BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

HAT CREEK PROJECT

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B. C. HYDRO & POWER AUTHORITY

HAT CREEK PROJECT

ENVIRONMENTAL CONSIDERATIONS ASSOCIATED WITH THE BASE SCHEME AND ALTERNATIVE 'B' ASH DISPOSAL SYSTEMS

Integ-Ebasco
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Environmental Considerations Associated With The
Base Scheme and Alternative 'B' Ash Disposal Systems

1. INTRODUCTION

The Thermal Division of B.C. Hydro & Power Authority requested the Integ-Ebasco Joint Venture to perform a comparison of the relative environmental merits of two possible ash disposal systems presently being considered for the Hat Creek Project.[1] The systems to be evaluated include a wet sluice/ponding system for both bottom ash and fly ash, designated as the Base Scheme, and a "dry" collection, conveyance and disposal system for both bottom ash and fly ash, designated as Alternative 'B'.[2] It should be noted that Integ-Ebasco is also considering an Alternative 'A' ash disposal system which incorporates design features of the two previously mentioned schemes. This alternative is not considered in this comparison.

The purpose of this memorandum is to assist the Thermal Division in their alternative ash system evaluation. As engineering and economic data are available for these systems,[2] this comparison enumerating environmental considerations associated with both schemes augments these other evaluation parameters.

The source of the environmental information presented in this report is Ebasco Services of Canada Ltd., Environmental Consultants' (ESCLEC) Final Draft Environmental Impact Assessment Report (EIAR)[3] and various detailed environmental consultants' reports. The EIAR, prepared as a summary of the Hat Creek Project Detailed Environmental Studies under the coordination of the Generation Planning Department presents a detailed assessment of the wet sluice/ponding scheme and those impacts pertinent to this ash disposal scheme comparison are highlighted. The EIAR also presents an evaluation of two dry ash disposal schemes. These assessments are utilized in the evaluation of Alternative 'B' and are supplemented by specifics regarding new facility locations. It should be noted that the Base Scheme as presently envisioned and the wet sluice/combined ash pond system described and evaluated during the Hat Creek Project Detailed Environmental Studies are not entirely

identical. A number of design modifications have been instituted based on updated information derived from continuing engineering studies. Those changes pertaining to the ash disposal facilities, e.g. location of ash pond dam, final elevations of mine waste dump and ash pond, etc., are not considered significant for the comparative purpose of this study. The difference in area requirements created by these modifications should be less than 10 percent. Other power plant modifications are described in the text when pertinent.

This report should not be interpreted as an impact assessment of Alternative 'B', but rather a general overview of the salient differential environmental considerations between the two ash disposal systems. A full environmental assessment is only possible after multidisciplinary evaluations of Alternative 'B' preliminary engineered systems have been made.

2. BASE SCHEME: WET SLUICE ASH DISPOSAL SYSTEM

2.1 General Systems Description

Both bottom ash and fly ash would be sluiced in a 20 percent slurry to an ash disposal pond in Upper Medicine Creek. The pond would be formed behind an approximately 83 m high retaining dam and encompass approximately 4.5 km^2 (see Figure 1). Because the power plant would be operated in a "no-liquid discharge" mode of operation, ash sluicewater would be returned to the plant for reuse. Treatment of this return water would be necessary and would generate a solid waste residue consisting primarily of calcium carbonate, magnesium hydroxide and calcium sulphate.[4] This solid waste would be dewatered and subsequently disposed of in a sludge storage pond requiring a volume of approximately 1.36×10^6 m^3 and a surface area of 0.2 km^2. Reclamation of these disposal areas would not be initiated until the decommissioning phase of the power plant.

The makeup water reservoir associated with this scheme would be located

approximately 2 km from the southeast corner of the plant island. Its volumetric capacity would be 9.8×10^6 m^3 and it would encompass approximately 0.65 km^2.

The Base Scheme is described in detail in Integ-Ebasco's Project Specification[5] with its associated drawings and the Station Design Manual.[6] Area requirements for the ash disposal pond, reservoir, Medicine Creek mine waste dump and rainfall runoff facilities would total approximately 10.3 km^2.[7]

2.2 Environmental Consideration

The following environmental impacts are a summary of material presented in the EIAR and other detailed environmental consultants' reports. All impacts are discussed under appropriate disciplinary subheadings.

2.2.1 Air Quality/Meteorology

Fugitive dust emissions caused by the construction of all project facilities could create elevated suspended particulate concentrations within the project area. Effects of these emissions would be minimal, if not negligible, and can be mitigated through the use of watering systems.[3] Specific problems due to base scheme facility construction are not anticipated.

Localized fogging and possibly icing would likely be produced by the evaporation of water from the reservoir and ash pond and subsequent condensation in the air or on nearby surfaces on cold days in the fall and spring seasons. During these spring and fall fogging periods visibility on stretches of the project access road in the vicinity of these facilities could be affected. It has been assumed that most of the surface area of the ash pond and reservoir would be frozen during the winter and therefore would not be a significant fogging and/or icing source during this season.

Localized dust emissions could be experienced in areas of the ash pond

not covered by water during the dry summer months, but exposed areas would only result from an abnormal operating condition. Potential impacts from this source are therefore considered negligible.

2.2.2 Water Resources

a. Water Quality

Construction could cause an increase in the suspended sediment levels of Medicine Creek and Hat Creek. If construction related rainfall runoff is treated to comply with appropriate guidelines, water quality impacts would be acceptable.

The operation of the reservoir and ash pond would both create groundwater seepage situations. Reservoir seepage estimated at 3 to 10 m^3/d with a quality similar to that of Thompson River water will cause insignificant impacts to groundwater.[3] Ash pond seepage is, however, of poor quality containing high total dissolved solids and metal concentrations. Seepage from the ash pond estimated to be 20 m^3/d would primarily flow westward down Medicine Creek through the till layer (greater than 90 percent) and eventually discharge to Hat Creek.[3, 8] A moderate dilution potential exists for this seepage from a natural groundwater flow of approximately 175 m^3/d. In addition, Medicine Creek Valley's total groundwater flow would only comprise about 0.5 percent of Hat Creek's average annual flow. Beak Consultants Ltd. have recommended that a cutoff wall and subsurface recovery system be installed to guarantee groundwater quality integrity. At present this system has not been incorporated into the project design. With or without this system, impacts to groundwater and/or Hat Creek are expected to be minor.

Aboveground seepage, i.e. seepage through the ash retaining embankment, has been estimated to be between 20 and 100 m^3/d.[3, 8] This seepage would be collected and returned to the ash pond eliminating any surface water impacts.

b. Hydrology

From a groundwater hydrology viewpoint, seepage from both the reservoir and the ash pond are considered minor beneficial impacts in that increased groundwater recharge is considered beneficial. Impacts to surface water result from the modification and project use of the natural Medicine Creek drainage course. In the very localized area of Medicine Creek Valley, this is considered a significant modification, but when viewed in relation to Hat Creek Valley hydrology, the impact is not substantial.

c. Water Use

There are presently five irrigation water licenses on Medicine Creek totalling 2.36×10^6 m^3 per year, most of which (2.24×10^6 m^3) is for use outside of the Hat Creek drainage basin. The construction and operation of all power plant facilities would only alienate the use of 1×10^5 m^3/yr of irrigation water.[8] This small quantity is not considered significant.

d. Aquatic Hydrology

Medicine Creek supports a very minor fishery resource mainly near its confluence with Hat Creek. It does not represent an important habitat nor an allochthonous input to the Hat Creek/Bonaparte River systems.[8] Impacts to the area's fishery resource due to the disruption of Medicine Creek are therefore considered insignificant.

2.2.3 Land Resources

a. Physical Environment

Only two soil units rated as being of high sensitivity would be disturbed by the ash disposal pond. The high rating is due to the soils high reclamantion suitability. The small area affected, however, approximately 0.4 km^2, suggests that impacts are minimal.[3] Soil loss impacts associated with the reservoir are also considered minimal.[3] These minor impacts can be mitigated by storing this soil for future site reclamation.

b. Natural Vegetation

Construction of the makeup water reservoir would disturb approximately 0.6 km^2 of the Englemann Spruce-Grouseberry-Pinegrass association, while the ash pond would disturb approximately 3.3 km^2 of the Douglas-Fir-Pinegrass association, and about 3.1 km^2 of the Kentucky Bluegrass association. The Kentucky Bluegrass association would be the most affected because 10 percent of the total area covered by this association within the project locale would be disturbed. Impacts on the other association are considered minimal.[3]

c. Wildlife

Habitat losses due to base scheme facilities are not considered significant.

d. Forestry

The construction and operation of base scheme facilities would result in a loss of the forest resource. This loss when compared to the forest resources in the project locale is considered insignificant.

e. Agriculture

Approximately 314 ha of spring grazing land and 424 ha of summer rangeland would be utilized for the construction and operation of the reservoir and ash disposal area. Spring grazing resources of the entire Hat Creek basin currently support approximately 1960 animal units (AU) and would consequently be reduced by approximately 80 AU through the development of these facilities. The estimated summer rangeland current productivity of 3047 AU would be reduced by approximately 24 AU.

f. Other

Impacts on the area's cultural heritage resources, geological resources and biophysical units due to the construction and operation of base scheme facilities are not considered significant.

2.2.4 Socio-economics

a. Recreation

The location of base scheme facilities will not affect any existing recreation facilities. The operation of the ash pond would, however, restrict backroad travel activities. The significance of this impact is considered low.[3]

b. Aesthetics

The ash disposal area and water reservoir affect one "visual unit", Medicine Creek Valley and two special features, the Cornwall Lookout and Trachyte Hills. The level of visual impact assigned to the ash pond has been "extreme".[10] Mitigation measures suggested by Toby Russell Buckwell & Partners include: the development of a system to provide for the sequential reclamation of the ash pond and the development of a visually attractive water reservoir to compensate for the negative visual qualities of the ash pond.[10]

c. Other

Impacts to other socio-economic areas relate to construction and operation of the entire project and not to specific facilities within the project.

2.2.5 Noise

Power plant equipment associated with the operation of the water reservoir and ash disposal system have not been enumerated as major contributors to power plant noise levels.

2.2.6 Reclamation and Reuse

Reclamation of the ash pond would be more difficult than a comparable dry disposal system. Freestanding water must be removed and/or evaporated and the pond must be covered with a suitable topping material of sufficient depth to ensure adequate load bearing capacity. Also with a single pond system, reclamation could not be initiated until the project's decommissioning phase.

Reuse of power plant waste materials would be difficult if wet disposal is practiced. Dewatering and subsequent drying of settled ash and the collection and drying of cenospheres (if produced) would be necessary. The alumina content of Hat Creek fly ash is at a marginal level for cost effective reuse of this material for aluminum production. Aluminum ion extraction during wet sluicing would decrease this material's reuse capability.

3. ALTERNATIVE 'B': DRY ASH DISPOSAL SYSTEM

3.1 General Systems Description

Bottom ash produced in the boiler furnace will be continually cleared by a drag bar conveyor which is submerged in a cooling water trough. As the ash moves up an inclined section of the drag bar conveyor, water is drained from the ash back to the trough. The ash is then transported by belt conveyor to the Mid Medicine Creek disposal area (see Figure 2) in a dry state. Fly ash, economizer ash and air preheater ash will be collected dry in silos, wetted to prevent dusting and also transported by belt conveyor to the ash disposal area. It is presently envisioned that all ash conveyors and transfer points will be arranged in such a manner that bottom ash will normally be deposited on the belts on top of fly ash, thereby reducing dust potential. Permanent conveyors would also be covered. Most of the ash will be placed and compacted as a mixture of fly ash and bottom ash, but to ensure proper drainage in the pile, layers of bottom ash and fly ash will intersperse the pile at specified intervals. During the dry season watering will be used to prevent excessive dusting. Reclamation will proceed as soon as the final elevation of each section has been reached. This will occur following years 3, 6 and 15 of power plant operation (see Section A-A, Figure 2). Also following year 15, the Medicine Creek mine waste disposal system will begin operation and ash and mine wastes could be disposed of together.

The power plant makeup water reservoir for this alternative is located

in upper Medicine Creek. At its operating level, elevation 1230.0 m, the reservoir will encompass approximately 0.85 km^2. Medicine Creek's natural drainage will flow into the reservoir which has provision to regulate the creek's probable maximum flood. The existing Medicine Creek/MacLaren Creek diversion will be maintained.

This alternative scheme will require a total land area of approximately 5.8 km^2 for the reservoir, ash disposal area, mine waste disposal area and runoff canal facilities. This is less than 60 percent of the area requirements for the Base Scheme.[7]

3.2 Environmental Considerations

This section discusses specific impacts that would be attributed to the construction and operation of Alternative 'B' facilities. Comparisons to impacts associated with Base Scheme facilities are also presented. The discussion of system impacts has been derived from the EIAR and other detailed environmental consultants' reports. These reports have evaluated other dry ash disposal alternatives and have assessed the inherent significance of land and water areas that would be affected by Alternative 'B' facilities. A summary of the results of this environmental comparison between the two alternative ash disposal systems is presented in Table 1.

3.2.1 Air Quality/Meteorology

Construction related fugitive dust emissions would be similar to those associated with the Base Scheme. Operational phase fugitive dust could be experienced from the uncovered conveyors and ash disposal area especially during the dry summer months. Since this problem can be controlled to a large extent, its impact is not considered significant.

Localized fogging and icing would be much reduced when compared to the Base Scheme due to the substantial reduction in open water surface area. Specific impacts due to the Medicine Creek reservoir should not be

significant, but localized fogging and icing could still occur.

3.2.2 Water Resources

a. Water Quality

Construction related sediment loadings to Medicine Creek and Hat Creek would be similar to those associated with the Base Scheme. Operational groundwater seepage conditions would, however, be different. Seepage values from the upper Medicine Creek reservoir flowing under the embankment should be relatively small, less tha 20 m^3/d. This seepage would be good quality water compared to that of Medicine Creek and would therefore have a beneficial impact on groundwater quality. (Reservoir water quality has a total dissolved solids (TDS) concentration of approximately 91 mg/l while Medicine Creek exhibits a TDS concentration of approximately 222 mg/l.)[2] Groundwater seepage from the dry ash disposal area should also be minimal and less than 20 m^3/d. The area would be developed with alternating layers of free draining bottom ash and low permeability compacted fly ash (see insert, Figure 2). The high permeability bottom ash would also line the disposal area's side slopes and base permitting surface collection of most seepage. The area would also be revegetated at intervals during the operational phase reducing seepage quantities. Seepage that does enter the groundwater would be subject to a greater dilution potential than the Base Scheme due to reservoir seepage and thus impacts to groundwater quality and Hat Creek water quality should be insignificant from this source. Also contaminated seepage flowing east into the Cornwall Creek drainage basin would be eliminated.

Aboveground seepage, i.e. water flowing through ash disposal area drains and water seeping through the reservoir embankment, would be collected behind a berm and pumped to the runoff holding pond for use in dust control. Water quality impacts should not result from this operation.

The dry ash disposal alternative also obviates the need for a water treatment sludge disposal area. While the effects of seepage from this

area were not considered significant, its elimination would be beneficial.

Similar to the base scheme the power plant would be operated in a "no-liquid" discharge mode based on the present water management plan for this alternative.[2] This precludes any adverse water resource impacts due to plant process wastewaters.

b. Hydrology

Hydrological impacts associated with Alternative 'B' facilities are essentially the same as those described for the Base Scheme.

c. Water Use

The location of the reservoir in upper Medicine Creek will result in a beneficial impact on irrigation water use after project decommissioning. Unlike the Base Scheme reservoir, this alternative lies in a natural drainage area and will therefore be maintained by natural hydrological conditions. The reservoir could therefore provide a substantial source of irrigation water for future use. Also, the Medicine Creek/MacLaren Creek diversion will be maintained during the power plant operational phase thus minimizing impacts on present water licenses.

d. Aquatic Ecology

Operational impingement impacts on the fishery resource of the Thompson River would be directly proportional to the quantity of water withdrawn. Present estimates of Thompson River water use are approximately 724 l/s for the Base Scheme and 552 l/s for Alternative 'B'.[2] The Base Scheme

requirements would be considerably larger due to wet ash handling needs. The water management plan for the Base Scheme can, however, be altered so that ash handling water requirements could be partially augmented by Medicine Creek. This could reduce Thompson River withdrawals to approximately 677 m^3/d. While this modification mitigates Base Scheme impacts, Thompson River water use would remain less for Alternative 'B' and thus this scheme would be preferred.

3.2.3 Land Resources

The substantial reduction in land requirements associated with this alternative mitigates disturbances to high capability grazing land and its associated cattle population, wildlife habitat and forestry resources. While the impacts associated with the Base Scheme were not considered significant, any alternative abating these impacts would be considered preferable.

3.2.4 Socio-economics

a. Recreation

Recreational impacts associated with the Alternative 'B' are essentially the same as those described for the Base Scheme.

b. Aesthetics

The base scheme ash disposal area would have remained "open" during the entire deposition period. This fact led to a rating of "extreme" in regard to visual impacts attributed to the disposal area. Since Alternative 'B' would allow for sequential (as opposed to terminal) reclamation of areal segments, it would have less negative visual impact upon the viewsheds around it. Alternative 'B' should also better compliment the topography of the site vicinity and the water supply reservoir. These aspects should create a more acceptable site for observers than the Base Scheme.

c. Other

Impacts to other socio-economic areas would not be facility dependent.

3.2.5 Noise

Ash transportation and distribution will be accomplished by means of conveyors, mobile stackers and large rubber tired dozers. These facilities would produce a noise level increase in the Medicine Creek Valley area and would therefore affect the power plant's noise level contours (refer to Figure 4.1-28, Part Four of the EIAR).[3] These increases should not, however, significantly affect the previously predicted (see Reference 3) base scheme yearly day-night average sounds levels (YDNL) for the four important receptor areas located within the plant and mine environs. These receptor areas include Bonaparte Indian Reserves 1 and 2, the Trachyte Hills and Hat Creek Valley Ranches.

3.2.6 Reclamation and Reuse

Reclamation of the ash disposal area would proceed at specific intervals during power plant operation. This is environmentally advantageous as reclamation of disturbed land areas would reduce erosion, seepage and fugitive dust emissions.

The presently envisioned procedure of mixing dry bottom ash and fly ash would not enhance the reuse opportunities of this material over that of the Base Scheme. Bottom ash and fly ash could, however, be transported on separate conveyors and compacted in separate layers of substantial thickness suitable for future selective extraction. This latter procedure would therefore preserve the reuse potential of this material.

4. CONCLUSIONS

As shown in Table 1, the environmental impacts associated with both alternative ash disposal schemes range from moderate to insignificant Neither alternative creates a situation which would preclude project development. Based on the results of this comparative analysis, however, Alternative 'B' is preferred. Alternative 'B' offers five potential advantages in comparison with the Base Scheme:

Environmental Considerations Associated With The
Base Scheme and Alternative 'B' Ash Disposal Systems

i) Land requirements would be reduced, thereby abating impacts associated with land disruption.

ii) The reservoir would be self-sustaining and therefore capable of providing needed water for future uses.

iii) Thompson River water withdrawal quantities are reduced mitigating fishery resource impacts.

iv) The dry ash disposal system enhances reclamation opportunities and reduces seepage problems.

v) Fly ash and bottom ash could be disposed of separately suitable for future reuse.

Environmental Considerations Associated With The
Base Scheme and Alternative 'B' Ash Disposal Systems

1. Personal Communication. Letter: A. Cowley to E. Jodidio dated 7 November, 1978. Subject: Hat Creek Project Ash Disposal Alternatives.

2. Integ-Ebasco, Alternative 'B' Ash Disposal Study. November 1978.

3. Ebasco Services of Canada Ltd., Environmental Consultants. Environmental Impact Assessment Report - Final Draft. Hat Creek Project Detailed Environmental Studies. B.C. Hydro and Power Authority. Vancouver, B.C. October 1978.

4. Integ-Ebasco. Water Management Study for the Hat Creek Power Plant. February 1978.

5. Integ-Ebasco, Hat Creek Power Plant, Project Specification. British Columbia Hydro and Power Authority, Vancouver, B.C.

6. Integ-Ebasco, Station Design Manual for the Hat Creek Power Plant. British Columbia Hydro and Power Authority. Vancouver, B.C.

7. British Columbia Hydro and Power Authority. Hat Creek Project Water Supply and Ash Disposal Study, Design Memorandum on Alternative Wet and Dry Ash Disposal Schemes. Hydroelectric Design Division, Development Department. Report. No. DD122. August 1978.

8. Beak Consultants Ltd. Hydrology, Drainage, Water Quality and Use Report. Hat Creek Project Detailed Environmental Studies. British Columbia Hydro and Power Authority. Vancouver, B.C. 1978.

9. Beak Consultants Ltd. Fisheries and Benthos Report. Hat Creek Project Detailed Environmental Studies. British Columbia Hydro and Power Authority. Vancouver, B.C. 1978.

10. Toby Russell Buckwell & Partners. Aesthetic Considerations. Hat Creek Project Detailed Environmental Studies. British Columbia Hydro and Power Authority. Vancouver, B.C. 1978.

11. Acres Consulting Services Ltd. Solid Waste Disposal, Coal Storage and Land Reclamation Report. Hat Creek Project Detailed Environmental Studies. British Columbia Hydro and Power Authority. Vancouver, B.C. 1978.

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Base Scheme and Alternative 'B' Ash Disposal Systems

TABLE 1

ENVIRONMENTAL COMPARISON OF ALTERNATIVE ASH DISPOSAL SCHEMES

	Discipline	Environmental Considerations	Impact Significance Base	Impact Significance Alternative 'B'	System Preference
1.	Air Quality/Meteorology	Construction Related Fugitive Dust	Insignificant		None
		Operational Phase Fugitive Dust	Insignificant	Minor	Base Case
		Fogging and Icing	Minor	Insignificant	Alternative 'B'
2.	Water Resources				
	a. Water Quality	Construction Related Sediment Loading	Insignificant		None
		Seepage	Minor	Insignificant	Alternative 'B'
	b. Hydrology	Channel Disruption	Minor		None
	c. Water Use	Irrigation Use	Minor	Moderate (Positive)	Alternative 'B'
	d. Aquatic Ecology	Fishery Resource	Minor	Less than Minor	Alternative 'B'
3.	Land Resources				
	a. Physical Environment	Soil Alienation	Minor	Minor	Alternative 'B'
	b. Natural Vegetation	Vegetation Alienation	Minor	Minor	Alternative 'B'
	c. Wildlife	Habitat Disruption	Minor	Minor	Alternative 'B'
	d. Forestry	Loss of Forest Resource	Minor	Minor	Alternative 'B'
	e. Agriculture	Loss of Grazing	Moderate	Less than Moderate	Alternative 'B'
4.	Socio-economics				
	a. Recreation	Restricted Backroad Travel	Minor	Minor	None
	b. Aesthetics	Visual Impact	Extreme	Less than Extreme	Alternative 'B'
5.	Noise	Plant Operation Noise Contours	--	--	Base Case
6.	Reclamation Potential	--	Poor	Good	Alternative 'B'
7.	Reuse Potential	--	Poor	Possible	Alternative 'B'