turbine. Nettles and Gloss (1987) found that penstock entrainment occurred when 86 percent of the flow passed to the turbines with a trashrack perpendicular to flow. At similar high turbine flows, they found all the sample fish bypassed the penstock when an angled trashrack was in place. The facility even with slightly different trashrack spacing should effectively encourage movement towards the bypass weir and, thus, facilitate downstream passage of emigrating smolts in the Black River.

In regards to the expansion of the weir width from 2.5 feet to 3 feet as favored by the FWS, we note that the wider weir would increase the discharge through the weir from 20 cfs to 25 cfs. Increased flow would likely provide somewhat greater efficiency of the bypass but its significance is unknown. The width of the weir should be considered during consultation with the resource agencies prior to preparation of functional design drawings.

Staff's alternative:

Staff's alternative facility would be a less extensive facility, described as a collection facility attached to an 18-

to 24-inch-diameter PVC pipe at the flashboard section nearest the trashrack to convey emigrating salmon smolts to the tailwater pool, thereby eliminating most concrete work. Existing flashboard repair procedures, which could effect the efficiency of the facility, would not be altered. In the draft EA, we concluded that this simplified facility would provide reasonable protection at significantly less cost to the licensee.

The FWS and the VDFW stated that, without design drawings, it is not fully possible to critique this alternative, but they did not actively oppose the concept of using a pipe to convey fish to the base of Comtu Falls. The agencies did note that this facility would not function when the flashboards failed and the durability of the facility given the potential for ice damage is highly questionable.

The licensee also expressed concern that winter ice buildup would likely destroy the pipe associated with this alternative. Additional costs related to reinstallation and repair would be incurred annually.

While its initial costs appear less than other alternatives considered, it is likely that the bypass entrance and sections of the conveyance pipe would require annual replacement because of ice damage. Further, as this alternative would not include modifications to the dam crest to facilitate rapid flashboard replacement, the facility may not operate for extended periods after flashboard failure. This is because the PVC pipe and the flashboard section to which it would be attached may need to be replaced because of ice damage and/or flashboard failure caused by high flows. This type facility would also be prone to clogging with debris, requiring added maintenance.

FWS alternative plan:

The FWS offered its plan as an alternative that would function with or without the flashboards in place. This alternative would obviate the need to modify the dam crest for more efficient flashboard installation for fish passage purposes. Although the FWS provided no drawings of its alternative, we presume that this alternative design would also require construction of a plunge pool similar to the licensee's plan, with similar effects. Further, because the top of the penstock is located above the elevation of the crest of the dam, the intake may need to be modified as the notch would extend below the top of the penstock, potentially affecting project operation. Construction activities would create increased noise levels and would extend over several months if modifications to the intake were found necessary.

The FWS and the VDFW request that, should we find that extended periods of operation with a low headpond would occur with the licensee's or staff's proposed plan, we should consider the FWS' plan.

The licensee commented that the FWS alternative would essentially preclude project operation. The licensee reports that the top of the penstock lies 2 inches above the level of the dam crest. Submergence only occurs when the flashboards are in place; thus, the project cannot operate without flashboards. Removal of stoplogs in the notch would reduce the pond level, rendering the plant inoperative.

The FWS alternative would operate regardless of whether flashboards were erect and would not require the dam modifications required by the licensee's proposed plan. This alternative would be less affected by ice damage both in operation and maintenance than the staff's design. A plunge pool would still be required below the notch to safely pass fish to the pool below the falls. However, with the elevation of the top of the penstock higher than the elevation of the crest of the dam, we have reservations about the utility of this design because the bottom of the notch in the dam would extend below the top of the penstock. Depending on headpond level, flow patterns could develop that would effect project operation, but more important, the efficiency of the fish passage facility. Depending on the problems encountered, modifications to the intake may be required, the extent of which would be unknown until the fish passage is constructed and operated under various flow conditions.

Comparison of alternatives:

The downstream passage designs reviewed are based on the existing angled trashrack guiding emigrating salmon smolts to a new bypass. There are, however, advantages and disadvantages associated with each alternative.

The licensee's proposed design is substantial and would withstand the rigors of ice floes, which can be severe. Further, the facility would require little maintenance outside of flashboard installation. However, the ability of the flashboards to maintain adequate headpond levels for operation of the bypass during the smolt emigration period has been questioned. The facility would be affected if the flashboards failed and the headpond was lowered. The licensee, though, would effectuate immediate installation of the flashboards after failure. Further, flashboards typically fail under very high flow conditions. Layer and O'Leary (1978) found that entrainment through turbine penstocks was related to the percentage of river flow diverted to the turbines. Under the high flow conditions

that would cause the failure of flashboards at the Comtu Falls Project, most emigrating fish would still pass downstream over the dam as opposed to through the project's turbine.

The staff's alternative would not operate under conditions when flashboards failed, would require more time to install flashboards, and has the potential to require constant maintenance from ice damage and debris clogging. During the potentially protracted periods requiring repairs for this alternative design, downstream emigrating salmon would be more susceptible to entrainment and mortality due to passage through the turbine. We conclude that this alternative is the least effective when compared to the licensee's proposal and the FWS' alternative design, for ensuring the safe downstream passage of salmon smolts. Therefore, we will not consider this alternative further.

The FWS' alternative design would be a low maintenance facility, unlike staff's alternative and would operate under all headpond levels. However, the effects of the depth of the notch in relation to the top of the penstock on project operation and intake flow patterns are largely unknown and may require future modifications to the intake.

In comparing the licensee's proposal and the FWS' alternative design, both designs are principally the same, that is they both would utilize an angled trashrack to guide emigrating smolts to a bypass. Passage efficiency with flashboards erect would be similar. Under the licensee's proposed design, fish would continue to be passed downstream even if the flashboards should fail (flow and fish would spill over the failed flashboard section and through the fish passage bypass weir). However, once flows recede to a level to allow flashboard reinstallation, a period of about 1 hour would be needed to replace the flashboards. Under the FWS' alternative design, the bypass weir would be operative regardless of the state of the flashboards. However, the FWS' alternative design could interfere with project operation, especially at lower pond levels when there is less difference between the pond's surface elevation and the top of the penstock. Thus, we would recommend that the licensee construct its proposed facility.

3. Historical and visual resources

Neither of the proposals would have a significant effect on the aesthetic climate of the site as the minimum flow of 4 cfs would continue to be passed along the top of the dam during operation of the passage facilities.

As discussed in the draft EA and the environmental impacts section, the Commission staff consulted with the SHPO.

Initially, the Commission staff concluded that the installation of the facilities would have no impact on historic resources. This determination was because the Comtu Falls Dam was a contributing element to the Springfield Historic District and was not listed or eligible for listing on the Register itself. The SHPO disagreed with this determination and stated that the proposal would have no adverse effect provided documentation of the dam be done prior to project implementation and insurance that rehabilitation and alterations to the property meet the Secretary of Interior's Standards.

In response to the SHPO's recommendation, the licensee suggests that the SHPO may not have adequately reviewed the justification for inclusion of the Comtu Falls Dam on the National Register before it recommended documentation of the dam. The licensee cites a April 21, 1986 letter from the SHPO which states the dam was included in the Springfield Historic District. The SHPO's justification was based on a report written in 1984 which states that the "dam and powerhouse were not included in the District because they were not old enough to be eligible." This report further states that the dam has "no intrinsic significance deriving from historical, industrial, or archeological values. However, it is an important element of visual landscape of the town of Springfield and lies within the National Register District." The Recommendation section of the report stated that the dam "structure should be added to the district since it contributes to the architectural and visual character of this industrial community." The Summary and Conclusion section of the 1984 report states "all of the dams, except for the Comtu Falls dam, should be included as contributing structures to the Springfield Historic District."

The licensee cites this apparent conflict between the SHPO's conclusions and the text of the report as reason enough for the SHPO to reevaluate it's recommendation for documenting the Comtu Falls dam. The licensee further objects to the expense of the documentation, estimated to be $3,200. In conversations between the SHPO and the licensee, the licensee reports that the SHPO had agreed to undertake additional reviews of the issue. Lastly, the licensee questions whether the Commission has the authority to require the licensee to undertake the necessary documentation.

In regards to the licensee's concern with respect to Commission authority to require the licensee to undertake mitigative action to protect cultural resources, staff notes that article 402 of the project's license requires such action. Specifically, article 402 requires that "prior to any future construction at the project, the licensee shall consult with the SHPO about the need for cultural resource studies or a management plan... The licensee shall make funds available in a reasonable amount for any required work."

In the event the Commission requires the construction of a fish passage facility, staff recommends the licensee undertake addition consultation with the SHPO in determining if any mitigative measures would be appropriate to minimize impacts to cultural resources

4. Water surface elevations

The project dam averages 4 feet high without flashboards and impounds 1.8 acre feet of water. The reservoir has a surface area of approximately 0.3 acres and extends less than 300 feet upstream of the dam. Due to the small storage, low height of the dam, and absence of downstream development in the hypothesized flood plain, the project is classified as low hazard. The licensee's proposed downstream fish passage facility would not increase the gross storage, result in additional downstream impacts, nor effect the hazard classification.

Operation of the project with the licensee's proposed downstream fish passage facility would, by reducing flashboard length, affect the impoundment surface elevation during high flow events. More to the point, as flashboards are designed to fail under certain high flow conditions, it could be inferred that the replacement of 51 feet of flashboards with permanent concrete capping would, under extreme conditions, increase the impoundment surface elevation. Our analysis of the stage/discharge relationship shows that the licensee's proposal would result in less than a foot increase in impoundment elevation under high flow conditions. Because the river approaching the dam is steep with a falls or cascade not far upstream and is bordered by industrial buildings, we conclude that, under this alternative with at least 74 feet of flashboards remaining, no significant adverse effects with respect to this increase would occur.

5. Economic analysis

The bulk of the costs to the project would result from construction of the fish passage facilities as well as operation costs. These costs would obviously vary depending on the selected alternative.

Construction costs would be minimal for staff's recommended alternative, estimated to be $10,000. Construction costs associated with the licensee's preferred design would range from $75,000 to $100,000. Although the FWS proposal incorporates the plunge pool facility that is also part of the licensee's proposal, no extensive concrete work would be proposed for the dam crest. As a result, construction of the FWS proposed facilities would cost less.

The costs associated with operation of the facilities would result from the loss of power generation associated with the diversion of between 20 and 25 cfs of flow through the fish passage facility. This flow represents approximately 10 percent of the plant's capacity. The reduction in power generation would occur when the flows of the river are less than the fish passage flow (20 to 25 cfs), minimum flow (4 cfs) and the hydraulic capacity of the plant (202 cfs). This would occur less than 5 percent of the time in April. For May, the fish passage flows would reduce power generation by 10 percent about 10 percent of the time. Finally, for the first two weeks in June, power production would be reduced less than 70 percent of the time. Although the estimates of the loss in power production are unavailable, the licensee states that the power losses associated with operation of the interim facility, which should be comparable to the losses associated with operation of all of the alternative designs, was 60,000 Kwh. This loss represents approximately 2.5 percent of the estimated annual generation for the project.

6. Final design drawings and monitoring

The FWS requests that, given possible alternative designs and design details, the Commission require development of final design drawings in consultation with the FWS. The FWS further notes that, depending on the final design, monitoring of the effectiveness of the facilities may be needed to determine bypass efficiency and/or safety and survival of fish that use the facility.

The fish passage facilities discussed herein are based on an angled trashrack diverting fish to a bypass. The FWS has recommended similar facilities at numerous Commission licensed or exempted projects in New England. Based on the FWS regard for this type of facility, we conclude that post operational monitoring is not warranted. However, the licensee should be required to consult on the functional design drawings with the FWS, to finalize specifics with respect to weir width.

II. CONCLUSIONS and RECOMMENDATIONS

The license was issued for the Comtu Falls Project on the premise that the project would not have an adverse impact to the Connecticut River basin interstate-federal Atlantic salmon restoration program. Provisions were included in the license instrument to ensure such. The Commission has used those provisions by initiating this proceeding to ascertain whether the licensee should provide a downstream fish passage facility at the project. Our review indicates that a facility would reduce potential entrainment mortality, thereby increasing survival of emigrating smolts stocked as fry in upstream rearing areas.