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FINAL

ENVIRONMENTAL IMPACT STATEMENT

ON

CONTINUED OPERATION OF THE

HANFORD GENERATING PROJECT

9313043.0376

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ENVIRONMENTAL IMPACT STATEMENT
ON CONTINUED OPERATION OF THE
HANFORD GENERATING PROJECT

INTRODUCTION

1.0 ACTION SPONSOR AND PROPOSAL

The proposed action is being sponsored by the Washington Public Power Supply System, a joint operating agency and municipal corporation of the State of Washington.

The Proposal is to continue the provision of up to 5 billion kilowatt-hours of electrical energy per year to the Pacific Northwest through the continued operation of the Washington Public Power Supply System's Hanford Generating Project. Identifiable actions functionally related to the proposal include the delivery of energy produced by the Hanford Generating Project to the Pacific Northwest power grid; renewal of the Hanford Generating Project National Pollutant Discharge Elimination System Permit; extention of existing contracts between the Supply System and the Bonneville Power Administration for marketing of the energy; and the extension of existing contracts between the Supply System and the U. S. Energy Research and Development Administration for steam. Hanford Generating Project operation is dependent upon the continued operation of the New Production Reactor by the U. S. Energy Research and Development Administration with its associated fuel cycle.

The Hanford Generating Project is located on the Hanford Reservation in Benton County, Washington, approximately 30 miles north of the City of Richland and adjacent to the Columbia River at river mile 380.

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2.0 LEAD AGENCY

The Washington Public Power Supply System is the lead agency. The responsible official is Mr. R. A. Chitwood, Manager, Environmental Programs. Comments, information or questions on this EIS should be addressed to Mr. R. A. Chitwood, Manager, Environmental Programs, Washington Public Power Supply System, P. O. Box 968, Richland, Washington 99352, Phone (509) 946-1611.

Comments on the Draft EIS were received from the following:

Washington State
- Parks & Recreation Commission
- Highway Commission
- Department of Natural Resources
- Department of Ecology
- Office of Community Development
- Department of Game
- Seattle City Light
- Department of Fisheries

Oregon State
- Department of Energy

Federal Agencies
- U. S. Environmental Protection Agency
- U. S. Army Corps of Engineers
- U. S. Energy Research and Development Administration
- National Marine Fisheries Service

Regional Organization and Individuals
- Sierra Club
- Mr. Robert G. Walton

The comments and the Supply System's responses are given in Appendix B of this Final EIS.

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3.0 AUTHORS AND PRINCIPAL CONTRIBUTORS

The authors and principal contributors and the subject areas of their contributions to this EIS are:

Mr. James B. Vetrano	All Sections
Ms. Sharon L. Engstrom	Physical Environment
Mr. G. Scott Jeane	Ecosystems
Mr. K. R. Wise	Human Environment
Mr. William W. Waddel	All Sections
Mr. Bruce W. Bentley	Alternatives, Short and Long Term Uses

4.0 LICENSES REQUIRED BY THE PROPOSAL

The proposal requires the renewal by the Washington State Department of Ecology of the National Pollutant Discharge Elimination System Waste Discharge Permit WA 002487-2, January 2, 1975. The present permit expires on June 1, 1978.

In addition, the Supply System must renew a contract with the U. S. Energy Research and Development Administration for provision of steam to the Hanford Generating Project.

5.0 BACKGROUND DATA

Data and reports used in the preparation of this document are available in the Washington Public Power Supply System's offices, 3000 George Washington Way, Richland, Washington 99352.

6.0 COST

Copies of this EIS may be obtained from the Washington Public Power Supply System in accordance with paragraph 2.0 above for $2.50 each.

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7.0 DATE OF ISSUE

The draft EIS was issued on November 10, 1976. The final EIS was issued on January 26, 1977 and listed in the Supply System's SEPA information center.

8.0 DEADLINE FOR COMMENTS

Comments on the Draft EIS received by December 30, 1976 from governmental agencies and members of the public were incorporated into the Final EIS. Additional comments on this Final EIS should be forwarded in accordance with paragraph 2.0 above.

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ENVIRONMENTAL IMPACT STATEMENT

ON CONTINUED OPERATION OF THE

HANFORD GENERATING PROJECT

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Vancouver, Washington

Pacific Northwest Regional Commission
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Pacific Northwest Utilities Conference Committee
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Vancouver, Washington

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CHAPTER 1
SUMMARY

1.1 SUMMARY - THE PROPOSAL

The proposal is to continue the provision of up to 5 billion kilowatt hours of electrical energy per year to the Pacific Northwest by the continued operation of the Washington Public Power Supply System's Hanford Generating Project (HGP). Identifiable actions functionally related to the proposal include the delivery of energy produced by the HGP to the Pacific Northwest Power Grid, renewal of the HGP NPDES (discharge) Permit, and extension of contracts between the Supply System, the Bonneville Power Administration and the Energy Research and Development Administration. HGP operation is dependent upon the continued operation of the New Production Reactor by the Energy Research and Development Administration (ERDA). The objective of the proposal is to maintain existing electrical generating resources which can continue to provide adequate, reliable and economical electrical energy to consumers in the Pacific Northwest.

1.2 SUMMARY - ENVIRONMENTAL IMPACTS OF THE PROPOSAL

The primary interaction between the HGP and the environment occurs with the once through cooling of the steam condensers. The potential for impacts exists through impingement of drifting or weakly swimming organisms on the intake screens, the passage of juvenile fish and other organisms through the condenser and the exposure of fish and other organisms to the thermal plume after the cooling water is discharged into the Columbia River.

Studies conducted at the HGP intake have shown past interactions between the intake and fall chinook fry. Modifications to the intake have presently reduced this interaction so that estimated losses of less than 1000 fall chinook fry per year occur at the HGP intake. This represents less than 0.05% of the Chinook fry exposed to the intake.

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Passage through the condensers subjects drifting organisms such as phytoplankton, zooplankton and insect larva to both thermal and physical stress. The removal of these organisms is not considered ecologically significant because of the relatively small fraction of Columbia River water actually passed through the condensers. It is estimated that less than 1% of the drifting organisms are exposed to passage through the condensers.

Entrainment of fish in the HGP thermal discharge plume is not reasonably expected to cause either thermal shock or death to fish exposed to the plume. It is estimated that less than 3% of the out-migrant fall chinook fry will be exposed to the plume. Analysis of the time-temperature exposure experienced by these fish indicates that the levels of exposure are below those required to detect damage to fish. Minor ecological shifts in the community residing on the bottom of the river in the area effected by the plume are anticipated. Operation of HGP results in an incremental temperature increase in the Columbia River of 0.3 to 1.2^{o}F during the late summer.

Discharges from the HGP to the land and air are small in volume and pose no unusual risks. No impacts on the land or air or on terrestrial vegetation or animals are reasonably anticipated from operation of HGP.

Continued operation of ERDA's NPR will result in the production of plutonium for national defense and research purposes and radioactive fission products. Individual radiation doses of 0.16 mrem per year, or about 0.2% of natural background will be received by the hypothetical maximum individual living 5.5 miles from the NPR. Continued operation of the HGP is dependent upon the continued operation of the NPR by the ERDA. However, the continued operation of the NPR has utility independent of the HGP and may occur regardless of the decision by the Supply System on HGP.

No significant impacts on the human environment from implementation of the proposal have been identified.

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1.3 SUMMARY - ALTERNATIVES

Three alternatives to the proposed action have been identified. These are to take no action to keep the HGP operating past the spring of 1978; to continue operation of HGP with periodic review of need, for example through 1983; and to continue operation of the HGP with modifications to plant facilities and/or modifications to the operation schedules. Not all of the alternatives are reasonable when considering the relevant economic, technical, and environmental factors. These alternatives along with the principle environmental impacts are summarized in Table 1.3-1.

Under the no action alternative HGP would shut down in 1978 and the impacts associated with the operation of HGP (see Section 1.2 above) would cease to occur. NPR impacts may or may not continue to occur depending on decisions by ERDA relating to the need for continued operation of NPR for defense purposes. Three variations which may be adopted to balance regional electrical loads and resources were identified. The first variation considers the adoption of conservation measures by state and local governmental bodies which would decrease regional loads by the amount of HGP generation. The second variation is for utilities to plan the construction of generating capacity to replace the HGP. The third variation is for utilities to purchase energy from outside the region sufficient to replace HGP. Increased adverse impacts associated with these variations includes (see Table 1.3-1) an increased probability of an energy deficiency, increased generation in the Pacific Southwest using oil fired plants, and construction of generating resources to replace HGP. In each of the next 10 years a regional energy deficit greater than the energy generated by HGP is projected by the West Group Forecast (See Section 3.2.3) if critical year water flows occur. The probability of a deficit occurring in at least one of the next ten years exceeds 75% according to this forecast.

Operation of the HGP with periodic review continues HGP operational impacts until a future decision to cease operation is made.

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TABLE 1.3-1

SUMMARY OF ALTERNATIVES TO CONTINUED OPERATION OF HGP

Alternative	Environmental Impacts Related to HGP	Environmental Impacts Related to Other Actions	Regional Human Environment	Effects on Power Costs
1. No Action				
a. Conservation	HGP impacts cease	Possible increase in Pacific Southwest energy production using oil	None	Decommissioning
b. Replacement	HGP impacts cease	Possible increase in Pacific Southwest energy production using oil	Increase probability of deficit in near term	Decommissioning and purchase of power
c. Purchase	HGP impacts cease	Possible increase in Pacific Southwest energy production using oil	None, if power available	Decommissioning and purchase of power
2. Periodic Review	HGP impacts continue until shutdown then cease	None	None, until operation ceases	None until shutdown then decommissioning and purchase of power
3. Modifications				
a. HGP Intake	Reduced impingement	None	None	$4.5 million
b. HGP Discharge	Increased near field mixing	None	None	$1 million
c. HGP Off Stream Cooling	Reduced thermal discharge	None	None	$62 million
d. NPR Effluents	Reduced radioactive releases	None	None	$0.5-22 million
e. Seasonal Limits	Reduced impingement Reduced thermal discharge	Increase spill at dams Possible increase in Pacific Southwest energy production using oil	None	Energy loss if not operated
f. Annual Limits	HGP impacts would occur only during low water years	Possible increase in Pacific Southwest energy production using oil	None	$10 million/yr

Modifications could be made to the HGP intake, discharge, or to the entire cooling system. The intake could be changed to further reduce the possibility of impingement. Since present impingement is estimated to effect less than 1000 fry per year, or less than 0.05% of the chinook fry exposed to the intake, this modification is unnecessary. The discharge could be modified to produce increased near field mixing of the thermal effluent with the river. The present system is not reasonably anticipated to produce sufficient thermal dose to detrimentally affect aquatic species in the river. Modifications of the HGP cooling system could be pursued to eliminate once through cooling and utilize offstream cooling (e.g. cooling towers). This would reduce the required intake water volume by a factor of 20 and the heat load discharge to the river by a factor of 100. Because of the lack of impacts noted above for present HGP operation, the installation of offstream cooling is not considered reasonable. However, this modification may be required if once-through cooling is precluded by discharge limitations.

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The NPR effluent treatment systems could be modified by ERDA to reduce the level of radioactive effluents presently discharged. While the present discharges result in negligible doses to the population some reduction of long-lived isotopes is possible. The practicality of these reductions is discussed in detail in ERDA-1538.

Seasonal limits could be applied to the HGP to prevent it from operating in the spring when many of the downstream migrants are in the vicinity of the intake or to prevent it from operating in the late summer or early fall when river temperatures are highest. Since present impacts are small, beneficial changes in impacts which would occur with this action would also be small. Operating limits could be imposed upon the HGP such that it is operated only during a critical water year when Northwest river flows are low. Impacts on the physical environment of this region associated with HGP's operation would then exist only when energy were needed from the HGP to prevent a deficit in the region. This would eliminate HGP's present role as a base-load energy resource and benefits associated with HGP's generation in average water years would be lost.

1.4 SUMMARY - MITIGATING ACTIONS

The modifications to the HGP described under the alternative section above can be considered as mitigating measures for impacts from the HGP. No additional reasonable mitigating measures have been identified. The impacts associated with the present operation of HGP are not considered significant and additional mitigating measures would not materially change the already negligible impacts associated with operation of HGP.

1.5 SUMMARY - UNMITIGATED IMPACTS

No significant adverse environmental impacts have been identified with the operation of HGP. Unmitigated adverse impacts which do occur are the estimated loss of less than 1000 fall chinook fry each year, minor alteration of the river bottom community below the discharge, passage of less than 1% of drifting organisms through the condensers, and an incremental increase of 0.3 to 1.2^{o}F in river temperature during late summer.

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CHAPTER 2

DESCRIPTION OF THE PROPOSAL

2.1 THE PROPOSED ACTION

The proposal is to continue the provision of up to 5 billion kilowatt-hours of electrical energy per year to the Pacific Northwest through the continued operation by the Washington Public Power Supply System (the Supply System) of the Hanford Generating Project (HGP). Identifiable actions functionally related to the proposal include the delivery of energy produced by HGP to the Pacific Northwest power grid, renewal of the HGP National Pollutant Discharge Elimination System (NPDES) permit, extention of existing contracts between the Supply System and the Bonneville Power Administration (BPA) for marketing of the energy, and the extension of existing contracts between the Supply System and the U. S. Energy Research Development Administration (ERDA) for steam. HGP operation is dependent upon the continued operation of the New Production Reactor (NPR) by ERDA with its associated fuel cycle. The objective of the proposal is to maintain existing electrical generating resources which can continue to provide adequate, reliable and economical energy to consumers in the Pacific Northwest.

The provision of energy from HGP to load centers in the Northwest requires delivery of that energy to the BPA power grid through existing transmission lines. This is accomplished via existing 500 kv lines from HGP to the BPA Vantage substation, 22 miles to the west. BPA transmits the power over their existing transmission network to load centers within the Northwest. Existing contracts between the Supply System and BPA for disposition of the energy from HGP to customers in the Northwest will be continued. The energy from HGP is distributed equally between the public and private utilities in the Pacific Northwest.

An existing NPDES Permit, No. WA 002487-2, must be renewed by the Washington State Department of Ecology for the liquid discharges associated with HGP. This permit, originally issued on January 2, 1975, expires on June 1, 1978.

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The existing contract between the Supply System and ERDA must be extended for ERDA to supply by-product steam from the NPR to HGP. The contract provides for the conditions under which the steam will be supplied, the cost for the steam, delivery rates, and scheduling. Continued operation of the NPR may occur regardless of the extension of a contract between the Supply System and ERDA.

The NPR utilizes uranium fuel to produce plutonium for national defense and research purposes. By-product heat from the NPR is converted to steam for use by HGP. The NPR discharges small amounts of heat and radioactive material into the environment. Processing of the spent fuel is expected to be accomplished on the Hanford Reservation.

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2.2 LOCATION OF THE HANFORD GENERATING PROJECT

HGP is located on ERDA's 570 square mile Hanford Reservation in Benton County, Washington, approximately 30 miles north of the City of Richland (Figure 2.2-1). HGP is adjacent to ERDA's NPR on the right (South) Bank of the Columbia River at approximately River Mile 380.

The legal description of the 48.57 acre parcel which the Supply System has leased from ERDA (formerly the A.E.C.) is as follows:

> A tract of land, commencing at the Southeast corner of Section 28, Township 14 North, Range 26 East, Willamette Meridian (said point being located by reference to the Washington Coordinate System, South Zone, at Coordinates North 486,994.01, and East 2,236,672.11); thence North 72° 02' 15" West 3,483.15 feet, thence North 67° 11' 41" West 1,810 feet more or less to a point on the line of ordinary high water on the right bank of the Columbia River, which point is the TRUE POINT OF BEGINNING: thence South 67° 11' 41" East 1,810 feet more or less to a point (said point being located by reference to the Washington Coordinate System, South Zone, at Coordinates North 488,145.71 and East 2,233,174.37) thence North 22° 48' 19" East a distance of 1,060 feet to a point, (said point being located by reference to the Washington Coordinate System, South Zone, at Coordinates North 489,122.84 and East 2,233,585.24) thence South 67° 11' 41" East 200 feet to a point, (said point being located by reference to the Washington Coordinate System, South Zone, at coordinates North 489,045.32 and East 2,233,769.60), thence North 22° 48' 19" East a distance

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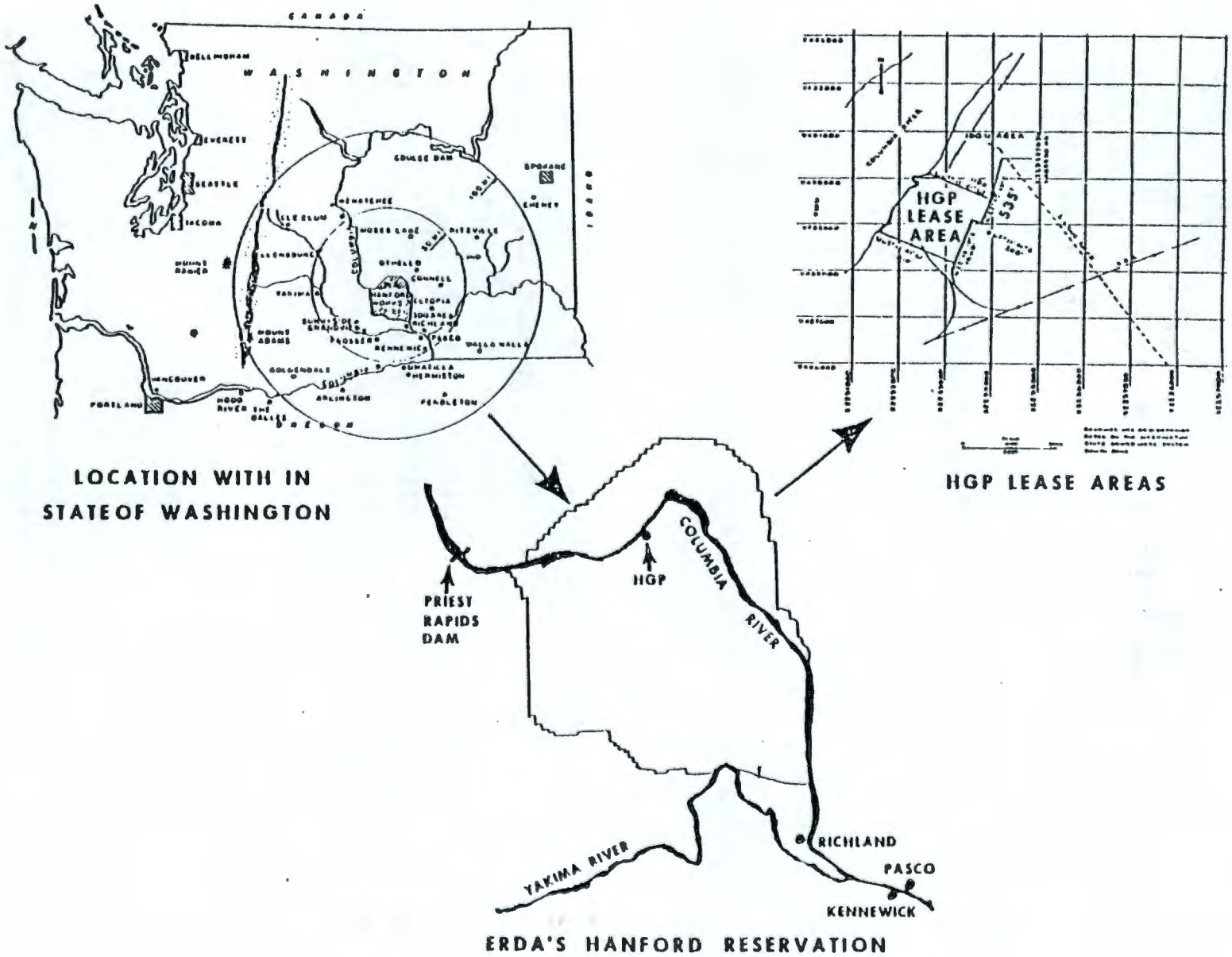

Figure 2.2-1
Location of WPPSS Hanford
Generating Project

of 535 feet to a point; (said point being located by reference to the Washington Coordinate System, South Zone, at Coordinates North 489,538.48 and East 2,233,976.96) thence North 67° 11' 41" West 1,108 feet more or less to a point on the line of ordinary high water on the right bank of the Columbia River, thence southwesterly along the said line of ordinary high water to the point of beginning containing 48.57 acres more or less.

2.3 LICENSES AND SCHEDULE FOR THE PROJECT

The HGP has been operational for several years. No new construction is associated with implementation of the proposal. Some key dates in its development are:

September 26, 1962	- Congress authorizes AEC (now ERDA) to sell waste heat in the form of steam from the NPR.
April 11, 1963	- Contract No. AT(45-1)-1355, the Operating and Construction Contract, establishes conditions for sale of steam to WPPSS. - Contract No. AT(45-1)-1355, the Indenture of Lease contract, provides leased land for the HGP.
September 26, 1963	- Groundbreaking for HGP.
April 18, 1966	- First power produced synchronized into the Northwest Power Pool.
August 5, 1971	- Contract No. At(45-1)-2263 is executed to establish payment of additional money for increased availability of steam energy.
January 2, 1975	- NPDES Permit No. WA 002487-2 issued by Department of Ecology pursuant to the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500).

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October 31, 1977 - Contract No. AT(45-1)-2263 expires unless extended or renewed but Contract No. AT(45-1)-1355 remains in force.

Contract No. AT(45-1)-2263, with Supplements Nos. 1-4 expires on October 31, 1977, but an option for an extension of operation for one year to June 30, 1978 is available. The Supply System is now considering a new contract for steam purchase of five years duration which would run from July 1978 to June 1983. Options for further extension are possible.

As has been the case in the past, five private utilities (Washington Water Power, Puget Sound Power and Light, Pacific Power and Light, Portland General Electric and Montana Power) would receive equal shares of 50 percent of the power produced. The public utilities have rights to the remaining 50 percent of the power. The public utilities would in turn transfer their rights to this power through 1983 to BPA. BPA would use this 50 percent, melded with all other sources, to meet its firm loads.

At the present time HGP is operating under NPDES Permit, No. WA 002487-2 which expires June 30, 1978. An application for a renewed permit will be filed with the Washington State Department of Ecology at least 180 days prior to the date of expiration of the present permit. The NPR is presently operating under NPDES Permit No. WA-000374-3 which expires on June 1, 1981.

2.4 HANFORD GENERATING PROJECT DESCRIPTION

2.4.1 General Description

The major existing structural features of the HGP are a river-bank intake structure, a mid-stream discharge line, steam condensers, twin steam turbines and generators, and a switchyard. An artist's rendering of HGP and NPR is shown in Figure 2.4-1.

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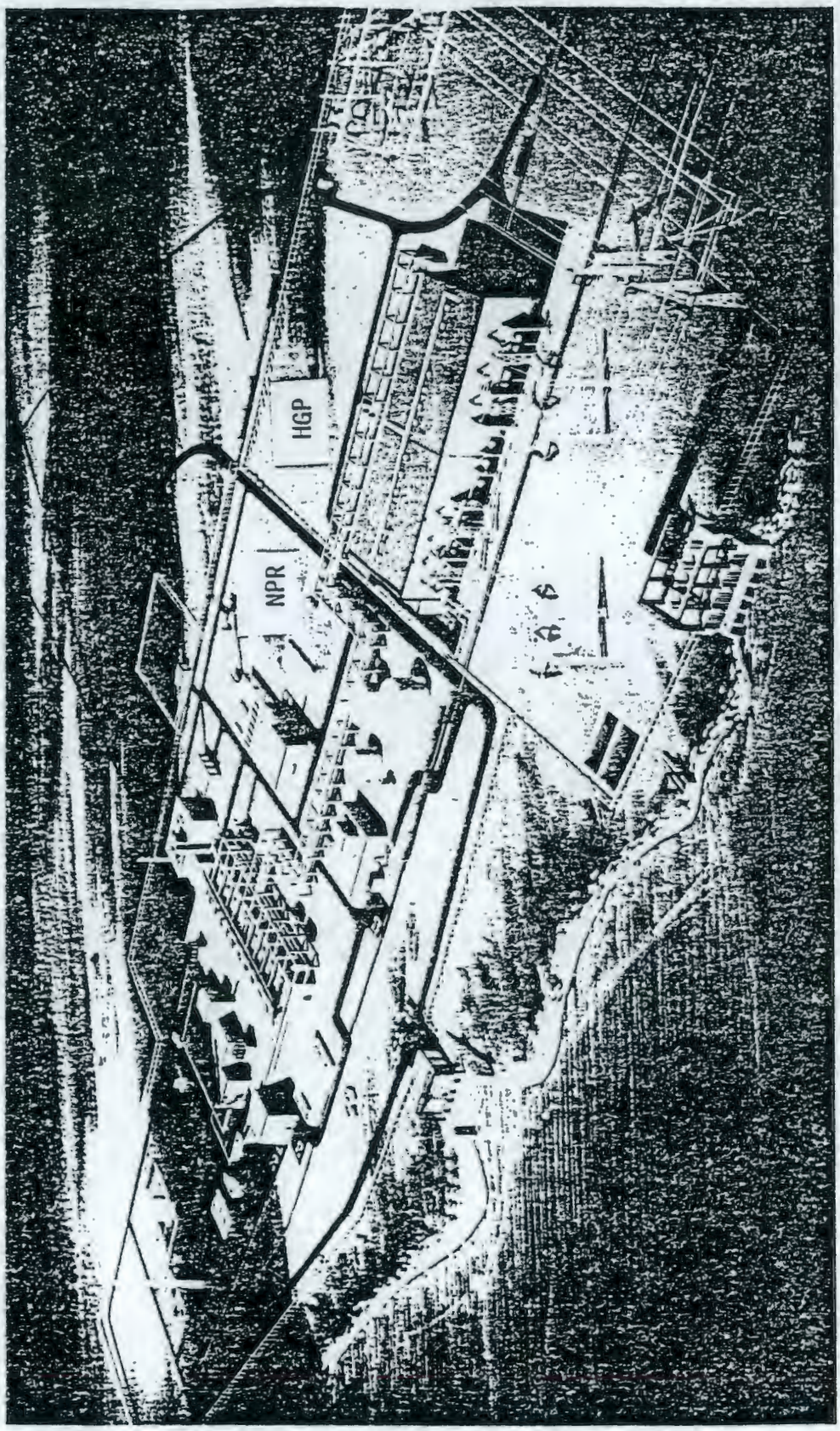

Figure 2.4-1
Artist's Sketch of HGP and NPR

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Steam for the turbine generators is generated in the adjacent NPR and piped to the HGP. Steam condensate is cycled back to the NPR. The HGP intake and discharge systems are principally for the supply and discharge of condenser cooling water.

2.4.2 HGP Heat Dissipation System

The major physical feature of the HGP with a potential for operational impact on the environment is the heat dissipation system. This system,[2-1] shown in Figure 2.4-2, consists of an intake pumphouse, condensers and discharge line. The HGP operating parameters (and similar characteristics of NPR) are listed in Table 2.4-1.

TABLE 2.4-1
HGP/NPR OPERATING PARAMETERS

Item	HGP Operating Parameters	NPR Operating Parameters*
Megawatts Thermal	-	4000
Megawatts Electrical	860	
Heat load to river	2680	460
Cooling water flow**	564,000 gpm (4 pumps) 423,000 gpm (3 pumps)	290,000 gpm normal (390,000 gpm maximum)
Intake screen velocity	0.8 - 1.25 ft./sec.	0.8-1.25 ft./sec.
Discharge water Temp.	35°F above ambient river (4 pumps) 43°F above ambient river (3 pumps)	83°F maximum

Intake Structure

Figure 2.4-3 shows the intake structure which is 95 feet high, 109 feet wide and 108 feet back to front. Four pumps, rated at 141,000 gpm each, pump the river water to the Turbine Generator Building and

*Assumes operation of HGP
**See discussion under "Intake Structure" relating to 3 and 4 pump operation

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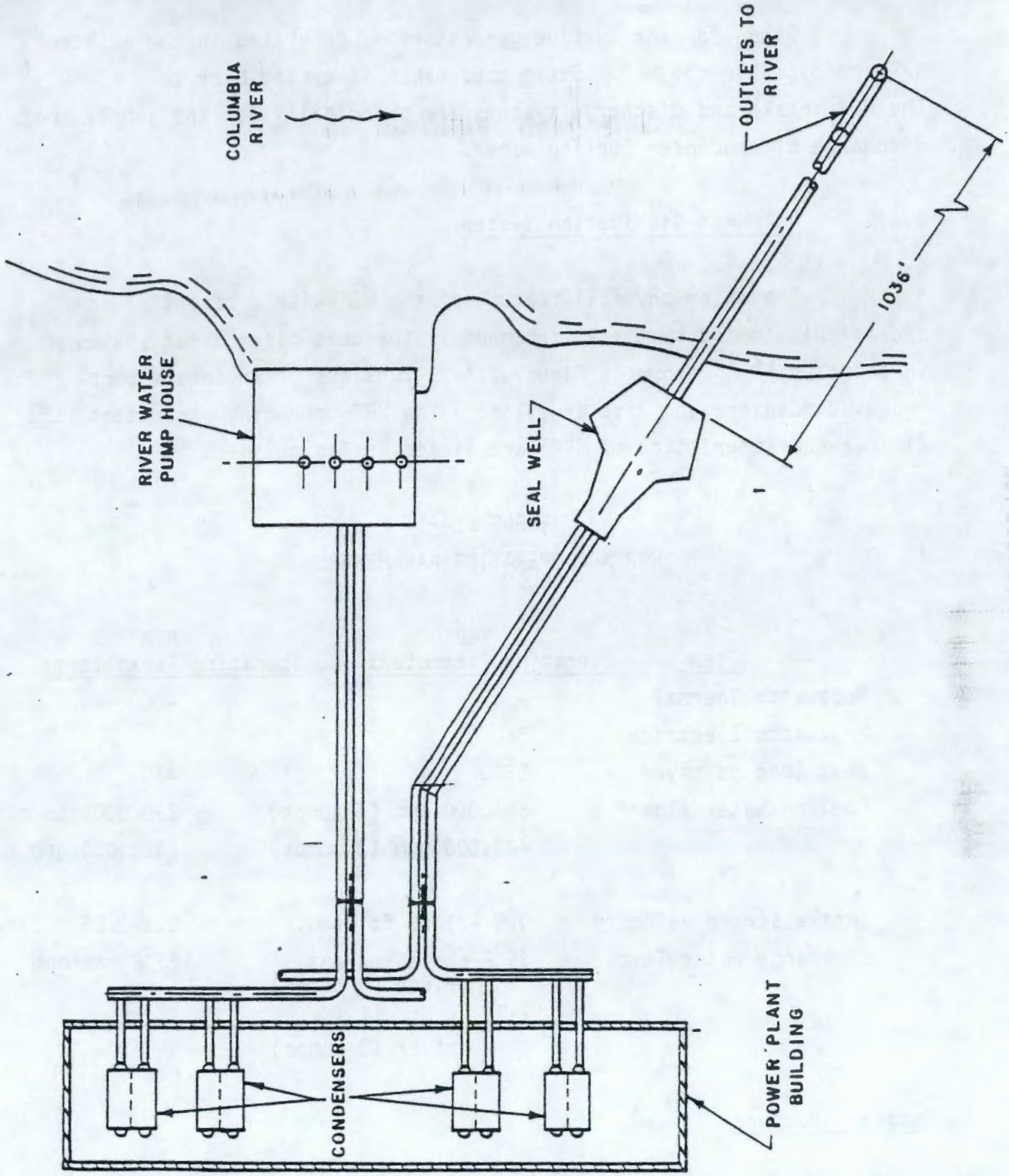

Figure 2.4-2
HGP Once Through Condenser Cooling System

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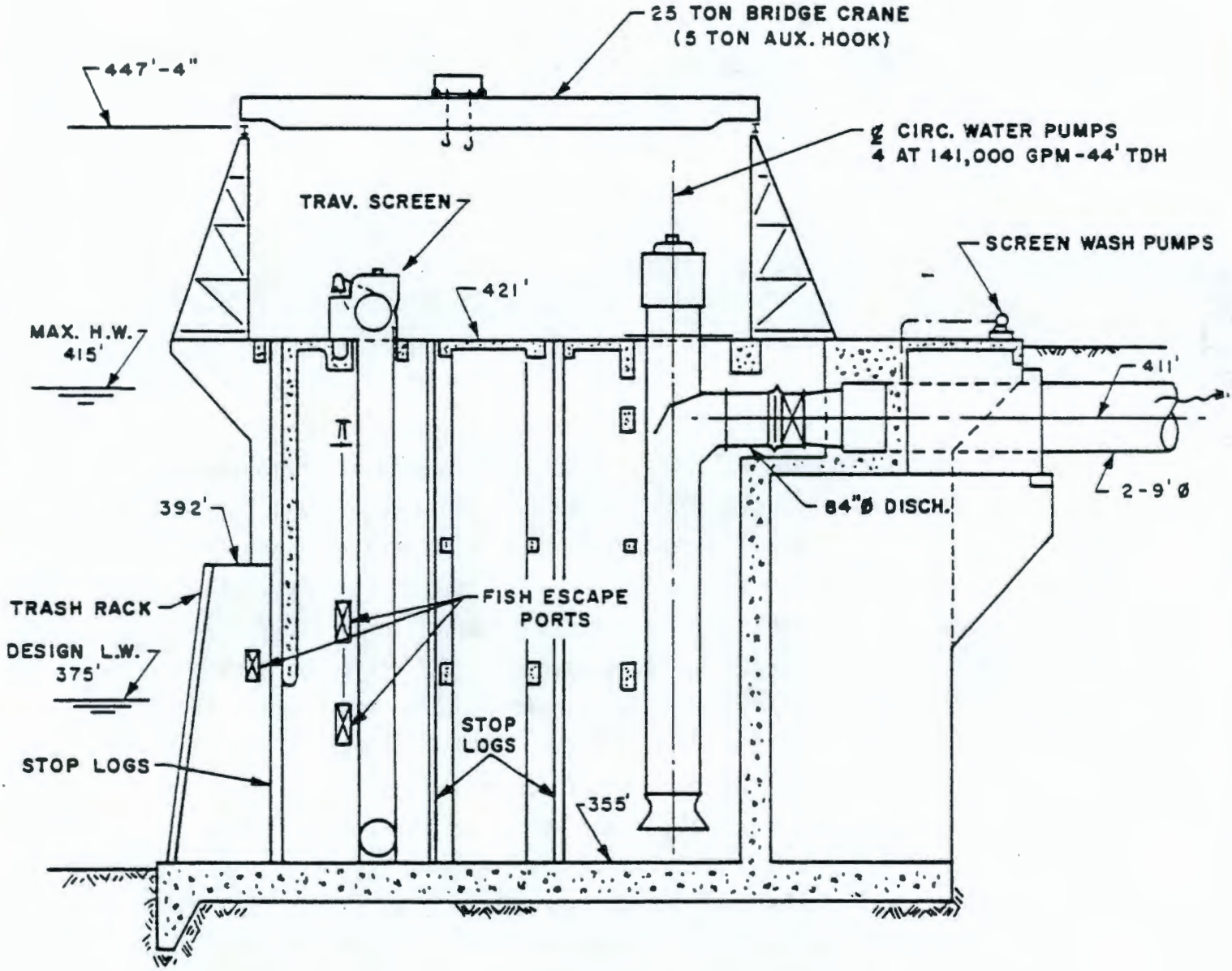

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Figure 2.4-3
HGP Cooling Water Intake
Structure, Profile

the main condensers. The large pump size precluded the use of conventional one screen - one pump type of pump chamber. Therefore, the three screen - two pump scheme was adopted.

During operation of the HGP one of two modes of pumping is used. During those months of the year when the river temperatures are warmer all four intake pumps are used and 564,000 gpm of cooling water is pumped through the condensers. During those months of the year when the river temperatures are colder only three intake pumps are used and 423,000 gpm of cooling water is pumped through the condensers. The nominal river temperature used to determine whether three or four pumps will be operated is 45°F but varies depending on the actual HGP condenser back pressures being measured at the time.

The intake facilities, originally designed to meet the criteria established by the Bureau of Commercial Fisheries, The Washington State Departments of Fish, Game, and Pollution Control Commission and The U.S. Bureau of Sports Fish and Wildlife, included conventional trash racks, traveling screens, stop logs for individually isolating screen bays and pump bays, and high pressure horizontal screen wash nozzles. Debris can be washed from the screens and returned to the river along with the wash water through a common trash trough. Trash racks are 5 inch by 1/2 inch bars, 3-3/4 inches on center. The traveling screen mesh was originally 1/4 inch. The net screen velocity was limited to 1 foot-per-second to protect fish. This resulted in a somewhat oversized screen bay. In addition, three openings were provided in each wall of the intake as fish escape ports. These ports can be seen in Figure 2.4-3. The theory was that any fish inside the trash racks will be able to swim through the normally open ports, parallel to the screens, and out through the downstream walls. Each escape port is 2 feet wide by 5 feet high with gates to permit blocking the port for screen dewatering during maintenance.

Intake Modifications

Over the period 1973 to 1976 a series of modifications were made at the HGP intake structure in order to minimize the impact on the fish in the Columbia River.

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Revision 1 (1973)

A number of juvenile chinook salmon were observed behind the HGP traveling screens in the Spring of 1973.[2-2]

One factor that appeared to increase the congestion of juvenile salmonids in front of the intake was a recirculating eddy caused by berms that extended some distance into the river both upstream and downstream of the intake (Figure 2.4-4). This eddy apparently increased the potential for multiple exposure of fry to impingement and screen passage. To mitigate the impact of the intake on outmigrating salmon, the Washington State Department of Fisheries requested that the intake forebay be modified by removing the berms before the 1973 spawning season. Berm removal was completed in September 1973 and diminished the eddy in front of the intake. It was not possible to completely remove the apparent downstream berm since much of this was natural riverbed and consisted of extremely hard materials which could not be removed by normal excavation procedures.

During this same season, the fish escape ports were permanently closed since the velocities during low flow precluded escape and induced eddy currents.

Revision 2 (1973)

Fish were passing through the traveling screens due to the 1/4-inch size of the screen openings.[2-2] As originally designed, and approved, the screens were only partially effective in excluding fish. Therefore, to reduce passage the Washington State Department of Fisheries requested that the size of the screen openings be reduced to 1/8-inch before the 1974 out migration. In February 1974, WPPSS began changing the traveling screen mesh from 1/4 to 1/8 inch openings. One half of the traveling screens were changed, while one half were left 1/4-inch mesh. This action afforded the opportunity for direct comparison of impingement and passage of fish with the two different travelling screen openings.

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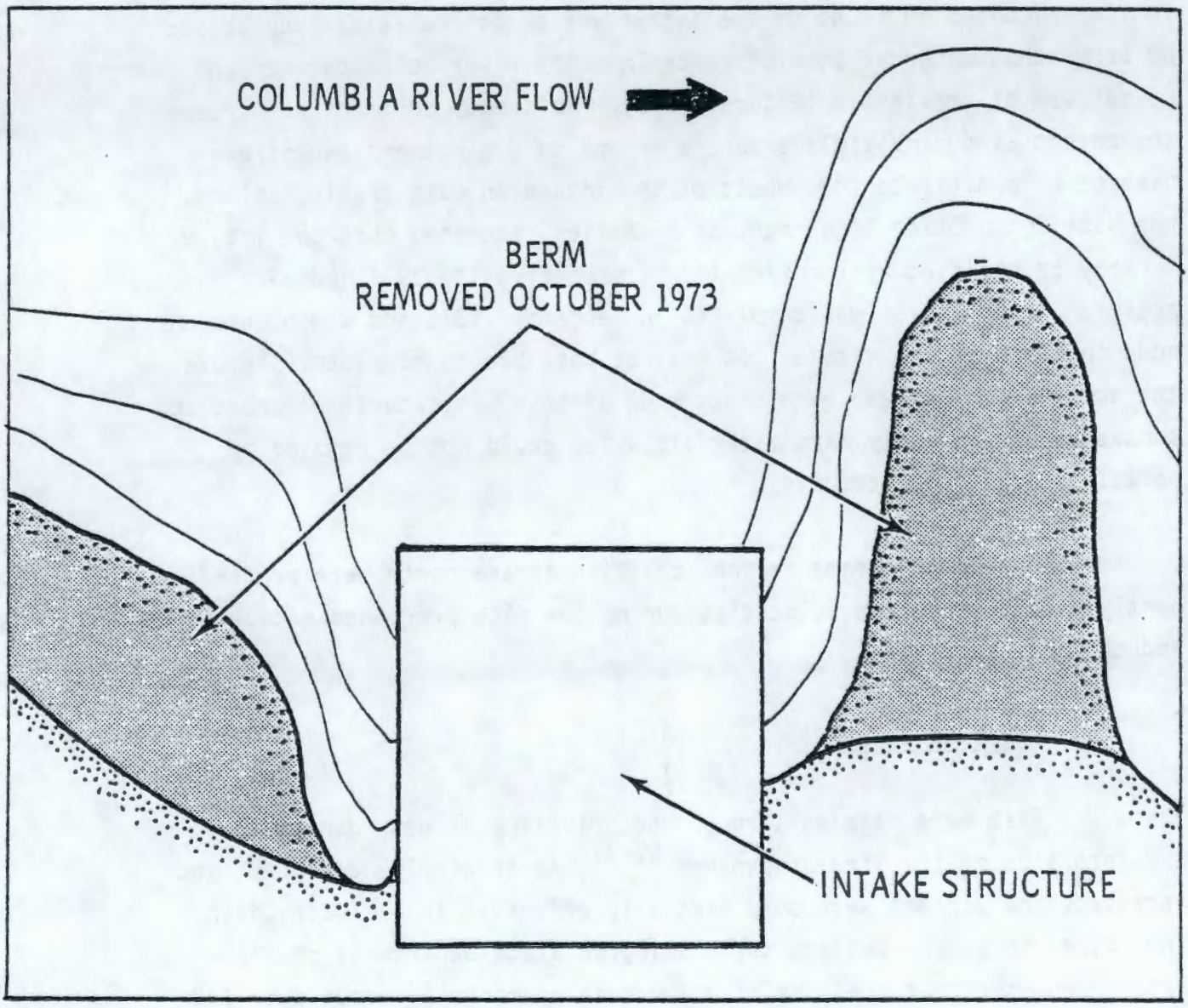

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Figure 2.4-4
HGP Intake Location
Showing Berm Removal

Revision 3 (1974)

The appearance of fish behind the 1/8-inch traveling screens throughout the 1974 out migration and the sizes of fish sampled indicated that fish were passing through the screens by some other means.[2-2] It appeared that this passage was a result of gaps between screen frames and between the edge of the screens and the concrete walls of the intake structure. The gaps between the screen frames were sealed with bitumastic paste. The gaps between the edges of the screens and the concrete walls were sealed with foam. These changes essentially eliminated passage during the 1975 out migration but increased impingement.[2-3]

Studies were conducted to determine if impingement could be reduced by withdrawing water into the intake from along the bottom of the forebay. Gates were lowered in front of the traveling screens to force water withdrawal from the bottom of the forebay. No significant improvement in impingement was noted.[2-3]

Revision 4 (1975)

Prior to the 1976 salmon out migration two changes were made to the intake structure to decrease the impact of impingement on outmigrants [2-4] These changes were designed to increase the survival of outmigrants which may become impinged. Buckets were added to the bottom of each section of traveling screen. These buckets lift impinged fish up to the level of the trash trough where a newly installed low pressure screen wash remove the fish from the bucket to the trash trough and return them to the river (See Figure 2.4-5). During the migration season the screens rotate continuously. Survival rates of 95% are being experienced with this system. [2-4]

Operating Procedures

Chlorination capability was initially installed in the intake structure. However, because of the water quality in the river, fouling of the condenser tubing has not occurred and this system has never been utilized.

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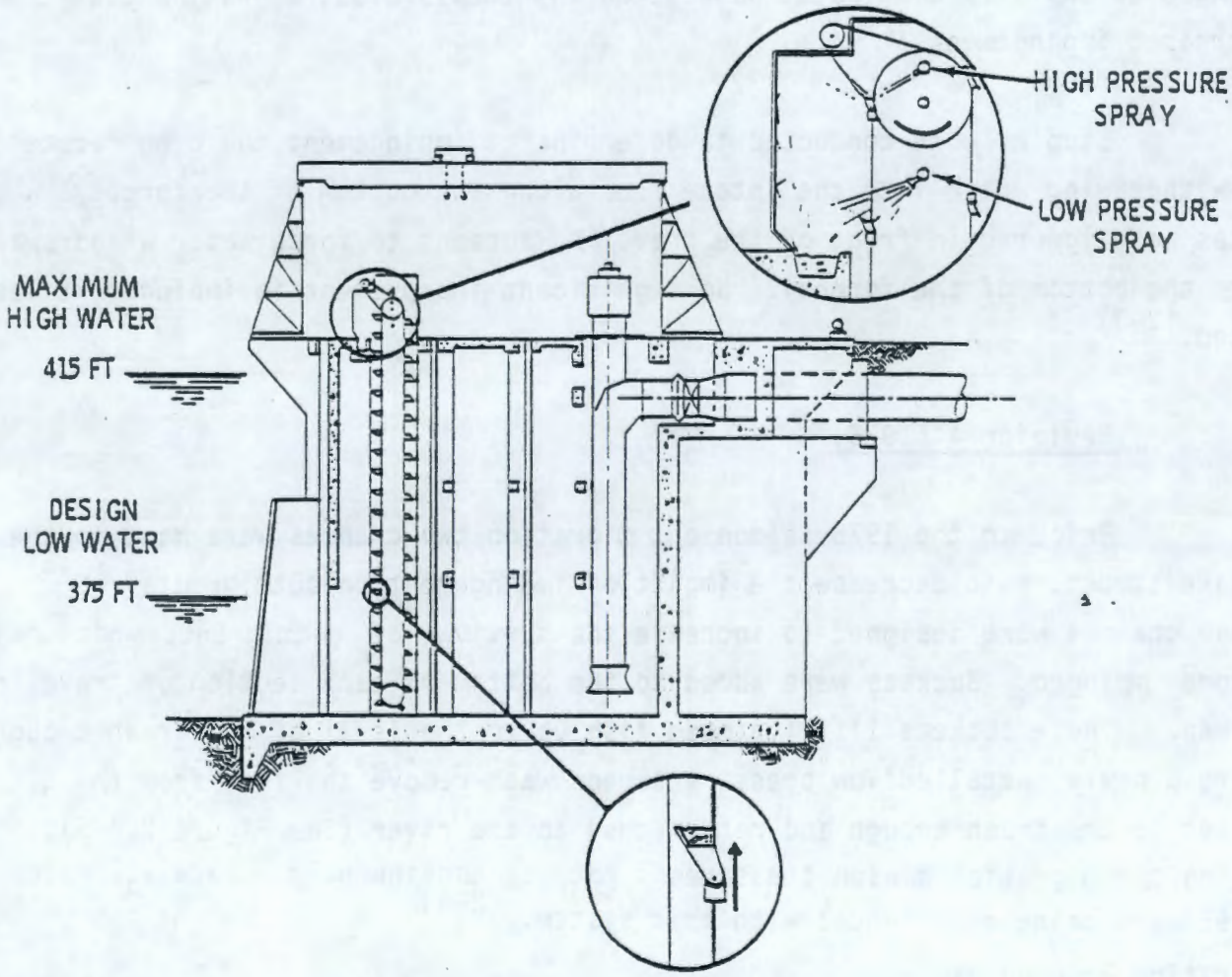

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Figure 2.4-5
Modification to HGP Traveling Screens for Protection for Fish

During the winter and early spring only three of the four pumps are required. Studies conducted in 1975 showed that operating two pumps on the downstream side of the intake and one pump on the upstream side significantly reduced the number of fish impinged. This operational mode is now used at HGP when three pumps are operating during the spring migration period.

Traveling screen rotation and washing is done on a continuous basis during the spring when salmon fry are in the river. This minimizes the length of time an impinged fry may be held next to the intake screen.

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Outfall Configuration and Location

Cooling water is transported from the Turbine Generator Building to a seal well located adjacent to the Columbia River.[2-1] The cooling water is then transported through an 11-foot diameter outfall line which extends 1,036-foot diagonally into the Columbia River, where the water is discharged through four vertically oriented ports 50 feet apart (See Figure 2.4-6). With four pumps operating, the total time of travel from the intake structure to the end of the outfall line is about 3.5 minutes. The outlet velocity through the end port is on the order of 7-10 feet per second.

The 11-foot diameter outfall line is buried below the river bed, covered with backfill and protected by riprap. Each discharge port is constructed in a manner as shown on Figure 2.4-7. Each port discharges water horizontally downstream parallel with the prevailing flow of the Columbia River. The top of the highest port is at an elevation of 363 feet. The remaining three outlets are at an elevation of 359 feet, which is 18 feet below the low water elevation of the Columbia River.

2.4.3 Other HGP Systems

A number of operations at HGP result in the discharge of small volumes of liquid effluents. Sanitary water is discharged to a tile field. Process water used for flushing and washing is discharged to

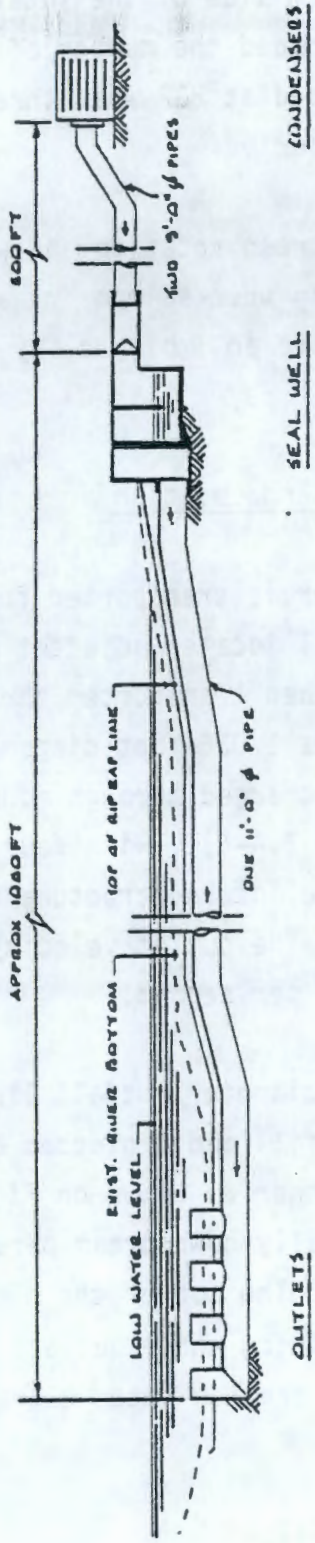

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Figure 2.4-6
HGP Outfall Pipe Configuration

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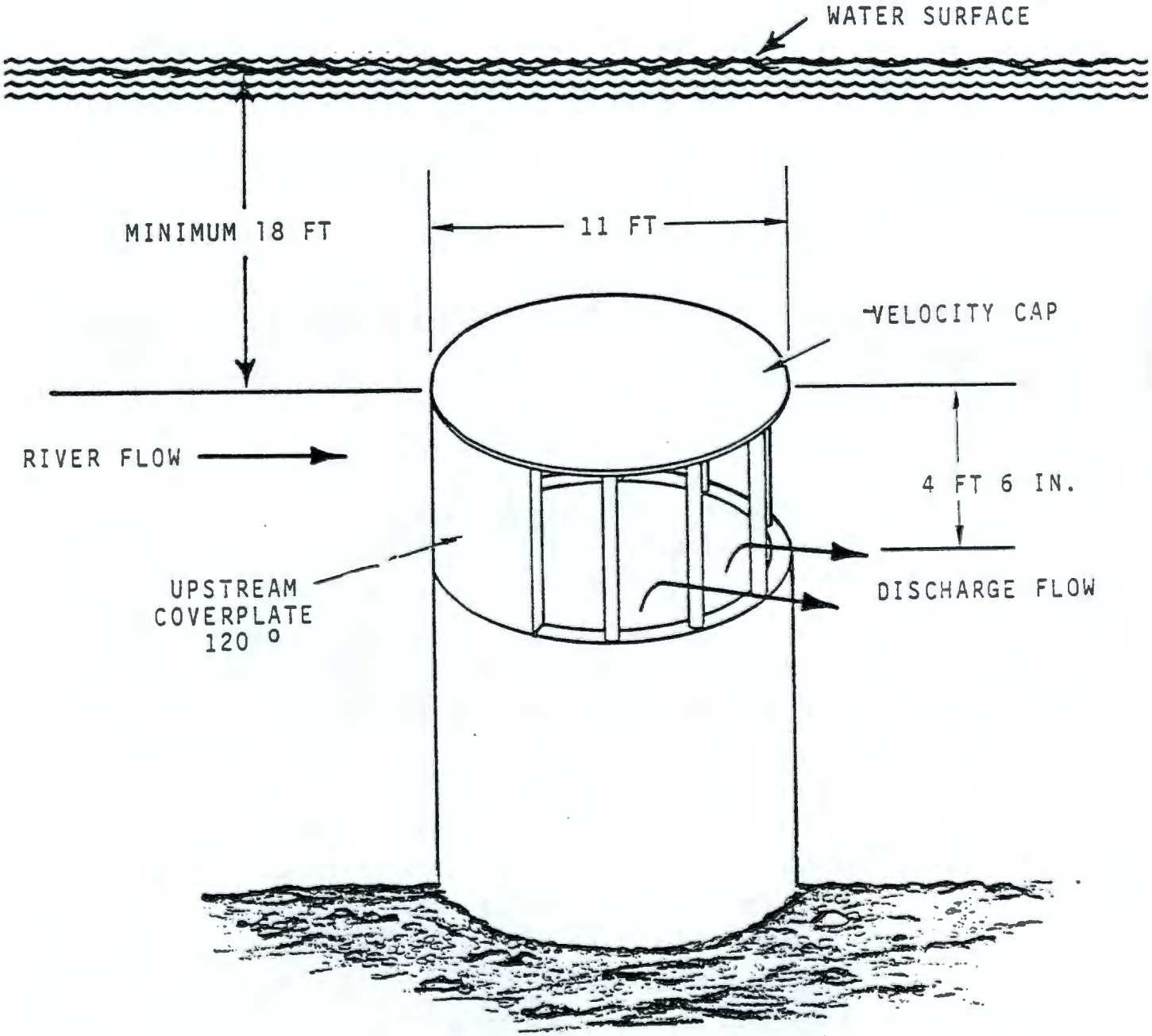

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Figure 2.4-7
HGP Discharge Port Configuration

floor sumps. Demineralized water is collected from various sources in pit sumps. The process and demineralized water, along with roof drains and demineralizer backwash water are all routed to a settling basin. The effluent from the settling basin is diluted by about a factor of 1000 by mixing it with the main circulating cooling water in the discharge line. It is then discharged into the center of the river. The physical and chemical characteristics of the discharge for both the cooling water and the low volume waste sources are shown in Table 2.4-2.

Gaseous effluents are discharged from an emergency diesel generator, an emergency diesel fire pump, and a fuel oil fired auxiliary boiler. These systems are only used intermittently. Consumption of petroleum fuels is on the order of 8,000 gallons of motor fuel and 4000 gallons of fuel oil annually.

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Oil Spill Preventention Control and Countermeasure

Sources of oil at the HGP can be classified into three groups according to the potential for spill and entry into the Columbia River (see Table 2.4-3). The first group has "zero potential" for spill into the river. These facilities cannot spill oil into the river because of their location far from the river, the relatively small volumes of oil present, and the lack of any direct pathway to the river.

The second group is in-plant sources. Oil spilled from in-plant sources would generally drain to floor sumps. These floor sumps are automatically pumped when the level in the sump reaches a certain height. The outflow from the sumps goes to a settling basin which drains directly to the river. It is possible to intercept any in-plant oil spill in one of two places, either in the sump, by shutting off the sump pump, or in the settling basin by closing the discharge to the river. All areas of the plant containing these potential oil spill sources are manned on a twenty-four hour basis. Many of these sources are periodically checked for oil levels. Additionally the equipment oil levels are automatically monitored, with alarms provided should oil levels drop below normal values. Should an oil leak be

TABLE 2.4-2

Summary of HGP Discharge Characteristics[1]

Item	NPDES Permit Value
Dissolved Oxygen (mg/l)	Exceeds 8.0 at all times [2]
pH	Between 6.0 - 9.0
Turbidity (JTU)	Less than 5 Above Ambient River [2]
Temperature (^{o}F)	Less than Ambient + 35°F (June - Sept) Less than Ambient + 43°F (October - May)
Total Dissolved Gas (% of Saturation)	Less than 110[2]
Total Coliform (medium values) (organisms/100 ml)	Maximum 240[2]
Toxic or Deleterious Materials	See Section 4.3.3
Aesthetic Values	See Section 4.3.3
Total Suspended Solids (lbs/day)	535
Oil and Grease (lbs/day)	107
Iron (lbs/day)	0.8

(1) From HGP NPDES Permit

(2) At 3,000 fee below discharge

H40.3.0.3.3

TABLE 2.4-3

SOURCES OF OIL AT THE HANFORD GENERATING PROJECT

Device	Number	Capacity, Gallons Each	Capacity, Gallons Total
a. Zero Spill Potential Sources			
Main Transformers	7	10,930	76,510
Auxiliary Transformers	2	2,775	5,510
Startup Transformers	1	2,758	2,758
Diesel Oil Storage Tank	1	20,000	20,000
Gasoline Fuel Storage	1	1,200	1,200
Lube Oil Storage Room	1	330	330
b. In-Plant Spill Potential Sources			
Condensate Pump Motors	6	26	156
Feedwater Pumps	6	15	90
Service Air Compresser	1	6	6
Inst. Air Compressors	4	3	12
Elevators	2	565	1,130
Diesel Generator Crankcase - motor oil	1	70	70
Day Tank (No. 2 Diesel)	1	520	520
Turbine Oil Reservoir	2	6,450	12,900
Oil Supply and Return Lines	2	2,200	4,400
Turbine Lube Oil Storage	1	14,000	14,000
Seal Oil Systems	2	200	400
Bowser Oil Purifiers	2	800	1,600
c. Intake Structure Spill Potential Sources			
Circ. Water Pump Motors	4	28	112
Fire Pumps	2	1	2
Diesel Fire Pump Crankcase	1	13	13
Diesel Fire Pump Day Tank (No. 2 Diesel)	1	270	270

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detected, standard operating procedures are implemented to stop all sump pumping, isolate the oil and clean up the spill. As additional protection an oil skimmer has been installed on the settling pond.

The third group is oil located at the intake structure. Curbing has been constructed around the intake pump motors and diesel fuel tank and a pre-set level indicator has been installed on the diesel fuel pump.

2.5 THE NEW PRODUCTION REACTOR (NPR)

Operation of HGP as a base load energy resource is dependent upon receiving steam from the ERDA NPR. To that extent operation of HGP is dependent upon continued NPR operation. However, the operation of NPR has utility for production of plutonium independent of HGP's operation and may be operated by ERDA for plutonium production regardless of whether HGP operates or not. For the readers information a description of the NPR is provided here as an other issue which does not pertain to any element of the environment listed in Table 3.0-1, but which is relevant to the proposal.

The NPR is a graphite moderated reactor with concrete shielding. Fuel elements are metallic uranium with a zirconium alloy cladding. The fuel is cooled by a recirculating primary coolant system which pumps high purity water through the process tubes where the coolant picks up heat generated by the fission process in the fuel elements. This heat is transported to the steam generators located in an adjacent building. Steam produced in the steam generators is used to drive the primary coolant pumps, to produce electricity for in-plant usage, and to supply steam to the HGP.

2.5.1 Heat Dissipation System

The NPR operates at a nominal rating of 4,000 MW thermal power (See Table 2.4-1). The majority of the by-product heat produced is transported to HGP for use in the production of electricity. The remaining heat is utilized in the operation of NPR and is eventually transferred to a circulating raw water system for discharge to the Columbia

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River. This system has a nominal intake flow rate of 315,000 gpm. Water is drawn from the river through a shoreline intake system, circulated through various condensers and heat exchangers and discharged back to the river through a mid-river discharge port and a shoreline flume.

Intake System

River water at the NPR intake flows through trash bars and traveling screens into four pump suction wells. The water is then pumped to the NPR by four pumps with ratings of 105,000 gpm each. The pump wells are connected by flood gates normally left in the open position. Only 3 pumps are required during normal plant operation. The maximum-water velocity through the traveling screen during low water is approximately 1.25 foot per second. The screen is 1/8 inch mesh. During screen operation, trash is washed from the screens by water jets to a trough from which the trash is removed and disposed of on land.

Discharge System

The circulating raw water for NPR is discharged to the river at two points: (1) a 102 inch line and a single port similar to that shown in Figure 2.4-7 located mid-river, and (2) a shoreline flume.

2.5.2 Other NPR Systems

Other nonradioactive liquid effluents are released from NPR via the main 102" line, the shoreline flume, several minor overflow lines and the sanitary tile field. Radioactive liquid effluents are released via the riverbank springs and the 102" line. Nonradioactive gaseous effluents are released from the oil-fired boilers. Radioactive gaseous effluents from the reactor ventilation systems are released via the main reactor ventilation stack and several smaller vents at the steam generator building. Radioactive and nonradioactive effluents from NPR are described in detail in ERDA-1538.[2-5]

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2.5.3 Fuel Cycle

Fuel for the NPR is manufactured in the ERDA fuel fabrication facilities run by United Nuclear Incorporated in the 300 area. The 300 area of the Hanford Reservation is located about 1 mile north of the Richland city limits on the bank of the Columbia River. This area is described in more detail in the Final Environmental Statement, Waste Management Operations, ERDA-1538.[2-5] Spent fuel which is removed from the NPR is currently placed in storage. Current plans are to begin processing spent fuel by 1979.

2.6 LAND USE PLANS AND ZONING REGULATIONS

The zoning status and land uses within a 25 mile radius of the Site includes residential and suburban, corporate city, agricultural, industrial and commercial, scenic and recreational, unclassified, and general use land areas. The region within 25 miles of the Site includes areas of Benton, Franklin, Adams, Grant, Kittitas, and Yakima Counties. HGP is in proximity only to Benton and Grant Counties.

Although the Hanford Reservation is a Federal reservation, county and state laws do apply to the Project area.

2.6.1 Zoning Status

The land zoning status of areas surrounding the HGP are shown in Figure 2.6-1.

Benton County

The Project is located on the U. S. ERDA Hanford Reservation within Benton County. The land area of the Hanford Reservation within Benton County is zoned as "Unclassified District" by the Benton County Planning Commission and there are no county or municipal land use restrictions on that portion of the Reservation located within Benton County that conflict with the land use as proposed herein.

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Figure 2.6-1
Land Zoning Status

Grant County

The land area in Grant County immediately surrounding the Hanford Reservation is zoned agricultural. Continued operation of the HGP will have no effect upon the zoning status of that land.

2.6.2 Land Uses

Land uses within the Hanford Reservation are shown in Figure 2.6-2.

The only present use of the Reservation near the HGP is for operation of the NPR and HGP. Continued operation of HGP on the Hanford Reservation is consistent with ERDA activities for the Reservation. Neither Benton nor Grant County has classified that portion of the Hanford Reservation located within its county. However, the proposal is not inconsistent with comprehensive plans or zoning ordinances. The land use plans for surrounding areas in Grant County are for continued agricultural use.

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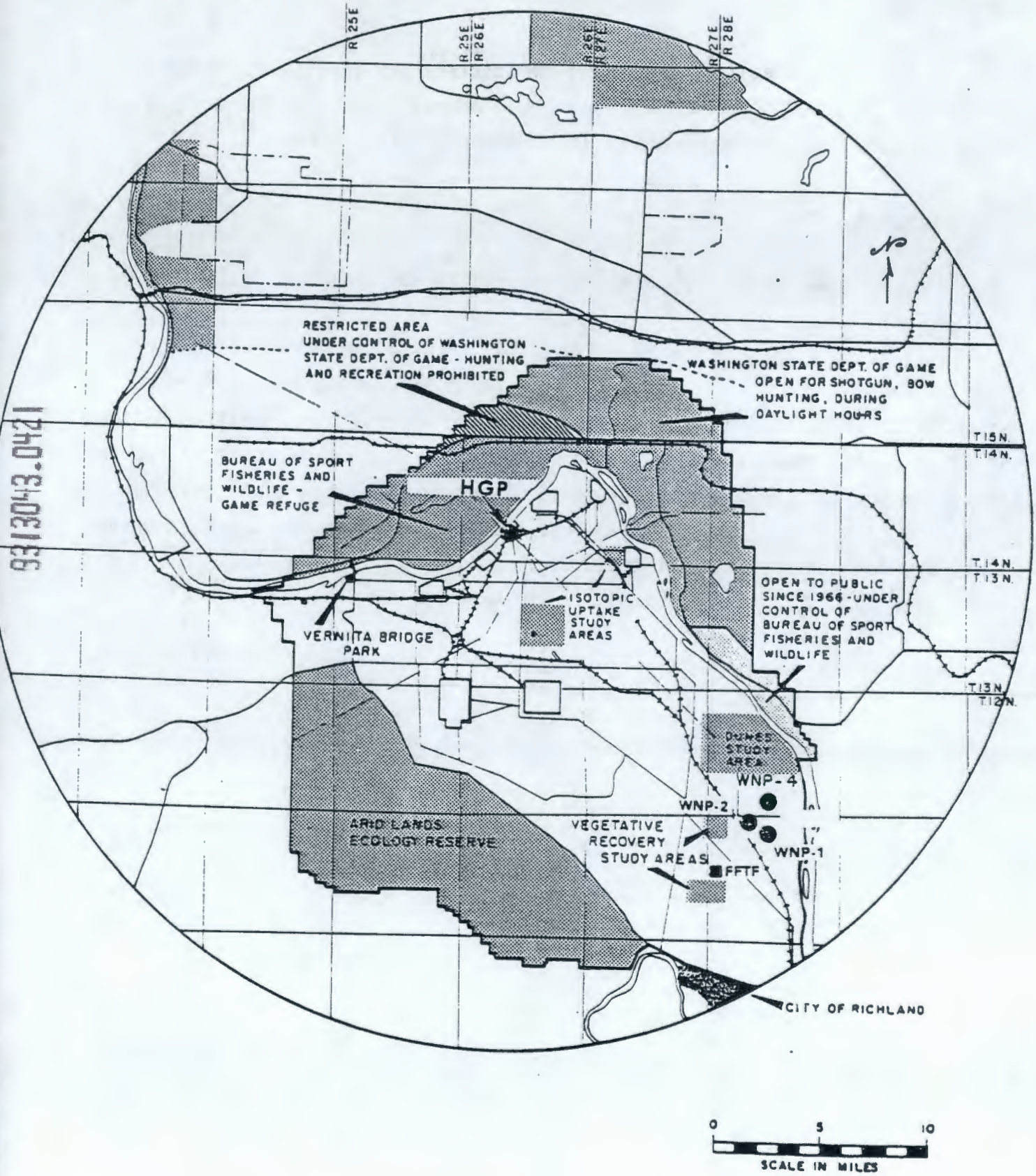

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Figure 2.6-2
Hanford Reservation Land Uses

CHAPTER 3

DESCRIPTION OF THE EXISTING ENVIRONMENT

In developing the material for this EIS, the Supply System has not identified any environmental impacts associated with the continued operation of HGP which could be considered "significant" within the meaning of the Washington State Environmental Policy Act (SEPA). This EIS was prepared to bring together environmental information on the HGP for the benefit of the Supply System, its Board of Directors and Executive Committee, regulatory agencies' officials, and the interested public.

Table 3.0-1 lists the elements of the environment which, according to SEPA Guidelines, must be considered in developing environmental documents. Since no elements of the environment are significantly affected, all of the elements of the environment listed in Table 3.0-1 should be marked "Not Applicable". This format has been used to assist the reader in identifying the sections in the document where each of the areas are discussed.

Numerous studies have been conducted and reports prepared documenting the physical, ecological, and human environmental aspects of the Hanford Reservation, the adjacent Columbia River and the adjoining communities. The impacts on the area from the operation of the now closed down government plutonium production reactors at Hanford and from the presently operating NPR and HGP have also been analyzed previously. Much of the available material directly related to HGP was first developed in 1972 and 1973 when the Supply System was considering constructing a commercial nuclear reactor to replace the NPR as a source of steam for the HGP turbines. Studies and analyses were developed for this new project, called "WPPSS Nuclear Project No.1" or WNP-1, and documented in numerous reports. Two of the most comprehensive reports developed by the Supply System were the "Application for State Site Certification for WNP-1" filed with the Washington State Thermal Power Plant Site Evaluation Council (now the Energy Facility Site Evaluation Council) in 1973

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TABLE 3.0-1

LIST OF ELEMENTS OF THE ENVIRONMENT

EXTRACTED FROM WAC 197-10-444

Element	Section Number
I. ELEMENTS OF THE PHYSICAL ENVIRONMENT	
A. Earth	
1. Geology	3.1.1
2. Soils	3.1.1
3. Topography	3.1.1
4. Unique Physical Features	3.1.1
5. Erosion	---
6. Accretion/avulsion	---
B. Air	
1. Air Quality	3.1.3, 4.1.2
2. Odor	3.1.3
3. Climate	3.1.3
C. Water	
1. Surface water movement	3.1.2, 4.1.1
2. Runoff/absorption	3.1.2
3. Floods	3.1.2
4. Surface Water Quantity	3.1.2, 4.1.1
5. Surface Water Quality	3.1.2, 4.1.1
6. Ground Water Movement	3.1.2
7. Ground Water Quantity	3.1.2
8. Ground Water Quality	3.1.2, 4.1.3
9. Public Water Supplies	3.1.2, 4.1.1
D. Flora	
1. Numbers or Diversity of Species	3.1.4, 3.1.5, 4.2, 4.3
2. Unique Species	3.1.4, 3.1.5, 4.2, 4.3
3. Barriers and/or Corridors	3.1.4, 3.1.5
4. Agricultural Crops	3.1.1
E. Fauna	
1. Numbers of Diversity of Species	3.1.4, 3.1.5, 4.2, 4.3
2. Unique Species	3.1.4, 3.1.5, 4.2, 4.3
3. Barriers and/or Corridors	3.1.4, 3.1.5, 4.2, 4.3.2
4. Fish or Wildlife Habitat	3.4.1, 3.1.5, 4.2, 4.3
F. Noise	---

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TABLE 3.0-1 (Cont'd)

Element	Section Number
G. Light and Glare	---
H. Land Use	3.1.1
I. Natural Resources	
1. Rate of Use	5.2
2. Nonrenewable Resources	5.2
J. Risk of Explosion of Hazardous Emissions	4.5
II. ELEMENTS OF THE HUMAN ENVIRONMENT	
A. Population	3.1.6, 3.1.7
B. Housing	3.1.6, 3.1.7
C. Transportation/circulation	
1. Vehicular Transportation Generated	3.1.7
2. Parking Facilities	---
3. Transportation System	---
4. Movement/circulation of People or Goods	---
5. Waterborne, Rail, and Air Traffic	---
6. Traffic Hazards	---
D. Public Services	
1. Fire	3.1.7, 4.4.2, 8.1
2. Police	3.1.7, 4.4.2, 8.1
3. Schools	3.1.7, 4.4.2, 8.1
4. Parks or Other Recreational Facilities	---
5. Maintenance	---
6. Other Governmental Services	3.1.7, 4.4.2, 8.1
E. Energy	
1. Amount Required	3.2.3
2. Source/availability	3.2.3
F. Utilities	
1. Energy	---
2. Communications	---
3. Water	3.1.7, 4.4.2, 8.1
4. Sewer	3.1.7, 4.4.2, 8.1
5. Storm Water	---
6. Solid Waste	3.1.7, 4.4.2, 8.1

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TABLE 3.0-1 (Cont'd)

	Element	Section Number
G.	Human Health (including mental health)	---
H.	Aesthetics	---
I.	Recreation	---
J.	Archaeological/historical	3.2.2
III.	OTHER - Additional population characteristics	3.2.1, 3.2.2

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and the "Environmental Report for WNP-1," filed with the Atomic Energy Commission (now the Nuclear Regulatory Commission) in 1973. Copies of these reports are available from the Supply System for the cost of reproduction. In 1974 the Supply System decided to move the WNP-1 project to another location on the Hanford Reservation and continue to obtain steam for the HGP from the NPR.

3.1 PHYSICAL ENVIRONMENT

3.1.1 Land

The HGP site is located in the Pasco basin which lies within the Columbia plateau physiographic province of south-central Washington. The Pasco basin is a structural depression bordered on the north by the Saddle Mountains, on the south by the Rattlesnake Hills, and on the west by the easterly end of Umtanum and Yakima Ridges. There is no well-defined surface feature bordering the Pasco basin on the east.

The oldest rocks exposed in the Pasco basin are volcanic flows. Most of the basalt flows range from 50 to 200 feet thick and the beds of sand, silt or clay range from 5 to 130 feet thick. Overlying the basalt is the Ringold Formation. This formation consists primarily of apparently lake-deposited clay, silt and fine-grained sand.

Glacio-fluvial sediments called the "Pasco Gravels" lie on an eroded surface of the basalt flows and interbeds and the Ringold Formation. In places, fine-grained sand and silt occur within the glacio-fluvial sediments and are termed the "Touchet Beds". Radiocarbon dates from ash beds in the uppermost part of the glacio-fluvial sediments indicate ages of 6,000 to 12,000 years.

The HGP is located in a region described as Knob and Kettle topography. This is an extremely stony area of glacio-fluvial sediments. Knobs are long steep mounds of glacial drift. The Kettles are depressions between these drifts. These formations resulted from the debris of glaciers or other forms of glacial ice. A more detailed description of the geology of the site is given in Reference 3-1.

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3.1.2 Water

Surface Waters

The Columbia River is the major source of water in the vicinity of HGP. The River flows south and west out of Canada and across eastern Washington. The major tributaries in the United States above the HGP site are the Spokane River, the Pend Oreille River, and the Wenatchee River. Immediately below the HGP site are the Yakima and Snake Rivers. Numerous hydroelectric dams have been constructed on the Columbia River. Seven of these dams are located in the United States upstream from HGP and four are downstream. Additional dams for the development of flood control and hydroelectric power production are located in Canada. The addition of the new Canadian dams has increased the water storage capacity in the upper Columbia River Basin to well over 35 million acre feet.

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The flows in the Columbia River in the vicinity of HGP are highly regulated by the Priest Rapids Dam just upstream of the Project. Electric power is produced by the Grant County Public Utility District at this dam. The minimum flow at the dam is administratively set at 36,000 cfs by the Federal Power Commission License. Flows during the summer, fall and winter may vary each day from this low of 36,000 cfs to as much as 250,000 cfs. During the spring runoff, high flows from 250,000 cfs to 450,000 cfs are usually recorded. The annual average flow at the site is about 120,000 cfs whereas during low flow periods, flows may average around 60,000 cfs for one month. Average flows at Priest Rapids, based on 14 years of data, are shown in Figure 3.1-1.

The lowest flows experienced since the completion of Grand Coulee Dam on the Columbia River has been 32,000 cfs in 1943. This flow was due to activities related to the filling of Lake Roosevelt, the backwater of Grand Coulee Dam.

Temperature measurements of the water flowing in the Columbia River have been recorded both above and below the site for many years. Figure 3.1-1 summarizes temperature measurements on the Columbia River at Priest Rapids for eight years of record.

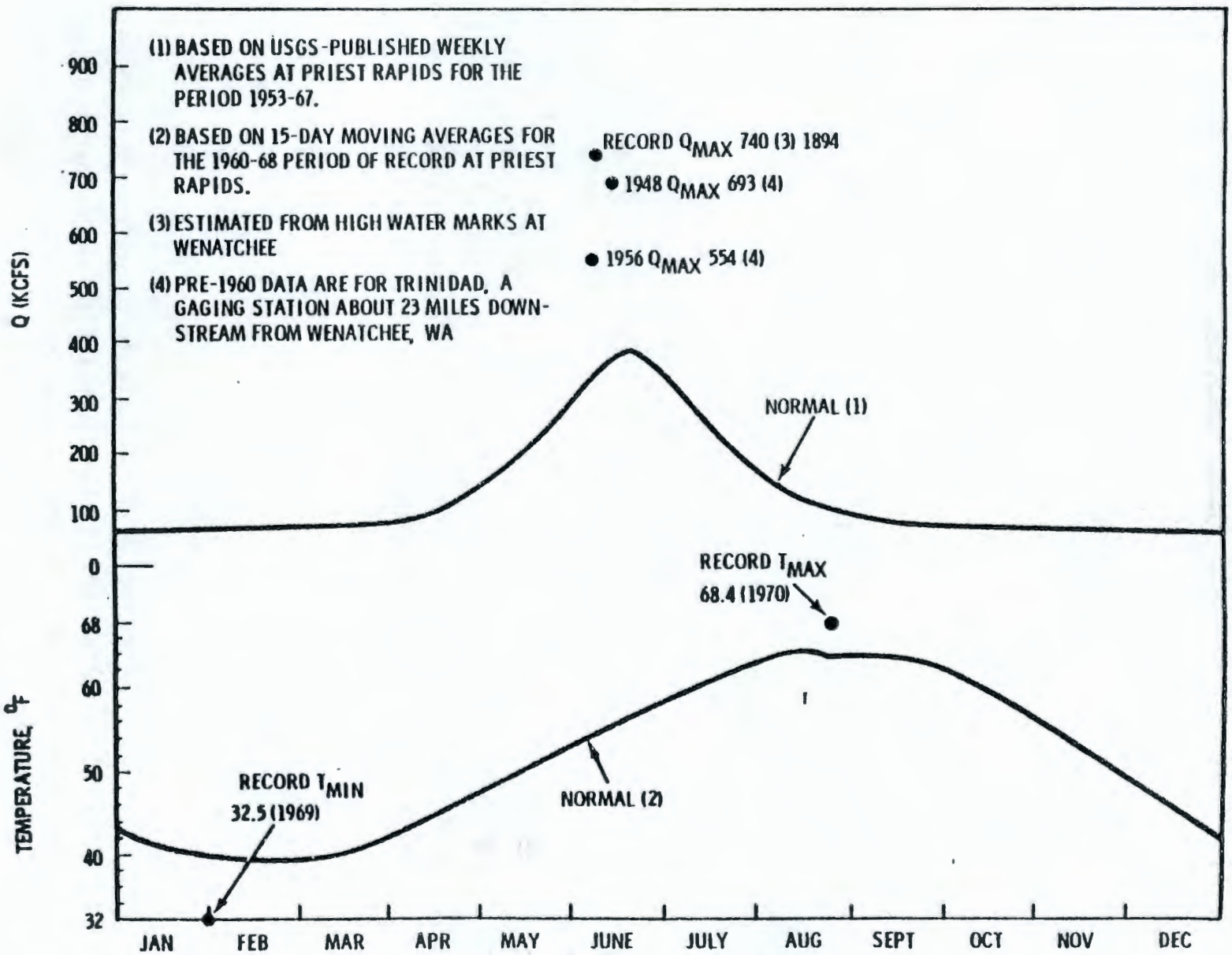

Figure 3.1-1
Average Flows and Temperatures of the Columbia River at Priest Rapids

The river stage at the HGP site, as a function of flow rate is given in Figure 3.1-2. Flow distributions and bottom contours are shown in Figures 3.1-3 & -4. Because of the local conditions, the river in the vicinity of HGP is vertically well mixed and shows a uniform vertical distribution of properties such as temperature and chemical constituents.

Table 3.1-1 lists chemical measurements taken 11 miles downstream from HGP. Additional water quality measurements for the Columbia River have been made directly above the Hanford Reservation for the water year 1972 by the U. S. Geological Survey and the Washington State Department of Ecology.[3-2]

The water quality of the Columbia River is quite good.[3-3] In the vicinity of the HGP, the dissolved solids have ranged between 73-120 mg/1, and the hardness between 65-85 mg/1. Dissolved oxygen concentrations are routinely near saturation levels. Occasionally seasonal dips occur, but they do not constitute any significant impairment of the water quality. Oxygen levels average around 11.0 mg/1 and range from about 8 to 13 mg/1. Coliform organisms average 30/100 ml in the reach below Priest Rapids Dam and range from 4 to 75/100 ml. Turbidity in the river is very low, generally measuring less than 5 Jackson Turbidity Units (JTU). The pH is normally slightly alkaline at 8-8.5 pH units.

Additional detail on the Columbia River is given in references 3-1 and 3-4.

Ground Waters

The unconfined aquifer in the portion of the Hanford Reservation near HGP is bounded by the Columbia River on the north and east. On the south and west the Gable Buttes and Gable Mountain basalt anticlines impede groundwater flow. The aquifer bottom is at an elevation of 335-350 feet MSL beneath the HGP giving a saturated aquifer thickness of from 35-65 feet in this area.

The unconfined aquifer is hydraulically connected to the Columbia River and seasonal variations in the groundwater table are

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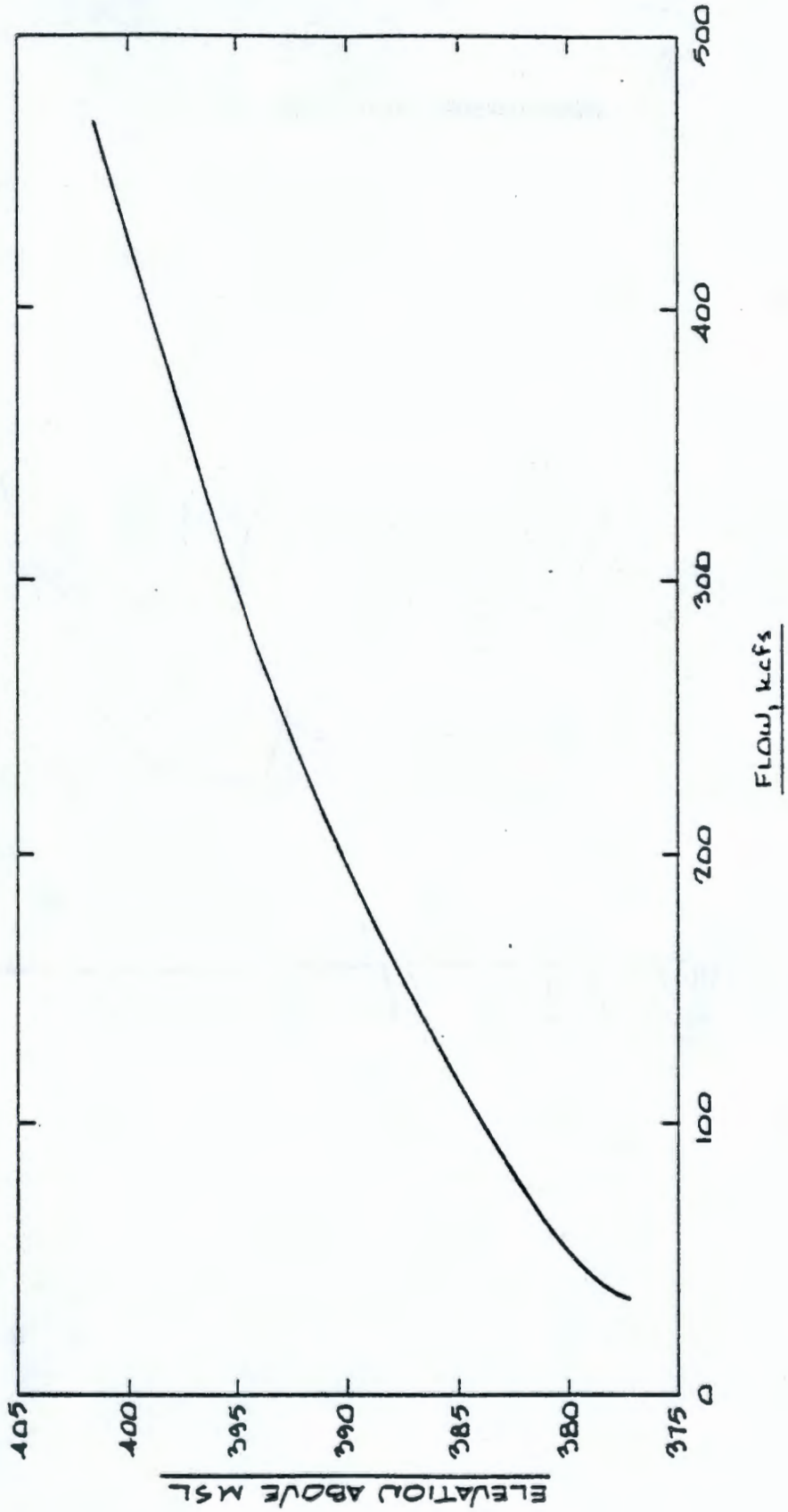

Figure 3.1-2
Elevation vs. Flow at Columbia River Mile 380.0

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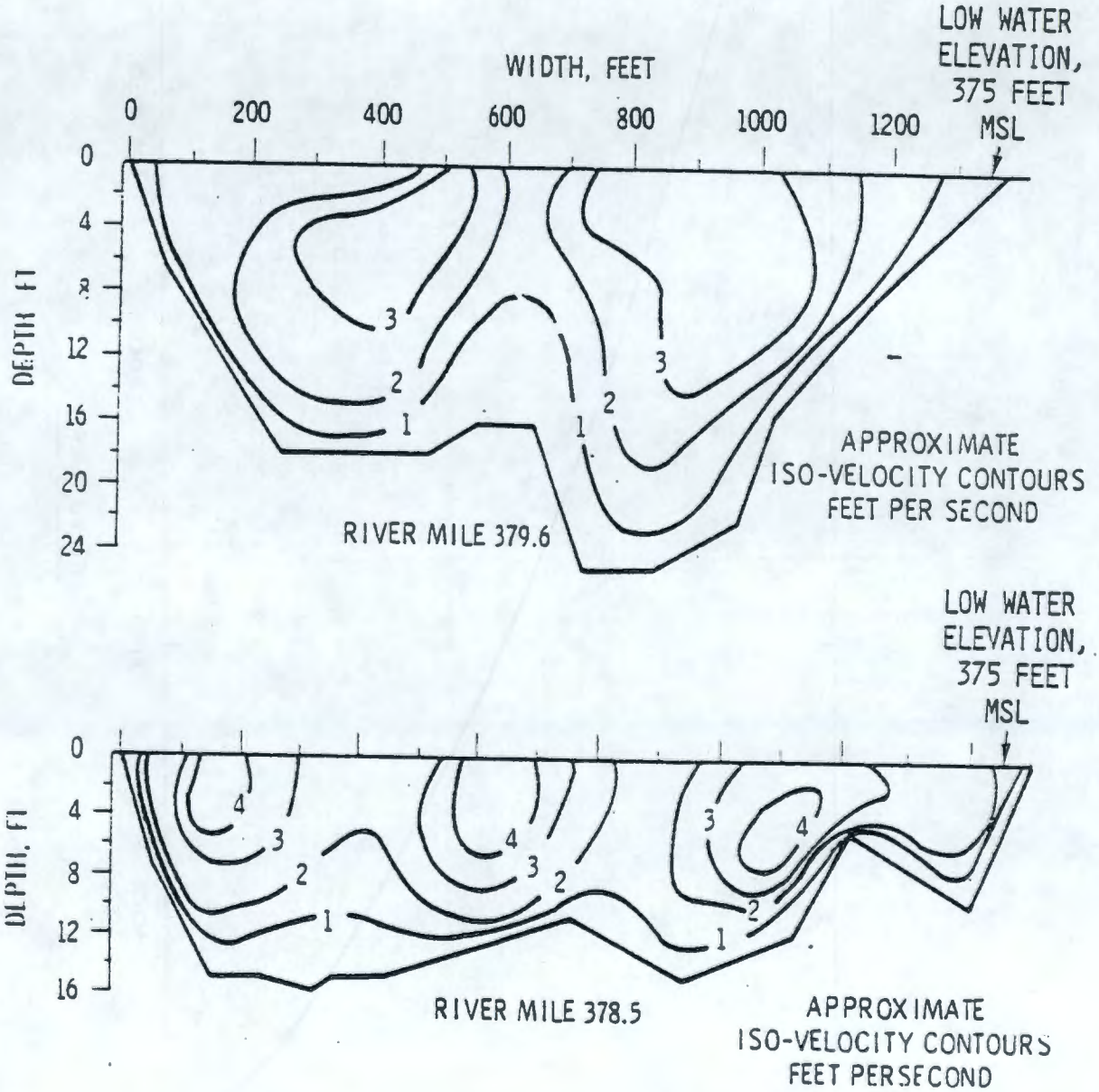

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Figure 3.1-3
Velocity Profiles at Low River Flows in the Vicinity of HGP

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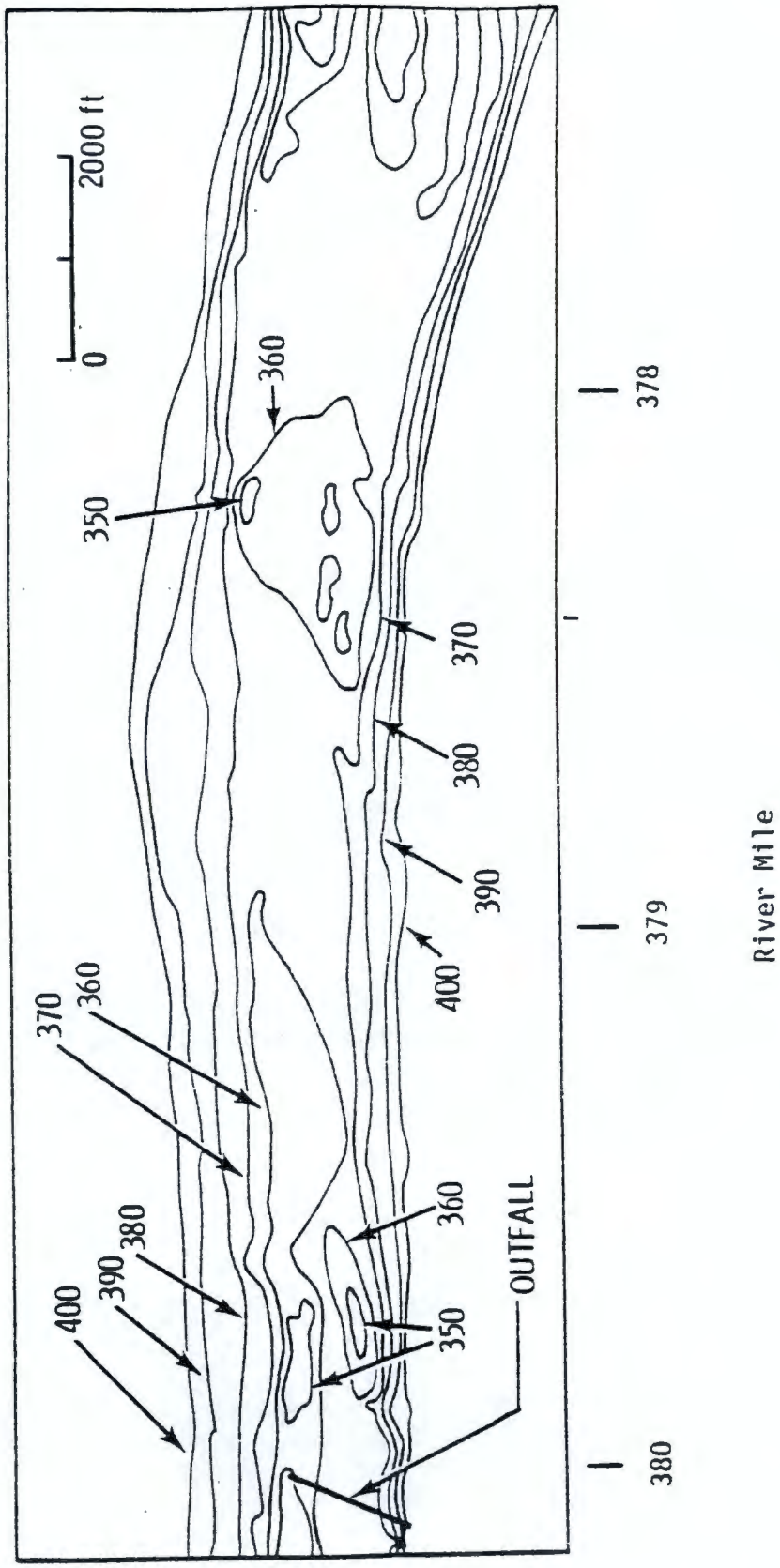

Figure 3.1-4
Columbia River Bottom Contours
in the Vicinity of HGP

TABLE 3.1-1

CHEMICAL CHARACTERISTICS OF
COLUMBIA RIVER WATER 1970
Results in parts/million

Date	Mg	Fe	Cu	Ca	SO_4	PO_4	Cl	Diss O_2	Phth Alk	MO Alk	Hard-ness	Solids
1/6	6.0	0.03	0.002	20.	15.	0.00	0.33	NA	2.0	68.	74.	93.
1/20	4.0	0.01	0.004	22.	15.	0.05	0.36	7.8	2.0	71.	73.	84.
2/3	5.0	0.01	0.002	21.	13.	0.06	0.33	12.	2.0	69.	72.	100
2/17	5.0	0.01	0.004	22.	19.	0.01	0.33	11.	2.0	68.	75.	100
3/3	5.4	0.02	0.003	22.	17.	0.04	0.26	8.3	1.0	65.	76.	96.
3/17	6.2	0.03	0.004	19.	17.	0.02	0.50	13.	1.0	65.	73.	81.
3/31	6.2	0.07	0.005	20.	17.	0.02	0.39	12.	2.0	69.	76.	81.
4/14	4.4	0.22	0.002	24.	20.	0.05	0.60	12.	1.0	66.	77.	100
4/28	6.3	0.12	0.005	22.	24.	0.02	0.56	12.	1.0	70.	82.	120
5/12	5.5	0.02	0.02	25.	23.	0.005	0.40	12.	2.0	72.	85.	100
6/16	4.6	0.00	0.01	22.	13.	0.04	0.29	11.	2.0	56.	68.	74.
7/21	4.2	0.09	0.007	23.	15.	0.02	0.16	9.6	1.0	61.	76.	75.
8/4	3.9	0.02	0.007	25.	17.	0.02	0.46	9.6	1.0	70.	78.	86.
8/18	4.0	0.03	0.004	24.	13.	0.02	0.26	8.9	1.0	70.	77.	110
9/8	4.8	0.03	0.005	23.	15.	0.08	0.43	9.0	3.0	70.	77.	73.
9/22	5.3	0.02	0.002	17.	13.	0.03	0.26	9.4	2.0	63.	65.	87.
10/6	4.0	0.03	0.003	21.	20.	0.02	0.66	8.2	2.0	66.	70.	99.
10/20	5.4	0.02	0.006	16.	12.	0.01	0.32	11.	0.0	92.	66.	80.
11/3	5.3	0.01	0.001	19.	18.	0.11	0.49	NA	2.0	70.	68.	80.
11/16	4.9	0.02	0.003	20.	15.	0.11	0.58	9.8	6.0	69.	70.	86.
12/1	3.8	0.01	0.002	20.	16.	0.01	0.46	NA	2.0	66.	65.	92.
12/15	6.6	0.01	0.000	18.	16.	0.11	0.53	NA	2.0	76.	73.	97.
Annual Average	5.0	0.04	0.006	22.	16.	0.04	0.40	10.	1.8	68.	74.	90.

NA indicates there was no analysis made. Analysis was made from single grab samples.

evident. Other variations in the water table are caused by disposal of water to the ground from ERDA facilities including the NPR.

Figure 3.1-5 shows the groundwater contours near HGP. A number of wells adjacent to the project have been monitored and the hydrographs for these wells are given in Reference 3-1.

The groundwater quality in this area has been monitored regularly. Nonradioactive chemical species identified include nitrate ion and chromium ion. Present nitrate ion concentrations vary from 3-6 ppm near HGP to 25-50 ppm 2 miles east of HGP. The recommended drinking water limit for nitrate is 45 ppm. No chromium ion as Cr^{+6} concentrations above the detection limit of 3ppb have been measured in the vicinity of HGP in recent years. The most recent temperature measurements were in 1974. At that time the groundwater temperature varied from 15 to greater than 21°C depending on location.

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3.1.3 Air

Meteorology data has been collected at two sites in the vicinity of HGP. A station was operated at the NPR site for a period of one year during 1970 where measurements of temperature and wind speed and direction were made. The station consists of a 300 foot tower with measurements being taken at the surface, 50, 200 and 300 feet. The other station is the Hanford Meteorology Station (HMS) located approximately 7.4 miles south of the proposed plant site and about 300 feet higher in elevation. Records at this station have been collected for a period of over twenty years.[3-5]

General Climatology of the Hanford Area

Hanford is in the rain shadow of the Cascade Mountains and receives precipitation on the average of only 6.25 inches annually. Precipitation during the 3 months November though January contributes 42 percent of this total, while the 3 months July though September contribute only 10 percent. There are only two occurrences per year of 24-hour amounts of 0.50 inch or more, while occurrences of 24-hour amounts of 1.00 inch or more number only four in the 25 years of record (1946-1970).

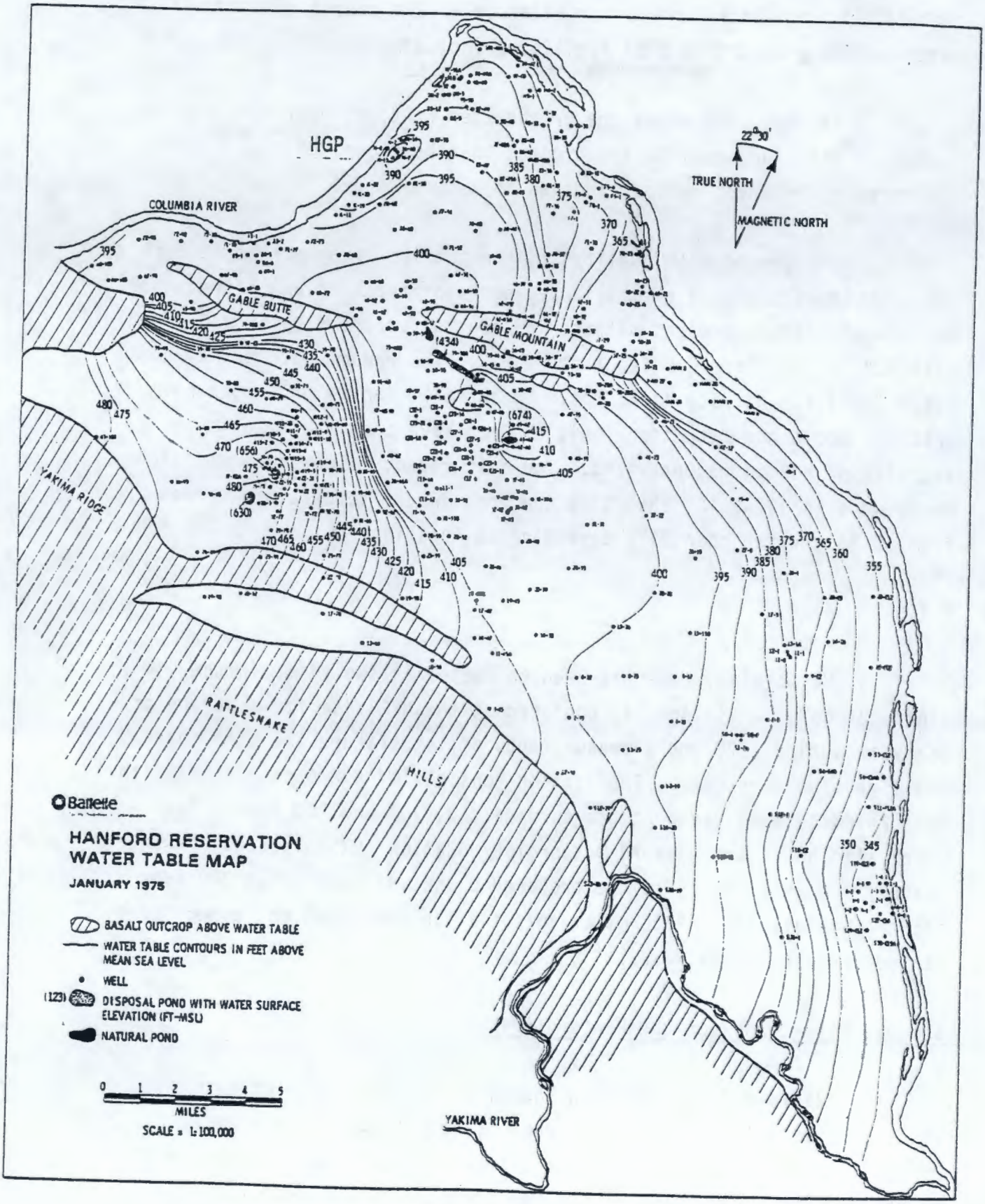

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Figure 3.1-5
Hanford Ground Water
Contours, January 1975

About 45 percent of all precipitation during the months December through February is in the form of snow. However, only 1 winter in 8 can expect an accumulation of as much as 6 inches on the ground. The average seasonal number of such days is 5, although the 1964-1965 winter had 35, 32 of which were consecutive.

By serving as a source of cold air drainage, the Cascade Mountains also have considerable effect on the wind regime at Hanford. This drainage (gravity) wind, plus topographic channeling, causes a fluctuating diurnal speed during summer. In July, hourly average speeds range from a low of 5.2 mph from 9 to 10 a.m. to a high of 13.0 mph from 9 to 10 p.m. In contrast, the corresponding speeds for January are 5.5 and 6.3 mph.

Although the gravity wind occurs with regularity in summer, it is never strong unless reinforced by frontal activity. It is also notable that, although channeling results in a prevailing WNW or NW wind the year around, the strongest speeds are from the SW direction.

Half of all winters are free of temperatures as low as 0°F. Six winters in 58 of record have contributed a total of 16 days with temperatures -20°F or below and in January-February 1950, there were four consecutive such days. There are 10 days of record when even the maximum temperature failed to get above 0°F. At the other extreme, in the winter of 1925-1926, the lowest temperature all season was $+22^{o}$F.

Although winter minima have varied from -27°F to $+22^{o}$F, summer maxima have varied only from 100°F to 115°F. However, there is considerable variation in the frequency of such maxima.

In 1954, for example, there was only 1 day with a maximum as high as 100°F. On the other hand, there have been 2 summers (1938 and 1967) when the temperature went to 100°F or above for 11 consecutive days.

Although temperatures reach 90°F or above 56 days a year, there have been only seven annual occurrences of overnight minima 70°F or above. The usual cool nights are a result of the gravity wind mentioned earlier.

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Air Quality

Air quality in the Hanford area, in terms of sulfur dioxide, nitrogen dioxide, and suspended particulates, is routinely measured by the Hanford Environmental Health Foundation. For the year 1971, SO_2 measurements in Richland averaged less than 0.02 ppm. At the other sampling stations the concentrations were below the detection limit of 0.01 ppm. The 1971 measurements for NO_2 and suspended particulates are shown in the following Table 3.1-2.

Table 3.1-2

Air Quality Measurements - Annual Averages for 1971

	NO_2 (ppm)				Suspended Particulate (gm/m^3)			
Location	# of Samples	Max.	Min.	Avg.	# of Samples	Max.	Min.	Avg.
Richland (747 Bldg.)	49	6.8	.06	.86	42	440	25	120
Ringold	166	0.028	.001	.006	-	-	-	-
White Bluffs	149	0.028	.001	.006	-	-	-	-

NOTE: (-) indicates no measurement was made.

Measurements of the particulate burden in air at a specific observation point 10 miles south of HGP showed values of around 100 micrograms per cubic meter of air when the wind was less than 8 mph. The particulate content increased when higher winds were present, averaging 1,000 micrograms per cubic meter with winds of 12 mph, and 3,000 micrograms per cubic meter with winds of 16 mph.

3.1.4 Terrestrial Ecology

The vegetation in the vicinity of HGP has been described as desert steppe, which is a nonforest vegetation in the dry interior of Washington. The land was grazed by herds of sheep and cattle more or less continuously from 1870 to 1940. Grazing by livestock was terminated when the site and thousands of surrounding acres were incorporated into the government-owned Hanford Reservation in the early 1940's. For 30 years vegetation use has been confined to

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fall and winter grazing by small herds of mule deer, flocks of Canada geese and populations of seed-eating pocket mice.

The presence of scattered, blackened stumps of sagebrush indicate that the Hanford Reservation formerly supported at least some sagebrush plants that have been destroyed by fire. Under pristine conditions, the site probably supported sagebrush with an understory of small perennial herbs characterized by the presence of sandberg bluegrass. Today many of the important plants on the site are aliens introduced into Washington with the advent of livestock grazing and agriculture. These alien plants are cheatgrass, tumblemustard and tumbleweed. The most common native plant species persisting are sandberg bluegrass, rabbitbush and sagebrush. There has been little tendency for the native plants to replace the alien plants even with the removal of livestock grazing pressure.

A vegetation analysis was conducted at five different locations near HGP.[3-1] Two of the locations presently support sagebrush while three do not. In all, 30 species (taxa) of vascular plants have been identified in the study. Of the 30 species, six are aliens. The amount of herbage produced annually is expected to be less than similar vegetation on the nearby Arid Land Ecology Reserve due to the extremely stony soil in the vicinity of HGP.[3-6] It is expected that the herbage yield will vary greatly from year-to-year depending upon the weather.

Streamside vegetation is not well developed along the Columbia River shore. This is partly due to the presence of boulder, cobble and gravel substrates along the Columbia. However, there are shrub willows, grasses, sedges, rushes and forbs that do grow in the cobble substrates.

Although streamside vegetation is very limited geographically it provides the only source of succulent green forage for animals during the summer when the upland vegetation is dry from summer drought. During spring the streamside vegetation provides important nesting areas for geese and several species of gulls. Mule deer and other herbivores subsist mainly on the streamside vegetation during the summer. Streamside vegetation is also important as a winter food source for birds in the steppe region of Washington.

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Historically, large trees such as native cottonwoods and willows were not associated with the Columbia River in Benton and Franklin Counties. With the settlement of the region, non-native trees were planted for shade and ornamental purposes. The trees most often planted were white poplar, Lombardy poplar, Siberian elm and black locust. Some of these trees are still living and provide nesting sites for large raptors such as the Swainson's hawk and great horned owl.

Canada geese and chukars are popular game birds in Southwestern Washington and are resident on the Hanford Reservation.[3-1] Over a period of years, 1953-1970, the nesting population of geese on the Columbia River islands has ranged between 123-306 pairs. Canada geese also utilize the Columbia River islands as a resting site during winter migration when large flocks (100-1000 birds each) congregate and make daily foraging flights from the river sanctuary to surrounding fields. The chukar is an exotic upland game bird that has been purposefully introduced to the semiarid regions of the Pacific Northwest. Although chukars are occasionally seen in the vicinity of HGP, this habitat is not regarded as ideal.

Mule deer are the largest mammals found on the Hanford Reservation. The major concentration of animals is adjacent to the Columbia River where drinking water is available and food and cover are provided by riparian herbs, shrubs and trees. Recent populations have been more or less stable at about 400, with surplus animals probably leaving the reservation. During fall and winter, deer forage upon the new growth of cheatgrass and will travel off the Reservation to feed upon orchard trees and crop plants. With no hunting, the deer have become quite tame and browse on the HGP grounds.

There are a number of smaller animals that occur in the area of HGP such as pocket mice, deer mice and black-tailed jackrabbits. These are important as food items for predatory birds (gulls, eagle and great horned owls) and mammals (coyote). The most important song birds are the Western meadowlark and the horned lark. Raccoons are common along the Columbia River.

There are no species or subspecies of vertebrate animals frequenting the environs of HGP that are considered endangered.[3-7] Some bird species

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are believed to be showing populaton declines or range diminution in all parts of their ranges, but are not now of sufficient rarity to be considered endangered.[3-8] The birds from this latter list that have been seen in the vicinity of HGP are Swainson's hawk, marsh hawk, osprey, prairie falcon, sparrow hawk, burrowing owl and loggerhead shrike.

Insects play important roles in cheatgrass ecosystems. Grasshoppers sometimes appear in pest abundances while darkling beetles are often the most conspicious insect in late autumn. Insects provide important foods for birds and certain species of mammals, such as darkling beetles which are avidly eaten by coyotes during the beetles' autumnal emergence.

3.1.5 Aquatic Ecology

The aquatic ecology of the Columbia River can be characterized by considering the status of three major communities. These are the benthic (bottom dwelling) community, the plankton (drifting organisms) community and the fish. Summaries of the many previous studies on the aquatic environment of the Columbia River are given in references 3-1 and 3-4. Two recent studies pertinent to River are references 3-9 and 3-10.

Benthic

The most predominant forms in the benthic community are midgefly and caddis fly larvae. On a weight basis, caddis fly larvae and molluscs predominate. Comparative artificial substrate data indicate that the density of benthic animals in shallow ripple areas are twice the abundance of those found in 10-15 feet of water. Benthic insects provide the major food item for both fry and juvenile chinook salmon during the spring and early summer in the Hanford reach of the river.[3-11]

The periphyton (attached organisms on any substrate) community is dominated by diatoms and appears to be maintained in a subclimax state of regrowth and recolonization due to the grazing of aquatic fauna and erosion from the river's flow.[3-12] Filamentous green algae are seasonally abundant during the spring.

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Rooted plant communities are commonly found in the sloughs and backwaters but have been precluded from growing near the HGP by the presence of cobble substrate shoreline and widely varying river flows.

Plankton

The phytoplankton (microscopic drifting plant life) is dominated by diatoms. Analysis of phytoplankton data collected during the summer of 1973[3-9] indicates the community is homogenous from top to bottom and side to side and is dominated by Asterionella and Fragilaria with Melosira, Synedra and Tabellari constituting the majority of the remaining population. Historically, the annual cycle of phytoplankton shows a major diatom pulse in the late spring and a minor fall pulse.

The major crustacean zooplankton (microscopic drifting animal life) are bottom cladocera which are restricted principally to slack water environments such as sloughs and the river shallows. The cladocerans show a seasonal maximum in the early spring and a minimum in the fall. However, they are only a minor dietary item (less than 0.3% of total diet) to salmon in the Hanford portion of the River. Copepodes, ostracods and amphipods are associated with the Cladocerans only as a minor component. Rotifers and protozoans are most abundant during the warm season.

Fish

Forty species of fish have been reported as being in the Hanford area of the Columbia River. None of the species present are considered rare or endangered.[3-13] The salmonids* represent the major species of interest and the main emphasis of past fisheries research has been directed at these populations. Locally important resident game species normally expected to be found in the area include bass and other spiny ray fish, catfish, whitefish, and sturgeon. Valuable anadromous** species that migrate through the Hanford

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* Salmonids refers to both salmon and trout.

** Anadromous refers to fish that breed in fresh water but spend most of their adult life in the ocean.

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reach on their way to and from spawning areas include chinook, sockeye, and coho salmon, steelhead trout and American shad.

The fish species of greatest importance from both a commercial and recreational viewpoint in the Hanford reach of the Columbia River are the salmon and steelhead. These fish spend most of their life in the marine environment and are in freshwater only during their early life stages and as mature adults returning to spawn.

Construction of hydro-electric dams has resulted in inundation of the majority of the Columbia River spawning grounds. The 50 miles of river downstream from Priest Rapids Dam, which includes the HGP site, represents the only remaining unimpounded water on the mid Columbia River.

The salmonids all have a similar life cycle yet each species and race matures at a different rate and has different timing and duration of the life states and activities. These species and their activities indigenous to the Hanford reach of the Columbia River are shown in Figure 3.1-6.

Adult salmonids move through the Hanford portion of the river during all months of the year, but the greatest numbers pass through primarily from April to November. Fish typically migrate near the shoreline along the northerly side of the river opposite the plant site. The 1975 salmon counts [3-14] at Priest Rapids Dam upriver from the HGP were 8,200 adult spring chinook, 19,900 adult summer chinook, 2,900 adult fall chinook, 55,200 sockeye salmon and 1,800 coho salmon. Adult steelhead counts at Priest Rapids Dam for the period 1960-1975 range from a high of 13,006 in 1966 to a low of 2,462 in 1975. The average is 7,705.[3-15] Steelhead counts at Priest Rapids Dam have fluctuated widely since they were started in 1960.

Estimates of fall chinook salmon spawning in the Hanford Reach have been made continuously since 1947 by making aerial counts of redds. In the last ten years the number of redds observed in the Hanford Reach have ranged from 738 in 1974 to 4508 in 1969 and averaged 2643. Additional salmonid spawning in the Hanford Reach of the Columbia include an estimated 10,000 steelhead trout annually.

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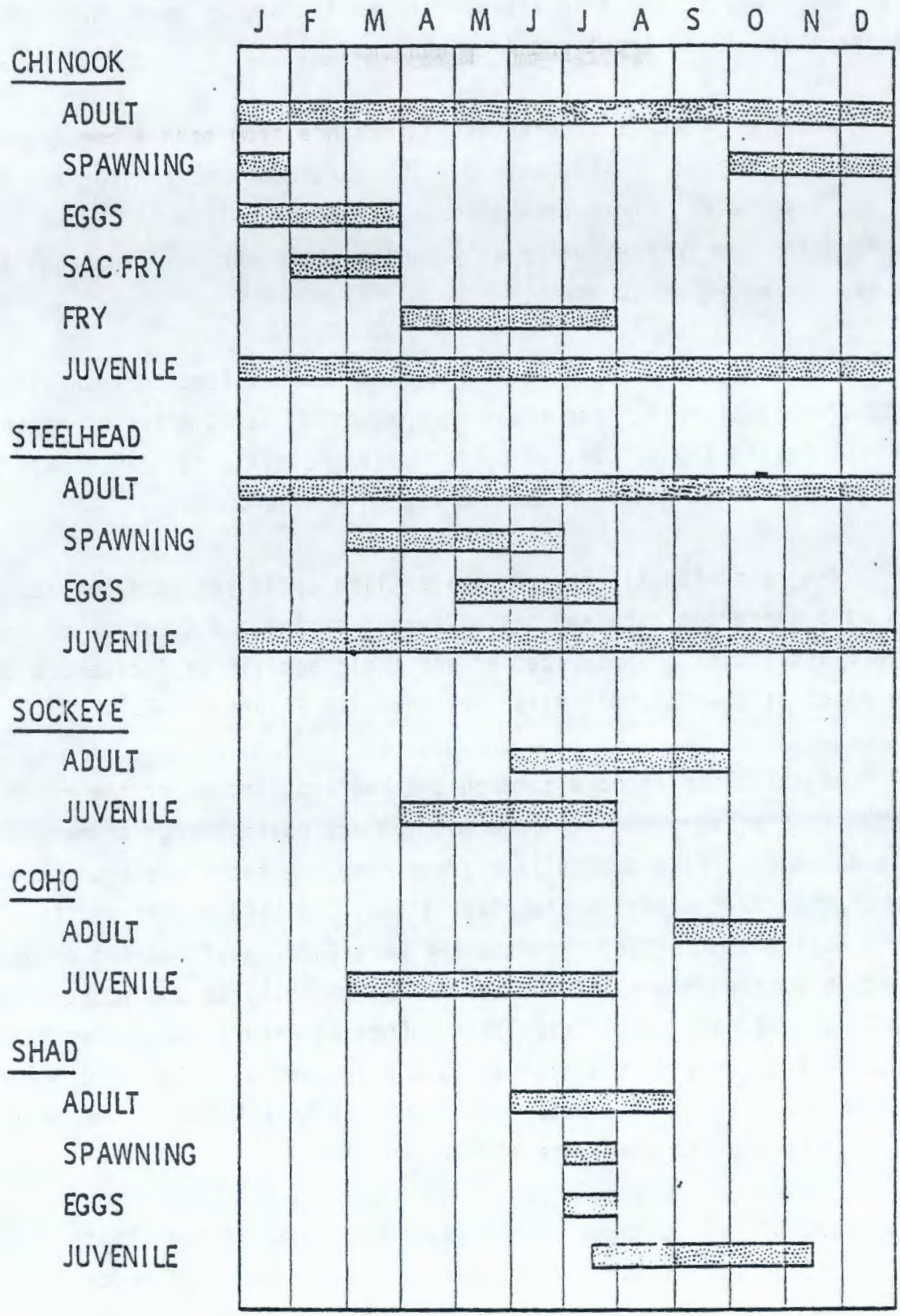

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Figure 3.1-6
Summary of Species and Activities for Andromous Fish in the Hanford Reach of the Columbia River

Fall chinook salmon spawn both above and below the HGP.[3-16] The closest major downstream salmon spawning area is located approximately 8 miles below the HGP. A minor spawning area occurs about four miles below the HGP. Midway Bar is a major spawning area located about 14 miles upstream from the HGP.

The salmon generally hatch and emerge from the gravel in February and March. Peak migration for juvenile sockeye, coho and steelhead is during May. Peak migration for fall chinook occurs from April to July.

As part of the effort to define the ecological characteristics of the free-flowing stretch of the Columbia River, investigations have been conducted for about 10 years on the effects of various diseases on the fish populations. The effect of environmental factors on diseases in resident fish and migrating salmonids in the Columbia River System with emphasis on water temperature and its relation to columnaris, furunculosis and dermocystidium disease have been investigated.[3-17,3-18] Columnaris and furuniculosis diseases are considered the most serious of bacterial fish pathogens in fresh water systems. Dermocystidium, a problem with salmonids presently unique to the Columbia River, is currently being studied because of major disease epidemics that have occurred among salmonids in spawning channels and in natural spawning areas.[3-19]

Investigations have suggested that strains of C. columnaris of high virulence were found in the Columbia River Basin, but not in waters of Western Washington.[3-20] Increases in temperature have been associated with increases in incidence of exposure and infection of resident fish and transmission of the disease to migrating salmonids in the river. The severity of the disease depends more on the occurrence of temperatures approaching 10°C (50°F) earlier in the year and the length of time temperatures stayed above this level than on the peak temperatures in late summer. In normal river flow and temperature years the disease occurs in late June or early July remaining evident through the end of November.[3-21] During migration under normal river temperature conditions, Spring-run Chinook salmon are not seriously exposed to C. columnaris disease.

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Furunculosis and dermocystidium are diseases mainly associated with fish hatchery and rearing facilities. Furunculosis has been shown to be endemic[3-18] among coarsefishes and can be transmitted to upstream migrant salmonids.

3.2 HUMAN ENVIRONMENT

3.2.1 Regional

HGP is a generation resource which provides base load energy for use throughout the Pacific Northwest region. The principal elements of the regional setting are briefly summarized in this section to provide a basis for considering any regional impact of the proposal. A more extensive discussion of the regional characteristics can be found in Chapter 2 of the WPPSS Supplemental EIS for WNP-4 and 5.[3-22] While the "West Group" discussed in Section 3.2.3 has slightly different boundaries, the majority of the population is in the States of Washington, Oregon and Idaho and a discussion of human environment on either of these defined areas would be substantially the same.

The total land area of the Pacific Northwest is comprised primarily of the states of Washington, Oregon and Idaho with a total land area of 151 million acres. The distributional split of this acreage is 28%, 38% and 34%, respectively.

The total population for these states was 6.23 million in 1970. The distributional split of this population for Washington, Oregon and Idaho was 54.8%, 33.7% and 11.5%, respectively. Between 1970 and 1973, the population of these states grew at an annual compound rate of 0.98%. The distributional split of this growth for Washington, Oregon and Idaho was 0.11%, 1.91% and 2.36%, respectively. It should thus be noted that Idaho, with the smallest population, grew the fastest, mostly due to in-migration.

The total employment for the states was 2.45 million in 1970. The distributional split of these jobs for Washington, Oregon and Idaho was 52.4%, 35.7% and 11.8%, respectively. Between 1970 and 1973, the

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employment grew in these states at an annual compound rate of 1.61%. The distributional split of this growth for Washington, Oregon and Idaho was 1.41%, 2.05% and 1.14%, respectively.

The total electricity consumed in 1971 by export-oriented or basic industries of the Pacific Northwest was estimated to be 48.8 million kilowatt hours. The largest user of this electricity was the Aluminum Refining Industry, using 42% of the total of 48.8 million kilowatt hours consumed by these basic industries. Other basic industries consuming large amounts of electricity were Paper and Allied Products (12%), Chemical and Allied Products (11%), Agriculture (7%), and Lumber and Wood Products (7%). The total electricity consumed in 1971 by nonexport-oriented industries of the Pacific Northwest was estimated to be 22.9 million kilowatt hours. The largest user of this electricity was the Electric Services Industry, using 42% of the total electricity consumed by these nonbasic industries. Other nonbasic or nonexport-oriented industries consuming large amounts of electricity were Wholesale and Retail Trade (19%), State and Local Government (14%), Individual, Business and Government Services (13%), and the Fire, Insurance and Real Estate Industry (6%).

In terms of the potential for water pollution in the Pacific Northwest, the existing water quality indicates that the watersheds which presently show deterioration are the following: Puget Sound; intersection of the Columbia, Snake and Yakima Rivers; Lower Willamette-Columbia Rivers; Grays Harbor; Lower Boise River and Snake River below Weiser; Snake River below Lewiston; Snake River below Twin Falls; Snake River below Idaho Falls; Clark Fork River below Missoula, and Lower Spokane River.

In terms of the potential for air pollution in the Pacific Northwest, the existing air quality indicates that the air sheds which presently show deterioration lie in the Willamette-Puget Sound Trough (Portland, Vancouver, Salem, Seattle, Tacoma, Olympia, Longview and Kelso), and the eastern portion of the Columbia Plateau (Spokane).

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Three high voltage transmission line interconnections (two 500 kV ac, one 800 kV dc) of the Pacific Northwest-Pacific Southwest Intertie have been completed and are now in operation. Two 500 kV ac lines interconnect the Federal Columbia River Power System with British Columbia, Canada, and several 230 kV ac lines interconnect the eastern portion of the system with utilities in adjacent Canadian provinces and the Mountain States. These interconnections provide, in addition to mutual support in the event of a breakdown or emergency, the means to carry capacity and energy which is temporarily surplus to the Pacific Northwest needs to these areas, and conversely to carry surplus capacity and energy from these areas into the Pacific Northwest. Excess energy available in the Northwest (due to above critical streamflows) may replace burning oil to generate electricity in Southern California. When energy from HGP is not needed to meet Pacific Northwest needs and when the excess hydro-energy is not sufficient to fully utilize the transmission capacity, energy from HGP can also be used to replace operation of oil fired central power stations in California.[3-23]

Southern California is a region with serious air quality problems. A large fraction of the electrical generating units in that region burn oil as fuel. Efforts are being made throughout the region to reduce all emissions from burning of oil and oil products, including emissions from electrical generating plants.

Additional population characteristics are given in reference 3-22.

3.2.2 Local

Staff

The majority of the employees working at the HGP and the NPR and associated fuel cycle facilities live in the Tri-Cities. The other employees live primarily in Yakima and the Yakima valley area. These workers commute substantial distances each day either in private cars (usually car-pooling) or in ERDA provided buses.

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HGP presently employs 46 staff members. United Nuclear Industries (UNI), which operates the NPR for ERDA, has 810 staff, although not all are directly associated with the day to day operation of the NPR. The Atlantic Richfield Hanford Company (ARHCO), the ERDA contractor responsible for NPR fuel processing, employs about 200 - 250 in activities related to the fuel processing for NPR. Of the total UNI and ARCHO staffs about 850 are employed in jobs directly related to the continued operation of the NPR. These positions are long term positions providing employment supportive of community stability.

Community

The population figures in Table 3.2-1 show the size and suggest the growth rate of the Tri-Cities area.

The Tri-Cities has been experiencing a high growth rate during the last few years. Part of this growth is based on construction of WPPSS Nuclear Projects 1, 2, and 4, construction and operation of various ERDA projects, including FFTF, and substantial agricultural and associated food processing growth. The Tri-Cities human environmental conditions were recently presented in a study[3-24] where a detailed assessment of community characteristics and infrastructure is given.

Additionally, a number of taxing districts have compiled substantial information on the operations of the various Tri-Cities governments to provide a basis for claims to WPPSS for the construction work force impact associated with WPPSS Nuclear Projects Nos. 1, 2, and 4. This document suggests, in the opinion of the consulting firm compiling that information, that the various governmental services are expected to be stressed in upcoming years.[3-25]

Archaeological/Historical

No historic places as listed in the "National Register of Historic Places"[3-26] occur in the vicinity of the HGP.

Archaeological investigations were conducted near HGP in 1972[3-27] when it appeared that future construction activities might disturb

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Table 3.2-1

Tri-Cities and Surrounding Area Populations

Area	1970*	1974	1975	1976
Benton County	67,540	69,800	73,250	78,700
Unincorporated	19,837	19,528	20,551	21,507
Incorporated	47,703	50,272	52,749	57,443
Benton City	1,070	1,128	1,315	1,422**
Kennewick	15,212	16,800	18,253	21,301**
Prosser	2,954	3,100	3,104	3,150
Richland	26,290	28,000	28,600	30,009**
W. Richland	1,107	1,247	1,477	1,561**
Franklin County	25,816	26,200	26,620	27,500
Unincorporated	9,622	9,958	10,091	10,510
Incorporated	16,194	16,242	16,609	16,990
Pasco	13,920	14,100	14,450	14,618**

* US Census 1970

** Census counts by OPPFM

Source: Socio-Economic Input Study WNP-1/4, Vol. 1, First Progress Report Review Draft, WPPSS, September 1976. (3-23)

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itentified sites. One site was salvaged and the information interpreted.[3-27] The continued operation of HGP will not effect the salvaged site or other nearby sites of potential significance.

Additional Population Characteristics

Additional population characteristics are given in reference 3-22 and 3-24.

3.2.3 The Need For Power

The West Group Forecast

Long range power planning in the Pacific Northwest is co-ordinated by the Pacific Northwest Utilities Conference Committee (PNUCC). Each year this group publishes the "West Group Forecast of Power Loads and Resources".[3-28] This forecast is a compilation of forecasts of the individual utilities in the West Group.* A number of different methodologies are used by the individual utilities in their forecasts, but the most common technique is the building block approach. In this method the growth factors for each individual component of the load are analyzed based on knowledge of local conditions. These building blocks are then aggregated to get total service area load. Numerous detailed descriptions of load forecasting methodologies used in the Pacific Northwest are available.[3-29, 3-30]

An econometric model has been developed to forecast total West Group load. This model explicitly accounts for growth rates in various sectors and price effects on energy consumption to project future demands. The model was applied to the West Group and the range of load values predicted by the model bracketed the single yearly values projected by the conventional West Group forecasts.[3-31]

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* The "West Group" consists of the States of Washington, Oregon and Idaho and part of Western Montana. Also included are minor portions of the northern parts of Utah, Wyoming, Nevada and California.

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The resources available to the West Group for generation are also computed by the PNUCC and included in Reference 3-28. Available resources are calculated using critical (low river flow) values for hydro generation.

The results of the March 1, 1976, West Group forecast of loads and resources are summarized in Table 3.2-2. Line 3 shows the net balance between peak* loads and resources by year. For all years shown, there is a surplus of peaking capacity in the region.

Line 6 summarizes the net balance between energy** loads and resources by year. As contrasted to the data on peak loads and resources, the energy data show a deficit in all years. This deficit is most severe in the period of 1978 - 1983 where it is always in excess of 2,000 MW average energy. The HGP is not included in Table 3.2-2 as an energy resource after October 1977 since the current agreement for its operation requires modification by that date to permit continued operation. Continued operation of the HGP would annually add up to five billion kilowatt hours of energy to the system. The energy contribution is roughly equivalent to 570 average MW. Thus the deficit, could be significantly reduced, but not eliminated

Although Line 6 shows an energy deficit in all years, the actual occurrence of a deficit in a given year depends on water conditions and this in turn is a probabilistic phenomenon. The annual energy deriveable from the hydro units counted as resources in Table 3.2-2 is calculated on critical period flow when extremely low water is experienced in Pacific Northwest rivers. In actual practice, the flows will quite likely be higher than this and the energy available from the hydro units will be greater than that indicated. The West Group Forecast reflects this probability as shown in Lines 7 and 8 of Table 3.2-2. Based on historic flow data and a Monte Carlo model, the probability of having an energy deficit in any given year is calculated, and the result is shown on Line 7. These data indicate that the most critical period

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* Peak loads refer to the greatest instantaneous loads expected during the year.

** Energy loads refer to the total energy required throughout the entire year.

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TABLE 3.2-2

ESTIMATED LOADS AND RESOURCES EXTRACTED FROM THE WEST GROUP FORECAST

JULY 1976 - JUNE 1987

Figures are Megawatts

	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
PEAK Loads and Resources											
1. Total Area Peak Load (January)	23,136	24,626	26,108	27,476	28,917	30,245	31,658	33,081	34,608	36,200	37,896
2. Peak Resources	24,280	25,334	28,133	29,984	30,523	31,172	31,996	35,335	34,847	36,906	37,982
3. Peak Surplus, Line 2 minus Line 1	1,144	708	2,025	2,508	1,606	927	338	2,254	239	706	86
ENERGY Loads and Resources											
4. Total July-June Energy Load	14,953	15,883	16,902	17,722	18,623	19,418	20,265	21,134	22,027	22,959	23,943
5. Energy Resources	14,332	14,592	14,749	15,490	16,270	16,999	17,743	20,045	21,086	22,492	23,496
6. Energy Surplus, Line 5 minus Line 4 (Parenthesis implies an energy deficient)	(621)	(1,291)	(2,153)	(2,232)	(2,353)	(2,419)	(2,522)	(1,089)	(941)	(467)	(447)
PROBABILITIES of Meeting Energy Loads											
7. Year Shown -%	97.0	87.2	80.2	82.2	77.0	76.6	79.4	82.4	90.2	91.4	88.2
8. Years, 1976 Through Year Shown -%	97.0	84.2	69.4	59.0	45.8	36.8	31.0	27.2	24.6	23.0	21.2

Source: West Group Forecast of Power Loads and Resources July 1976-June 1987, Pacific Northwest Utilities Conference Committee, March 1, 1976.

is 1980 - 1983, where the probability of meeting total energy loads is less than 80 percent (or the probability of having an energy deficit is greater than 20 percent). These probabilities are computed with the HGP as a resource through October 1977. With continued operation of the HGP the probability of meeting total energy loads could be increased an average of about 5% in the critical period 1978 - 1983 and in some years as much as 7%. Hence, instead of probabilities of not meeting load being on the order of 20-25%, they would be on the order of 15-20%.

The probability of meeting the energy load without operation of HGP as a base load resource each year consecutively from 1976 to the year indicated is shown in Line 8. For example, the probability of having sufficient energy for all years between 1976 and 1983 is only 31%, or there is a 69% chance that during one year between now and 1983 there will be an energy deficit in the Pacific Northwest. With continued operation of HGP as a base load resource the probability of meeting the energy load in all years is improved by over 10%.

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Other Forecasts

The West Group forecast, as supported by econometric modeling, provides utility planners in the Pacific Northwest with a reasonably expected level of demand for electricity at given times in the future. Other studies relating to the West Group forecast have recently been published.[3-32, 3-33]

Projections for total energy use (including electricity, natural gas, petroleum, coal, and uranium) in the Pacific Northwest were recently made.[3-32] This study projected 1980 electrical energy use of between 13,400 average MW and 16,000 average MW as compared to the West Group forecast of about 17,700 average MW. The study projected 1990 electrical energy demands from 14,600 MW to 20,700 MW as compared to West Group forecasts* of 27,200 MW. Demands forecasted by this study consistently fall below the West Group forecast. The reasons for this

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* This forecast is from Reference 3-34 which extends the West Group forecast from 1987 through 1996.

are presented in detail in Reference 3-35 and include the structure of the model used and the assumptions made relating to growth rates and price effects. The differences in projected load demand represent differing professional opinions as to a probable course of future events. Neither forecast precludes the reasonableness of the other forecast nor passes judgement as to the likelihood of which forecast will in fact occur.

The State of Oregon is in the process of developing a forecasting model. Preliminary calculations with the model revealed a number of deficiencies. Work is continuing on the model.

Conservation of energy is one of the more important factors which must be considered in the development of load forecasts. None of the forecasting methodologies presently in use explicitly take conservation into account. Instead, conservation is implicitly considered in the forecasts through such variables as the increase in consumption per capita and price elasticity. One popular method[3-33] of estimating the potential of conservation is to examine the percent savings in the energy demands forecast for some future time by certain individual actions or by implementing certain strategies. These percent savings are then deducted from the demand forecast. While this approach identifies the relative potential associated with various actions or strategies, it does not recognize the extent to which these conservation actions are already incorporated into the load forecasts. The West Group forecast made in 1976 shows loads between 5 and 7% lower in the years 1981-1985 than the West Group forecast made in 1974. This reflects to some degree an expectation of conservation efforts.

The emphasis placed on conservation and wise energy use can be expected to affect the levels of demand actually experienced. Utilities in the Pacific Northwest are presently encouraging conservation and the wise use of electrical energy. Additional programs outside the scope of utility powers and responsibilities could be implemented by federal, state or local governmental bodies.

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CHAPTER 4

ENVIRONMENTAL IMPACTS OF THE PROPOSAL

The elements of the environment considered in this EIS are listed in Table 3.0-1. As stated in the introduction to Chapter 3, since no elements of the environment are significantly affected, all of the elements of the environment listed in Table 3.0-1 should be marked "Not Applicable." However, to assist the reader in identifying where each of the elements are discussed the sections numbers for each element are included in Table 3.0-1.

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4.1 PHYSICAL IMPACTS

4.1.1 Water

Heated Effluent Distribution

The thermal patterns of the once through cooling water discharged from HGP into the Columbia River were measured in a series of studies conducted in October 1972. The studies[4-1] were conducted using aerial infrared sensing equipment which recorded the surface temperatures produced by the thermal plume downstream from HGP. Examples of the results of these tests are shown in Figures 4.1-1 through 4.1-6. Figures 4.1-1, -3, and -5 show the far field temperature patterns measured at river flow rates of 44,000, 88,000 and 134,000 cfs, respectively. Figures 4.1-2, -4, -6 show the detailed surface temperatures measured close to the discharge ports for each of the three river flows. In these detailed figures each patterned square represents the average temperature measured for the area covered by the square. The HGP cooling water flow rate and temperature rise during these tests were 1260 cfs and 32°F respectively. The ambient Columbia River temperature was 57°F.

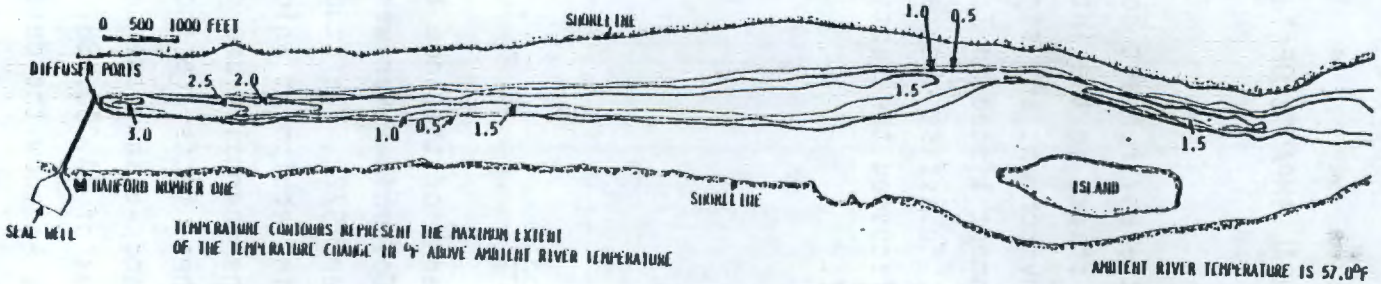

Figure 4.1-1
HGP Thermal Plume - Far Field
Temperature Patterns River
Flow 44,000 cfs

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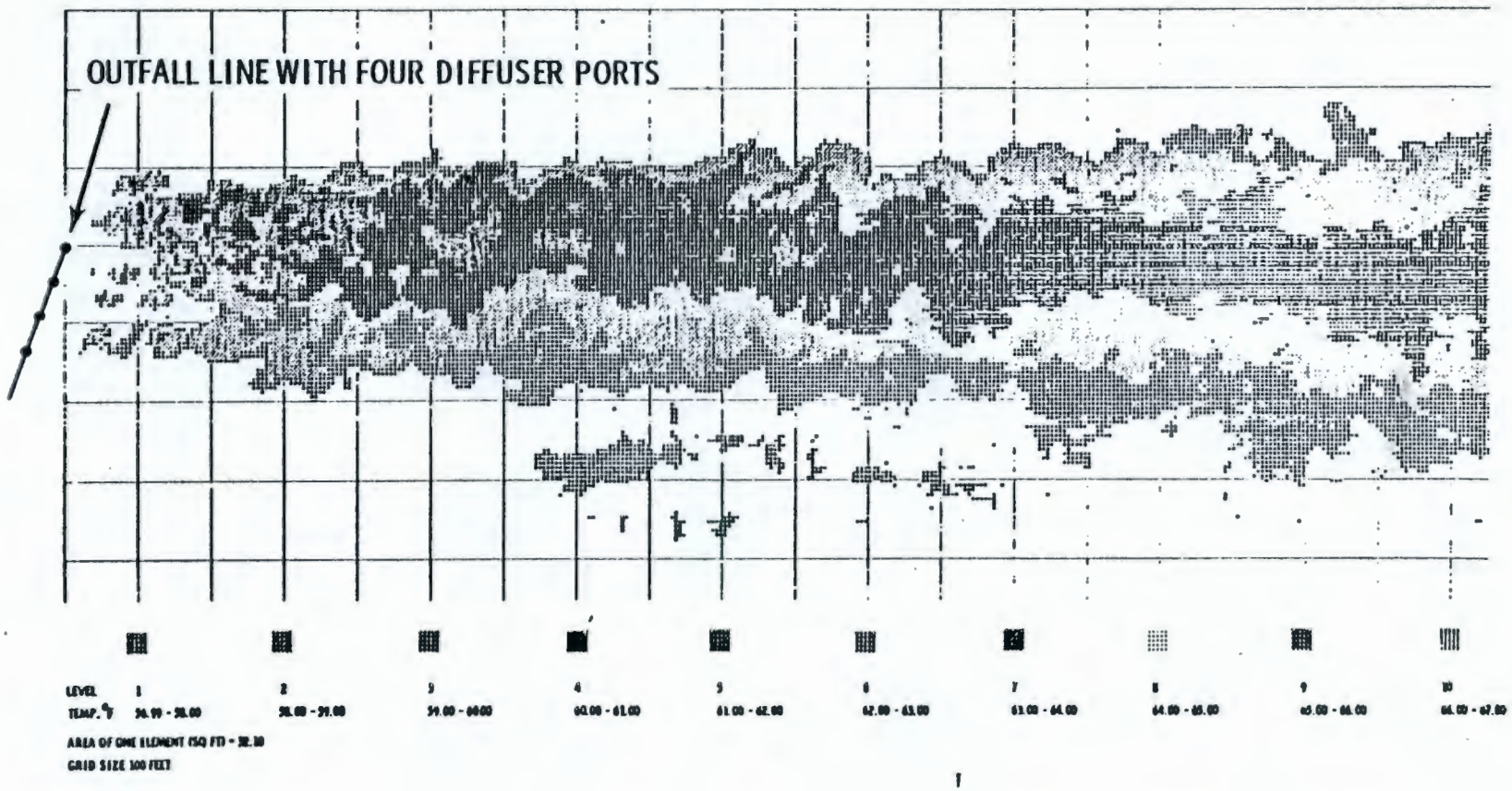

Figure 4.1-2
HGP Thermal Plume - Near Field
Temperature Patterns River Flow
44,000 cfs

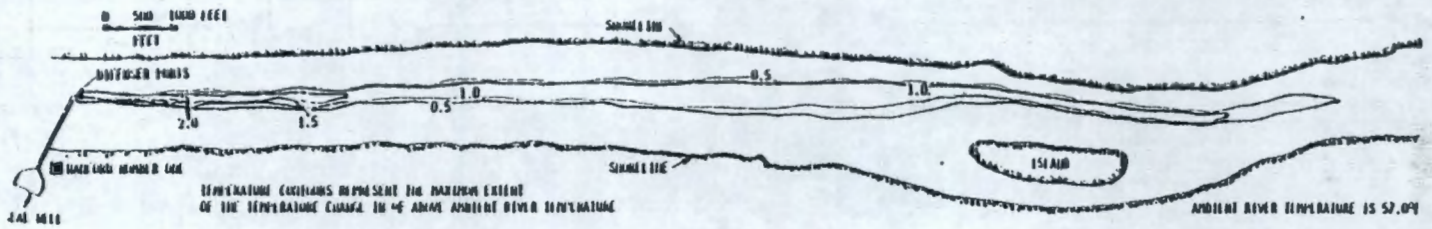

Figure 4.1-3
HGP Thermal Plume - Far Field
Temperature Patterns River Flow
88,000 cfs

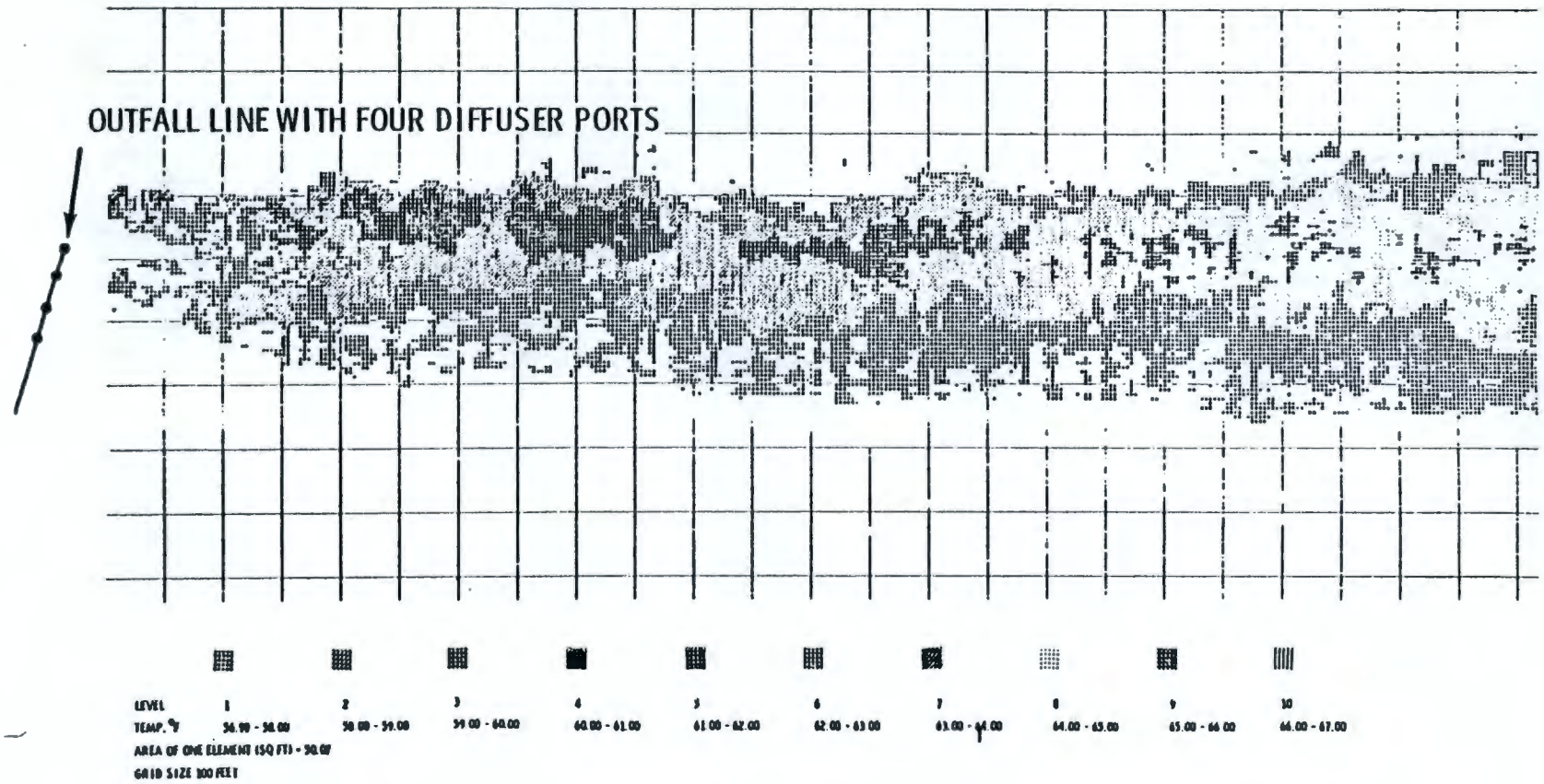

Figure 4.1-4
HGP Thermal Plume - Near Field
Temperature Patterns River Flow
88,000 cfs

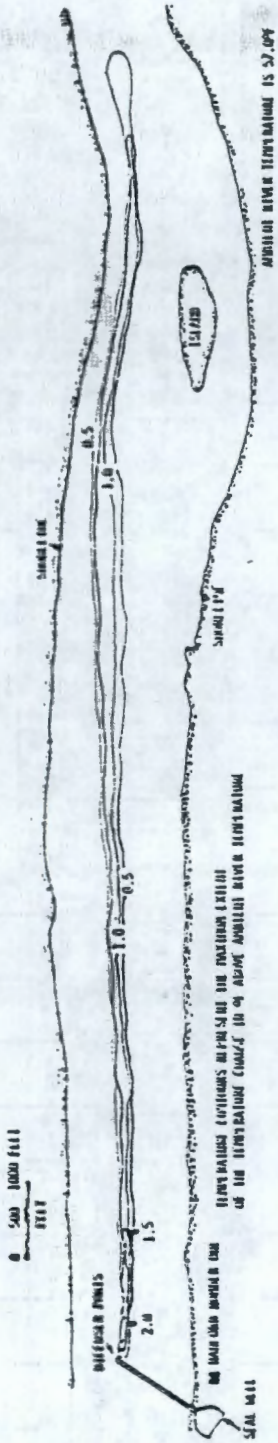

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Figure 4.1-5
HGP Thermal Plume - Far Field
Temperature Patterns River Flow
134,000 cfs

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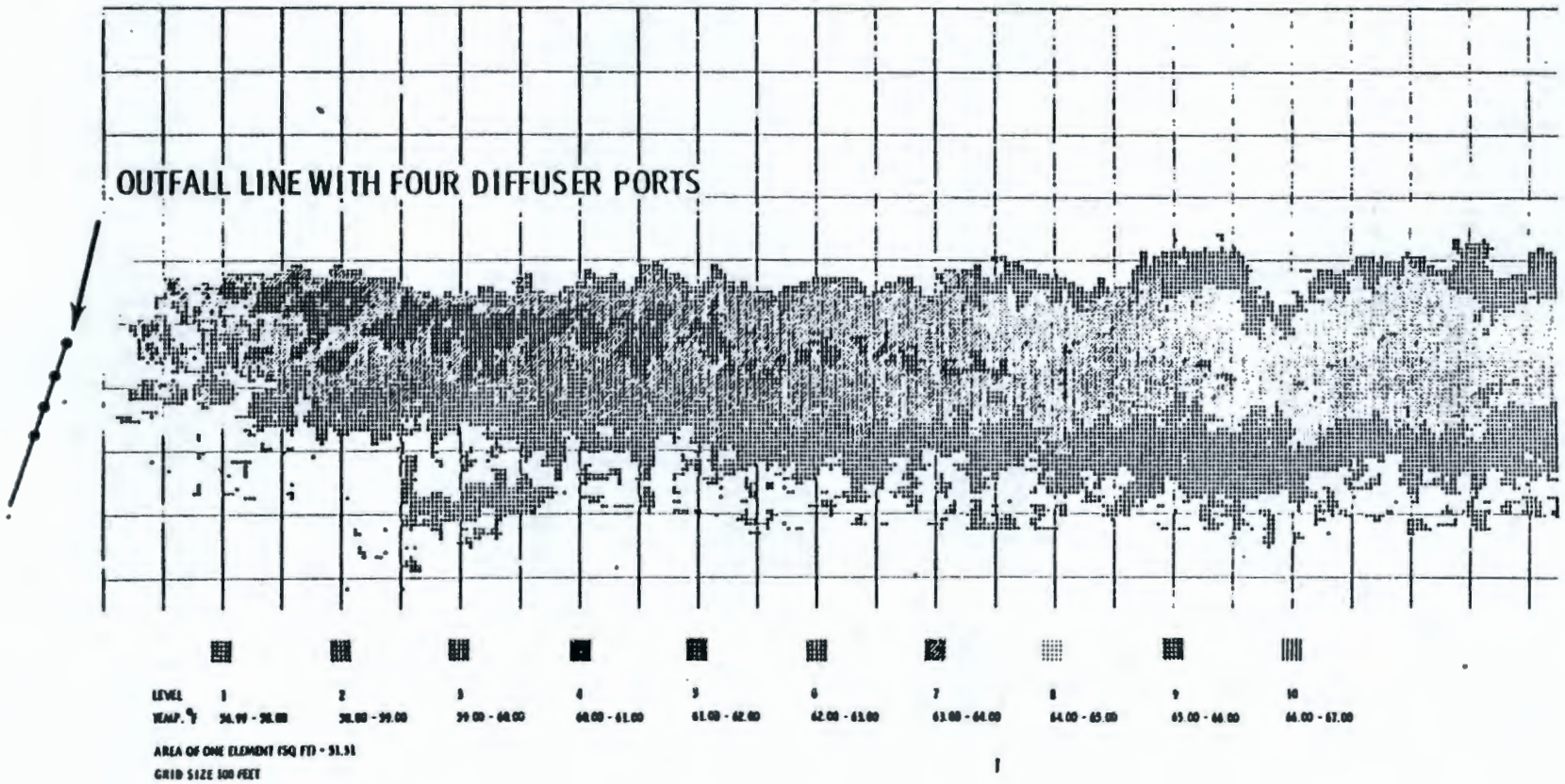

Figure 4.1-6
HGP Thermal Plume - Near Field
Temperature Patterns River Flow
134,000 cfs

Analysis of the data collected for the three river flows shows that the plume surfaces between 50 and 150 feet downstream of the discharge ports. An energy balance on the plume shows that the flow out of the last discharge port (located furthest from the HGP) accounts for about 60% of the total coolant flow discharged to the river. Approximately 20% of the coolant is discharged from the first port and 10% from each of the second and third.

The exit velocity out of the discharge ports has not been measured. The exit velocity out of the end is estimated to be between 7 and 10 feet/second. The velocity in the other ports is considerably lower. The major dilution of the coolant effluent occurs before the plume surfaces. This initial mixing is induced both by the flow configuration out of the end port and the jet turbulence of the exiting coolant. Further downstream the plume dilution is due primarily to turbulent diffusion induced by the river turbulence.

The Columbia River in the vicinity of HGP is vertically well mixed because of the high level of turbulence (minimum velocities of 3 - 4 feet/second) and the shallow bottom (depths less than 30 feet in most regions). Previous experiments[4-2] have shown that plumes from the now shutdown AEC production reactors were vertically mixed within 300-400 yards downstream of the outfall. A single vertical traverse over the upper half (top 15 feet) of the river and approximately 300 yards downstream from the discharge showed that at low river flow the river was uniformly mixed in the upper portion in that region. An energy balance on the thermal plume from the HGP showed that the plume becomes vertically mixed within 250 yards downstream of the outfall.

The maximum plume centerline temperatures above ambient river temperature for the three river flow rates are shown in Figure 4.1-7. This maximum temperature occurs in the plume downstream of the last discharge port. The temperatures directly downstream of each of the other ports are less since the flow out of these ports is only a fraction of the flow out of the end port. A vertical profile of the plume exiting from last port in the discharge line is shown in Figure 4.1-8.

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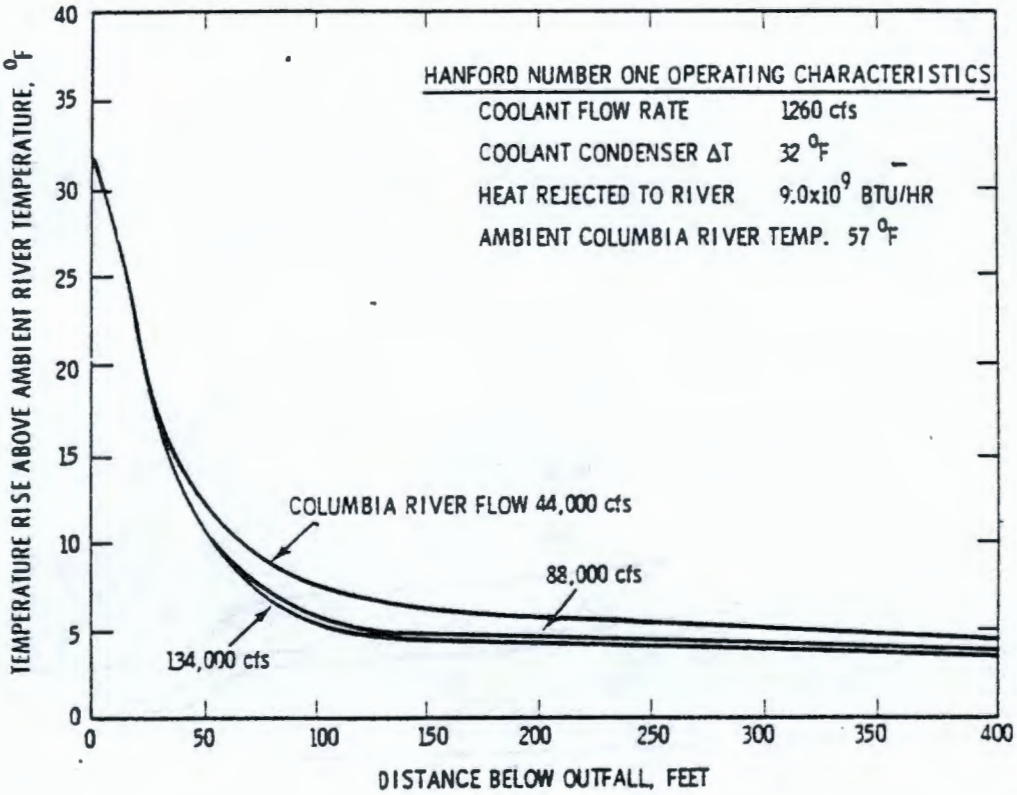

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Figure 4.1-7(a)
Maximum Measured HGP Plume Centerline Temperature Rise Above Ambient Temperature

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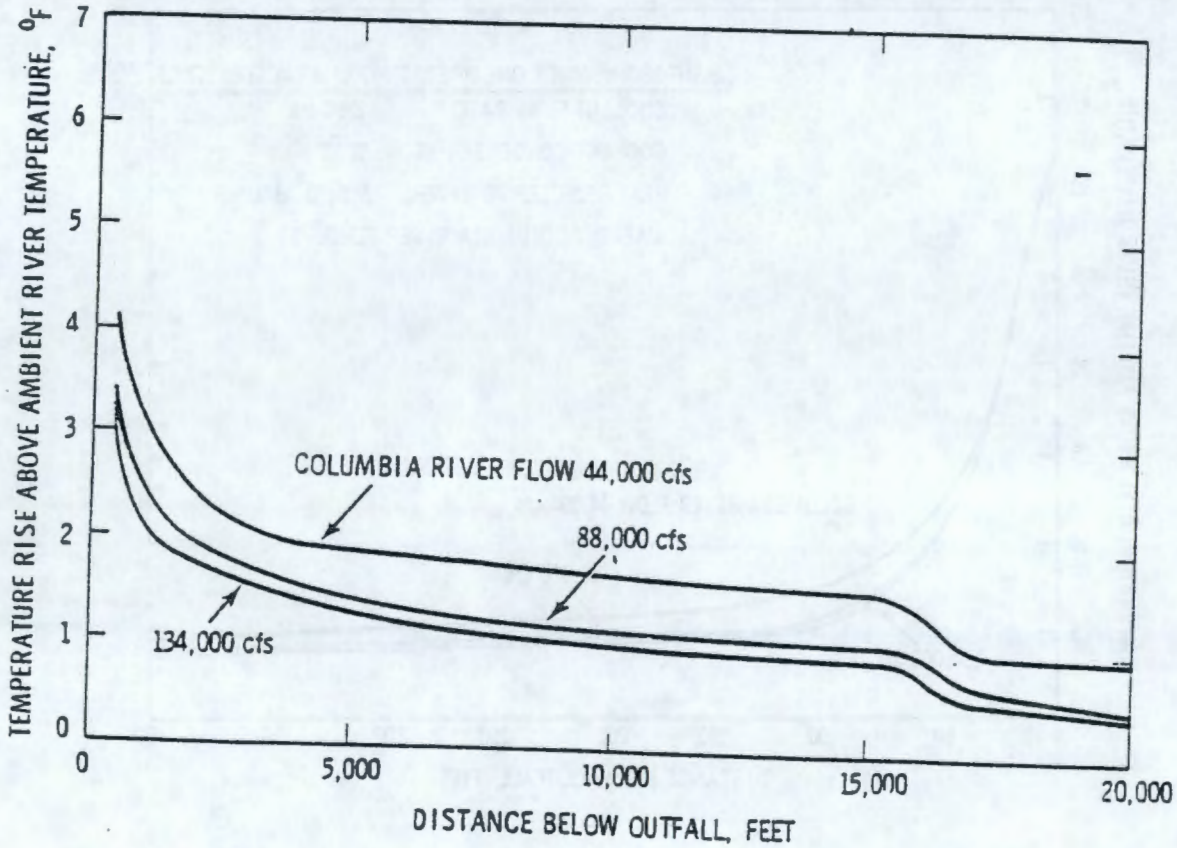

Figure 4.1-7(b)
Maximum Measured HGP Plume
Centerline Temperature Rise
Above Ambient Temperature

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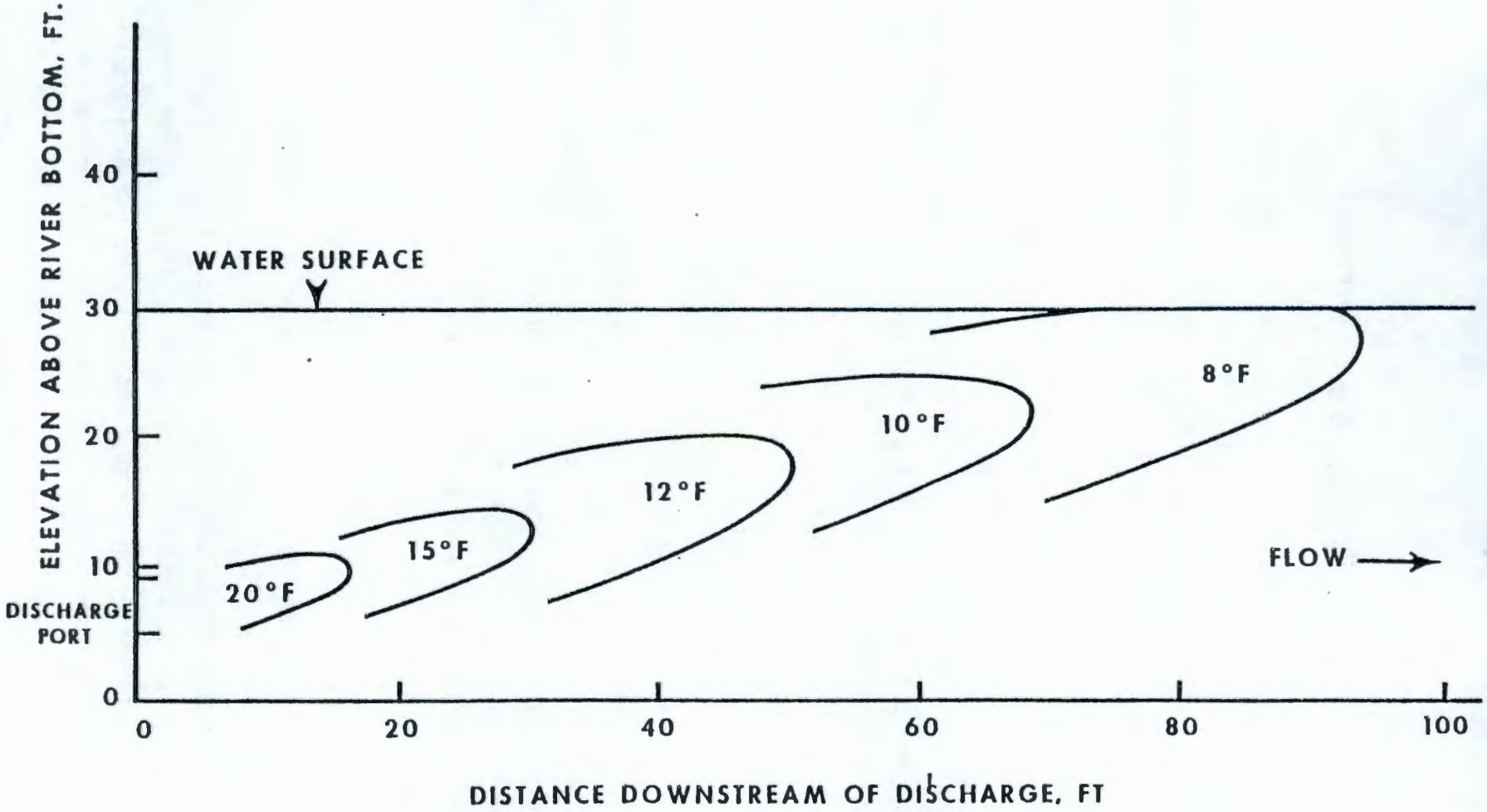

Figure 4.1-8
Vertical Temperature Profile
Downstream from End Port

The HGP plume does not interact directly with the discharge from the NPR. The NPR discharge is located approximately 200 feet nearer the shoreline and 400 feet downstream of the HGP discharge. The HGP plume width is sufficiently narrow within 400 feet downstream that it does not pass over or near the NPR discharge. The NPR plume is relatively small and is diluted rapidly to below an unmeasurable temperature (0.5^{o}F). Hence, the two plumes do not interact downstream.

Figure 4.1-9 shows the calculated temperature rise of the river at the location where the effluent is fully mixed with river water between 3 and 4 miles below the discharge. In this figure the conservative estimate is made that there is no energy exchange with the atmosphere between the point of discharge and the location where complete mixing occurs. At the minimum regulated flow of 36,000 cfs the river temperature is calculated to be increased about 1.2^{o}F. At a flow of 75,000 cfs the increase would be about 0.6^{o}F. At the annual average flow of 120,000 cfs the temperature increase is 0.3^{o}F.

Other discharges of heat into the Hanford Reach of the Columbia River will occur in the future approximately 30 miles downstream. These discharges will be the cooling tower blowdown from three other Supply System plants, WNP-1, WNP-2, and WNP-4. The HGP discharge will be fully mixed with Columbia River well upstream of these new discharges. The heat from each of these new discharges is very small (a factor of 100 less) in comparison to the HGP because WNP-1, 2, and 4 utilize cooling towers to dissipate the majority of the heat.

A series of computer runs were made with the temperature prediction model COLHEAT[4-3] to assess the downstream effects of the HGP thermal discharge on Columbia River temperatures. Verification of the applicability of this model to the Columbia River between Priest Rapids Dam and the Washington-Oregon border is given in Reference 4-3. Two COLHEAT simulations were made, one with thermal discharge and one without the thermal discharge The calculations were made using actual measured Columbia and Snake River temperatures and flows. The results of these calculations show that the changes in river temperature due to the thermal discharge are quite small when compared to daily changes

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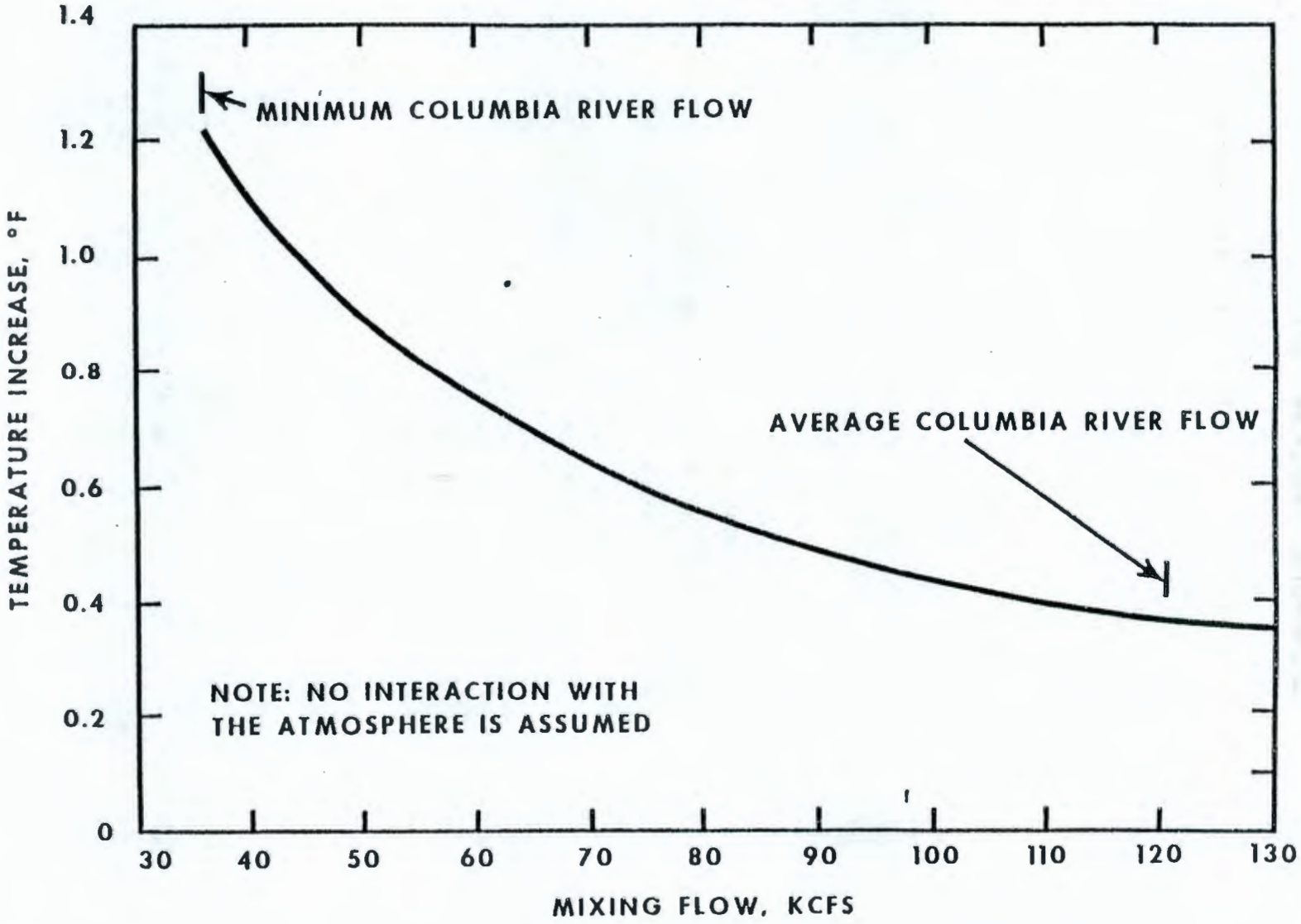

Figure 4.1-8
Maximum Increase of
Columbia River When Fully
Mixed with Hanford Generati
Project Effluent

which occur without the discharge of the plant. The incremental river temperatures due to thermal discharge have dissipated considerably at the Washington-Oregon border. The calculated temperature increase resulting from thermal discharge is immeasurable (less than 0.5°F) at the Washington-Oregon border. Hence, no impacts are reasonably anticipated at the Washington-Oregon border or downstream.

A study (4-3a) was conducted to determine the frequency of occurrence of various water temperatures downstream of the HPG discharge. A water quality computer model was used to simulate temperatures with and without operation of a once through cooling system. Calculations were made on an hourly basis for a period of 30 years of meteorological and hydrological conditions. The results of this study are shown in Figures 4.1-10 and 4.1-11. Figure 4.1-10 shows the amount of time calculated for a given temperature to be exceeded for a 24 hour period of time at three different locations. These locations are White Bluffs, about 11 miles downstream from the discharge, North Richland, about 38 miles below the discharge, and the Washington-Oregon border about 71 miles below the discharge. The amount of time the water temperatures are calculated to exceed 68°F (20°C) at each of these locations is summarized in Table 4.1-1.

Table 4.1-1

Frequency Columbia River Temperature is Calculated to Exceed 68°F (20°C) for 24 Hours

Location	Without Discharge		With Discharge	
	(%)	(Avg. Days/Yr.)	(%)	(Avg. Days/Yr.)
White Bluffs	0.0	0.0	0.0	0.0
North Richland	0.0	0.0	0.2	0.7
Washington-Oregon	2.0	7.3	2.7	9.9

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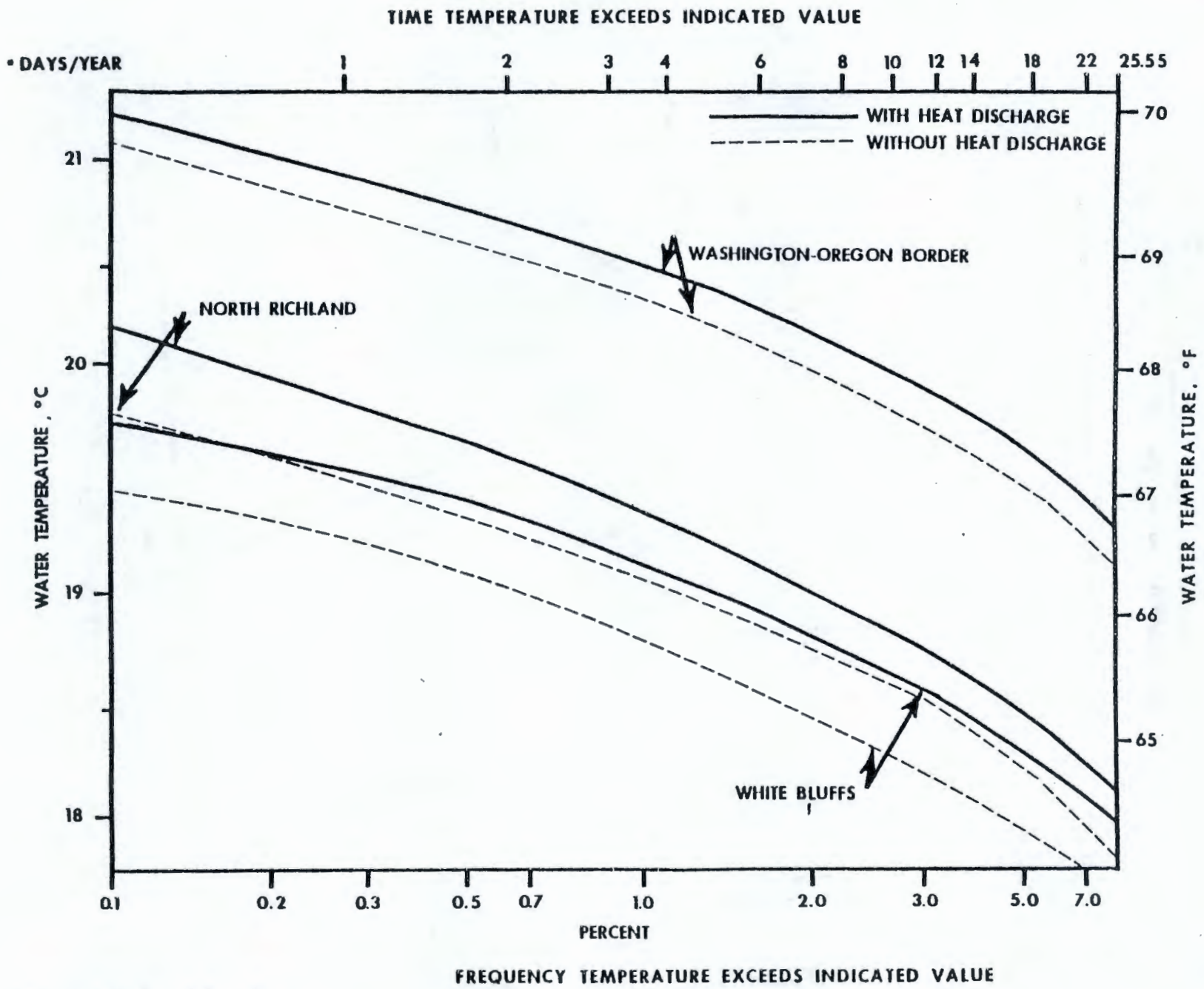

•Average Number of Days/Year based on 30 year record.

Figure 4.1-10
Frequency Columbia River Temperature Is Calculated To Exceed Indicated Value for 24 Hours Duration

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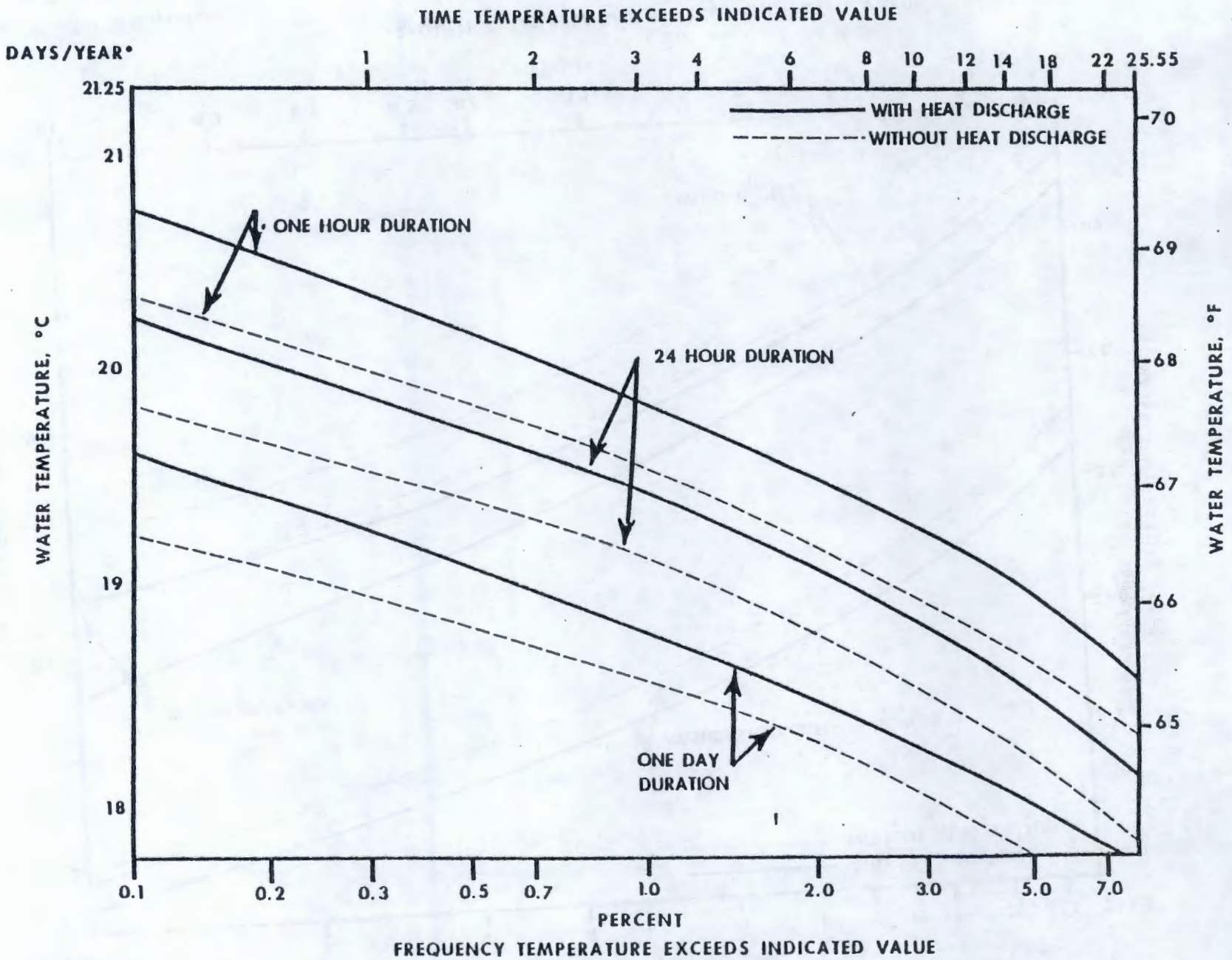

*Average Number of Days/Year based on 30 year record.

Figure 4.1-11
Frequency Columbia River Temperature Is Calculated To Exceed Indicated Value at North Richland

Figure 4.1-11 shows the amount of time calculated for a given temperature to be exceeded at North Richland for three different periods. These periods are one-hour, 24-hours and 7-days. The amount of time the water temperatures are calculated to exceed 68°F (20°C) for each of these periods is summarized in Table 4.1-2.

Table 4.1-2

Frequency Columbia River Temperature is Calculated to Exceed 68°F (20°C) at North Richland

Period	Without Discharge		With Discharge	
	(%)	(Avg. Days/Yr.)	(%)	(Avg. Days/Yr.)
One Hour	0.0	0.0	0.0	0.0
24 Hours	0.0	0.0	0.2	0.7
7 Days	0.3	1.1	0.6	2.2

HGP discharge characteristics for parameters other than temperature are given in Table 2.4-2. Liquid discharges from the HGP, other than the once through cooling water, are small in volume. These discharges consist of common substances in relatively dilute form which are neither toxic nor obnoxious. The discharges are rapidly diluted in the cooling water and the river, such that water quality standards are met at the edge of a mixing zone that extends from the river bottom to the river surface, 100 feet beyond each end of the diffuser, and 50 feet above to 3000 feet below the discharge. Hence, no impacts are reasonably anticipated at the Washington-Oregon border or downstream.

4.1.2 Air

The plant occasionally utilizes an auxiliary boiler and an emergency diesel generator. Annual consumption of petroleum fuels is 8,000 gallons of motor fuel and 4,000 gallons of fuel oil. There is no significant deterioration of the air quality resulting from operation of these units.

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4.1.3 Land

The only interfaces between the operation of HGP and the surrounding land is a septic tank-tile field used for disposal of sanitary wastes from the plant and the transmission lines which carry the power to the Northwest grid. No impact on the environment from the use of the tile field has been experienced nor is any impact expected during future operations.

No significant impact is reasonably anticipated from the transmission line due to continued operation of the HGP. Some soil was disturbed at the time the transmission towers were constructed (mid 1960's). At the present time a dirt track is maintained along the 22 miles of 500 KV transmission line from HGP to the BPA Vantage Substation to allow inspection of the lines. Minor local wind erosion occurs when this track runs through areas of very sandy soil.

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4.2 IMPACT ON TERRESTRIAL RESOURCES

The Desert Steppes and Knob and Kettle terrestrial types are not unique to the HGP site. No significant liquid, gaseous or solid wastes are emitted from HGP which interact with the terrestrial environment surrounding the HGP.

Tile field discharges and solid wastes are confined to inside the HGP site. It is reasonably anticipated that no impacts from HGP on the terrestrial environment will occur because of the absence of significant discharges which interact with the terrestrial environment.

Negligible impacts on vegetation are expected to occur along the 22 miles of 500 kv transmission lines connecting HGP to the Northwest power grid because of the infrequent use by maintenance vehicles. The low height of resident vegetation (sagebrush, cheatgrass) preclude any use of chemical control (herbicides) methods.

The thermal plume from HGP does not impact the river shoreline or islands until it has completely mixed with the river. Since the temperature rise of the fully mixed river is small (< 1.2°F, see figure 4.1-9) it is reasonably anticipated that impacts on streamside vegetation and wildlife will be negligible.

4.3 IMPACT ON AQUATIC RESOURCES

The possible areas where biological impacts may occur have been identified and organized under the headings: impingement on intake screens, passage through the condensers, and entrainment in the discharge plume.

4.3.1 Impingement

The potential impact of impingement (physical entrapment of fish upon trash screens by water velocity) upon the screens of the intake structure depends upon the intake current velocities, the presence of susceptible river organisms, and entrapment between the coarse trash racks and screens. Impingement primarily effects fish. Forty species of fish reside permanently or temporarily (anadromous forms) in the central Columbia River. Not all of these species are of equal susceptibility to the intake structures. Adult fish are in no danger from the intake structure because of their inherent swimming ability and stamina. Fish present in the vicinity of the intake during its juvenile stages are much more susceptible than larger fish.

Although scrap fish such as juvenile carp, suckers, squawfish, and shiners may be of ecological importance, they are generally available in biological surplus, are rarely harvested directly by man, and are quite adaptable to changing environmental conditions. In contrast, salmonid fish are important species. Intensive commercial and sport fisheries harvest large numbers of salmon, the supply of these species is limited, and they are more sensitive to changes in environmental conditions. Studies at the HGP intake from 1973 through 1976 showed

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that non-salmonid species made up only a small fraction of the total fish sampled.[4-4,4-5,4-6] Logically then, the assessment of the environmental impact of the intake structure must give first priority to juvenile salmonids.

Juvenile fall chinook susceptible to impingement at HGP are present in the area only for a brief span of time each spring. Fry emerge from the gravel of the river bed at a length of about 30-35 mm in fork length primarily during February and March. Many fry are displaced downriver immediately after emergence due to the strong directional flow of the current. Many of these fry reach inshore areas for a period of feeding and growth prior to direct seaward migration. This period is essentially complete by the end of July. Juvenile chinook spawned upstream of Priest Rapids Dam will pass through the Hanford reach during August. The seaward migrants usually exceed 50-60 mm in fork length and have relatively well-developed swimming ability and stamina. The weakly swimming fry present in the river immediately after emergence in the spring are those stages of juvenile chinook potentially most susceptible to intake structures withdrawing water from the central Columbia River. Weekly beach seining during March and April, 1976, revealed that the mean fork length of juvenile chinooks ranged from 40 to 47 mm.[4-6]

Other salmonid species of prime importance in the central Columbia River are rainbow trout or steelhead (Salmo gairdneri), coho salmon (Oncorhynchus kisutch) and mountain whitefish (Prosopium williamsoni). With the exception of whitefish, these fish are largely anadromous and deposit eggs in the gravel of the river bed; the emergent fry is the stage most susceptible to intake structures. Whitefish are residents that deposit adhesive eggs on the gravel of the river bed, and the resulting larvae and fry are both susceptible to intake structures when they appear in the river drift.

During the studies conducted at the HGP intake from 1973 through 1976, no natural steelhead were found either impinged on the intake screens or passed through the screens into the intake structure. It is, therefore, reasonably anticipated that the intake does not impact

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steelhead. In addition, few coho salmon or whitefish were collected during these studies. Therefore, the primary species of interest in considering the interaction with the intake is the fall chinook salmon fry.

The presence of fall chinook fry is limited in time to February through July with the greatest potential for resource damage occurring in March through May. During this span of time, water flow in the central Columbia range from about 36,000 cfs to a peak of well over 300,000 cfs, with a resulting differential in water level of 18 feet.

Modifications to the HGP intake as described in Section 2.4.2 were completed to reduce the impact of the intake on the fall chinook outmigrants. The elimination of access gaps and openings[4-4,4-5] has reduced the entrainment of juvenile salmonids far below past levels. Changing to the smaller mesh (1/4 inch to 1/8 inch) traveling screens reduced entrainment of young fish but increased impingement. Installation of the troughs, low pressure spray, and continuous operation of the screens has increased survival of impinged fry to 95%.[4-6] The Washington Department of Fisheries has estimated[4-6a] that an average of approximately 2 million swim-up fry pass the HGP intake each year. Of these 2 million fry less than 20,000 or 1% are impinged. Of those fry impinged less than 5% are lost. Hence, chinook fry losses are estimated to be on the order of 1,000 or less fry per year.

4.3.2 Passage

The withdrawal of waters from a water body may affect macroscopic and microscopic organisms drifting in the river such as fish eggs and larva, zooplankton, phytoplankton, insect larva and reproductive stages of various river invertebrates. These organisms passively enter the intake structure, pass through the screens and are subjected to thermal and mechanical stresses in the cooling system. Phytoplankton and zooplankton are evenly distributed in the Columbia River near HPG.

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The abundance of these organisms is highest in July. The flow rate of the Columbia River is also relatively high in July. Since the HGP uses about 1% of the annual average flow for cooling it is reasonable to expect that about 1% of these drift organisms are impacted by the HGP. It has been established that loss of these organisms will be ecologically negligible.[4-7] The impact of plankton entrainment upon the basic river ecology is not significant because: (1) the plant removes but a small portion of the large volume of water available in the central Columbia River (1% of average annual flow); (2) no nutrients are permanently removed from the water supply; (3) reservoirs located downstream provide enhanced capacity for plankton regeneration; (4) phytoplankton is derived to a large extent from areas upstream, although some local sloughing-off of periphyton contributes to the total plankton population; (5) the biological surplus of the organisms. Sealing of the gaps between the intake screen sections and the intake screens and walls resulted in large reductions in the number of fry passing the screens[4-5]. Observations conducted in April 1976 confirmed that very few fry had passed the intake screens.

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4.3.3 Discharge

Exposure of Fry to the Thermal Plume

There are two principle factors to be considered in any discussion of thermal effects: the magnitude of the change in the water temperature above or below ambient and the length of time the organisms are exposed to that temperature change. The great wealth of information in the literature on the thermal tolerance for a wide range of aquatic biota indicate that although an organism may be exposed to water temperatures above the apparent lethal limit, if the exposure time is sufficiently short, survival can be expected. Thus, in the following discussions predictions of effects will be based on time-temperature relationships.

Many years of research at Hanford and other laboratories have resulted in the determination of time-temperature relationships for many species of aquatic organisms. In a recent publication Coutant presents

data for over sixty species of fish.[4-8] A 1971 Environmental Protection Agency document discusses Columbia and Snake River species.[4-9] Much work has been directed toward determining the effect of thermal discharges on the various life stages of the fish found in the Hanford reach (see Figure 3.1-6). The salmonids have been emphasized in the Hanford studies because of the importance of the salmon. While fish have received the majority of the attention in these thermal tolerance studies, there is also information available for representatives of other forms of aquatic life.

Salmon and steelhead trout fry and juveniles occupy the water of the Hanford reach primarily during March through August.[4-10,4-11] Since many of these fish are in the zero age class, they do not possess the degree of swimming ability associated with the older juveniles or adults. They are to some extent passively drifting with the river currents. Mains and Smith[4-10] found that the majority of these fish, 50-60%, are to be found within a few hundred feet of the shorelines. The remainder are distributed in the river cross section, mostly in the upper 30 inches of water. This distribution implies that only a small percentage of the downstream migrants will be exposed to the HGP discharge plume. If the fish were evenly distributed in the river about 3% would be exposed to temperatures greater than 72°F.

The impact of thermal exposures on fall chinook fry is emphasized in the following discussion. Other salmonids such as steelhead and coho whitefish are equal or more tolerant of thermal dose than the fall chinook fry.[4-12,4-13] Hence, if no impacts are predicted for chinook fry it is reasonable to anticipate no impacts on these other species.

Models have been developed previously to predict the impact of thermal plumes on outmigrant chinook fry.[4-14] The models are based upon both physical measurements of a thermal plume and on laboratory data relating thermally induced mortality, equilibrium loss and behavior

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stress to thermal exposures. (4-15 through 4-23) The modeling approach has been applied to the HGP plume to determine its effect on downstream migrants. A recent study of the HGP plume (see Section 4.1) has been used to predict the time-temperature pattern experienced by a downstream migrating chinook fry assumed to pass through the plume centerline. The plume downstream of the end discharge port, where 60% of the total HGP discharge passes, presents the greatest thermal challenge to the fish and was used in the following analysis (see figure 4.1-2). With a distribution of fry similar to that measured by Mains and Smith and a plume width of 50 feet, less than 3% of the downstream migrant fry would be exposed to the plume out of the end port. For purposes of this analysis a low river flow and a warm ambient water temperature was selected. The assumption was that if an effect of thermal discharges could be demonstrated on fish fry, it would occur under these conservative conditions. The river flow conditions selected were 44,000 cfs at a water temperature of 18°C (64.4°F). Such conditions might exist in the late summer. Earlier in the summer or in late spring the ambient river temperatures are lower and the flows in the river can be many times greater than those of the test case. Thus, in the early summer when most fall chinook fry are present in the river, plume conditions are less severe than in the case being considered.

Utilizing the conditions set forth and the physical measurements that have been made on the actual plume, a time-temperature thermal exposure prediction was calculated for a fish 30 inches below the surface which may pass through the plume centerline. The results of these calculations are presented in Figure 4.3-1. Figure 4.3-1 indicates that during the first 100 seconds after the effluent leaves the discharge port the major portion of the plume dilution occurs. The exposure time on a descending scale of temperatures was generated using the flow velocity of the river at the centerline of the plume. The exposure times are presented in Table 4.3-1. Since the discharge ports are near the river bottom, in approximately 25 feet of water, the plume does not reach the surface for a distance of 60 to 100 feet from the point of discharge. By the time the plume reaches the surface, it has been cooled by dilution to a temperature of 4.5°C (8.1°F) above the

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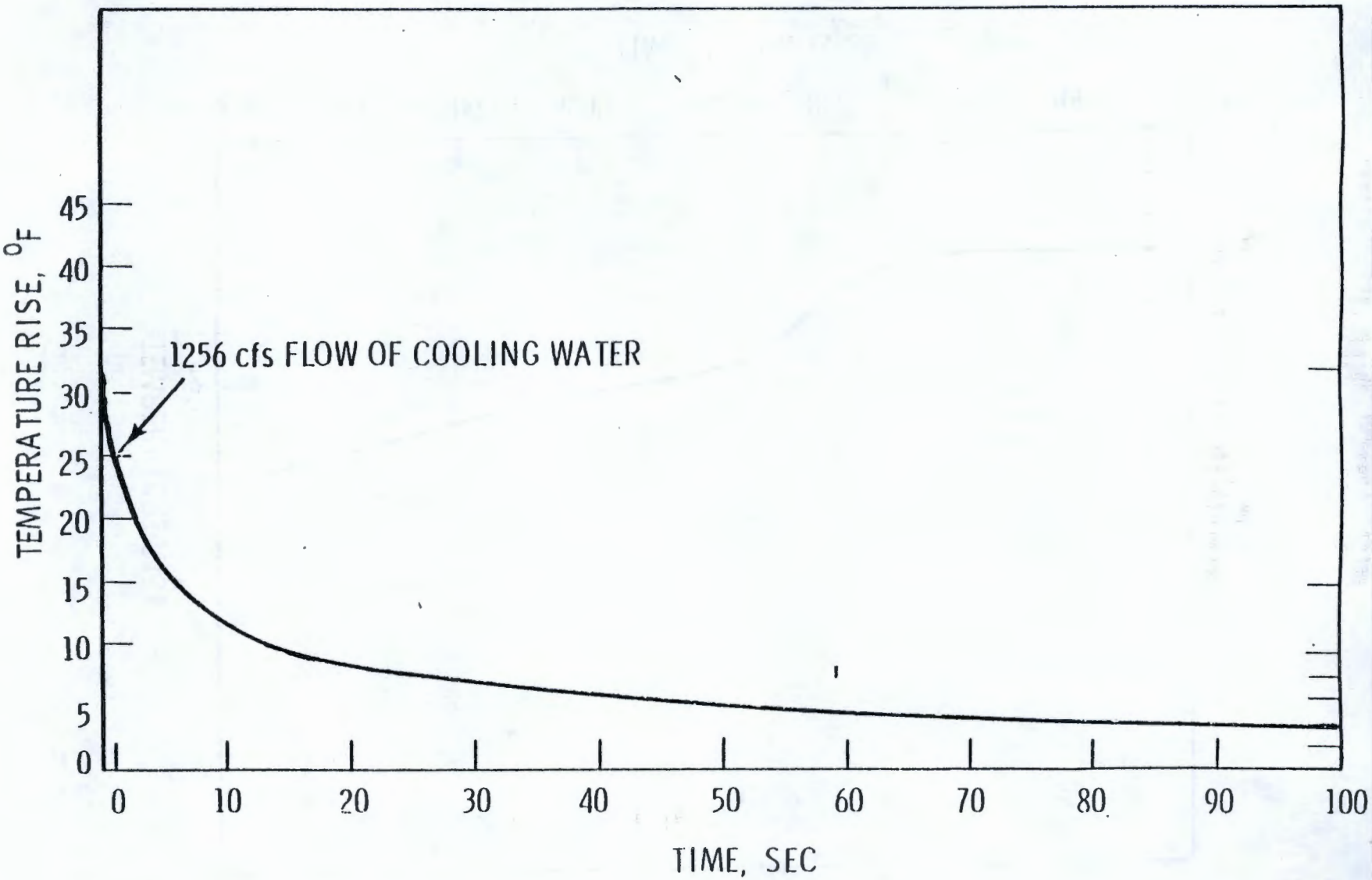

Figure 4.3-1(a)
Thermal Exposure in Plume
Centerline at Low River Flow

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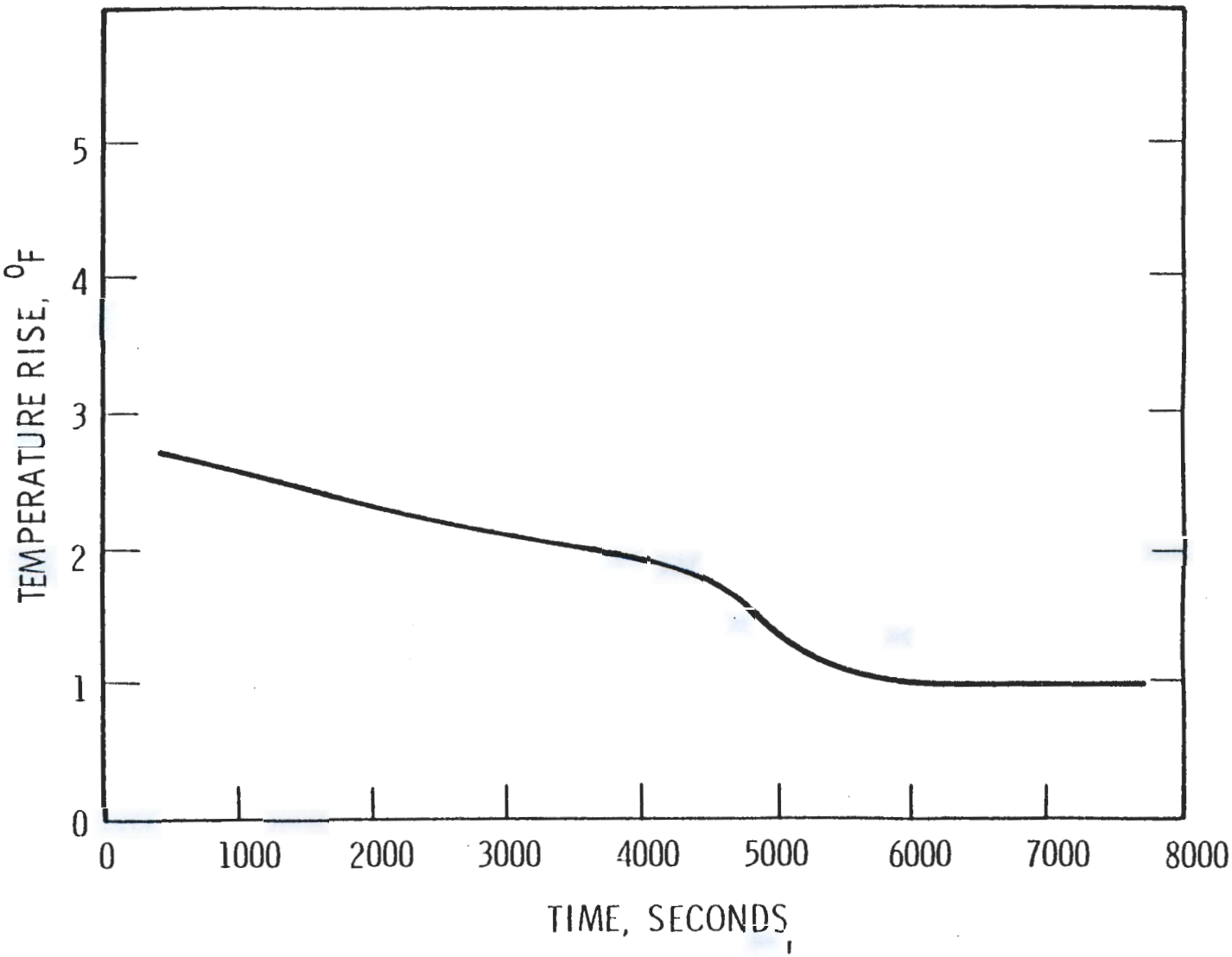

Figure 4.3-1(b)
Thermal Exposure in Plume
Centerline at Low River Flow

TABLE 4.3-1

ESTIMATED THERMAL DOSE AT PLUME CENTERLINE UNDER LOW RIVER FLOW (44,000 CFS) AND HIGH AMBIENT RIVER TEMPERATURE (18°C OR 64.4°F)

Delta Temperature		River Temperature		Exposure	Cumulative Exposure
°C	°F	°C	°F	Seconds	Seconds
17.5	31.5	35.5	95.9	0.10	.10
17.0	30.6	35.0	95.0	0.10	.20
16.5	29.7	34.5	95.1	0.11	.31
16.0	28.8	34.0	93.2	0.12	.43
15.5	27.9	33.5	92.3	0.13	.56
15.0	27.0	33.0	91.4	0.14	.70
14.5	26.1	32.5	90.5	0.15	.85
14.0	25.2	32.0	89.6	0.16	1.01
13.5	24.3	31.5	88.7	0.18	1.19
13.0	23.4	31.0	87.8	0.20	1.39
12.5	22.5	30.5	86.9	0.23	1.62
12.0	21.6	30.0	86.0	0.26	1.88
11.5	20.7	29.5	85.1	0.29	2.17
11.0	19.8	29.0	84.2	0.33	2.50
10.5	18.9	28.5	83.3	0.37	2.87
10.0	18.0	28.0	82.4	0.41	3.28
9.5	17.1	27.5	81.5	0.46	3.74
9.0	16.2	27.0	80.6	0.51	4.25
8.5	15.3	26.5	79.7	0.56	4.81
8.0	14.4	26.0	78.8	0.62	5.43
7.5	13.5	25.5	77.9	0.67	6.10
7.0	12.6	25.0	77.0	1.25	7.35
6.5	11.7	24.5	76.1	1.65	9.00
6.0	10.8	24.0	75.2	2.05	11.05
5.5	9.9	23.5	74.3	2.45	13.50
5.0	9.0	23.0	73.4	3.00	16.50
*4.5	8.1	22.5	72.5	3.50	20.00
4.0	7.2	22.0	71.6	4.00	24.00
3.5	6.3	21.5	70.7	5.50	29.50
3.0	5.4	21.0	69.8	10.00	39.50
2.5	4.5	20.5	68.9	20.50	60.00
2.0	3.6	20.0	68.0	25.00	85.00
1.5	2.7	19.5	67.1	2065.00	2150.00
1.0	1.8	19.0	66.2	2250.00	4400.00

*Point at which plume intersects river surface.

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ambient low flow temperature. In the test case, this would be 22.5°C (72.5°F). A graphical representation of the temperature profile of the plume both in time and distance from point of discharge is presented in Figure 4.3-2.

The second part of the model consists of the thermal tolerance data for the fish, in this particular case the chinook fry. The data were generated by Coutant[4-24] and have been represented graphically in Figures 4.3-3 and -4. The first figure indicates the time-temperature relationship for death at elevated temperatures and the second figure presents a series of curves for loss of equilibrium.

If a fish does pass directly through the plume centerline it will never encounter elevated temperatures for a time period which would prove lethal to it, or even cause it to lose equilibrium. This is seen by comparing the mortality and loss of equilibrium curves in Figures 4.3-3 and -4 with the temperature profile of the end port discharge at HGP, Table 4.3-1 and Fig. 4.3-2. The model predicts that if a fish encounters the plume at the surface, the highest temperature experienced by the fish would be 22.5°C (assuming an ambient river temperature of 18.0°C) for only 4.0 seconds (if the exposure time is assumed to be controlled by the river velocity). Figure 4.3-4 indicates that the lowest temperature which produced loss of equilibrium to less than ten percent of the fish was 26.0°C at an exposure time in excess of thirteen minutes.

The 1964 report of Mains and Smith[4-10] indicates that the majority of the fish are to be found along shore and in the upper portion of the water column. A graphical representation of salmon fry distribution was presented by Templeton and Olson in 1970[4-14] and has been reproduced here as Figure 4.3-5 with the HGP discharge shown. From this it can be speculated that a small fraction of the fry that are moving through the deeper waters might encounter the higher temperatures of the plume, temperatures that are above lethal levels if the

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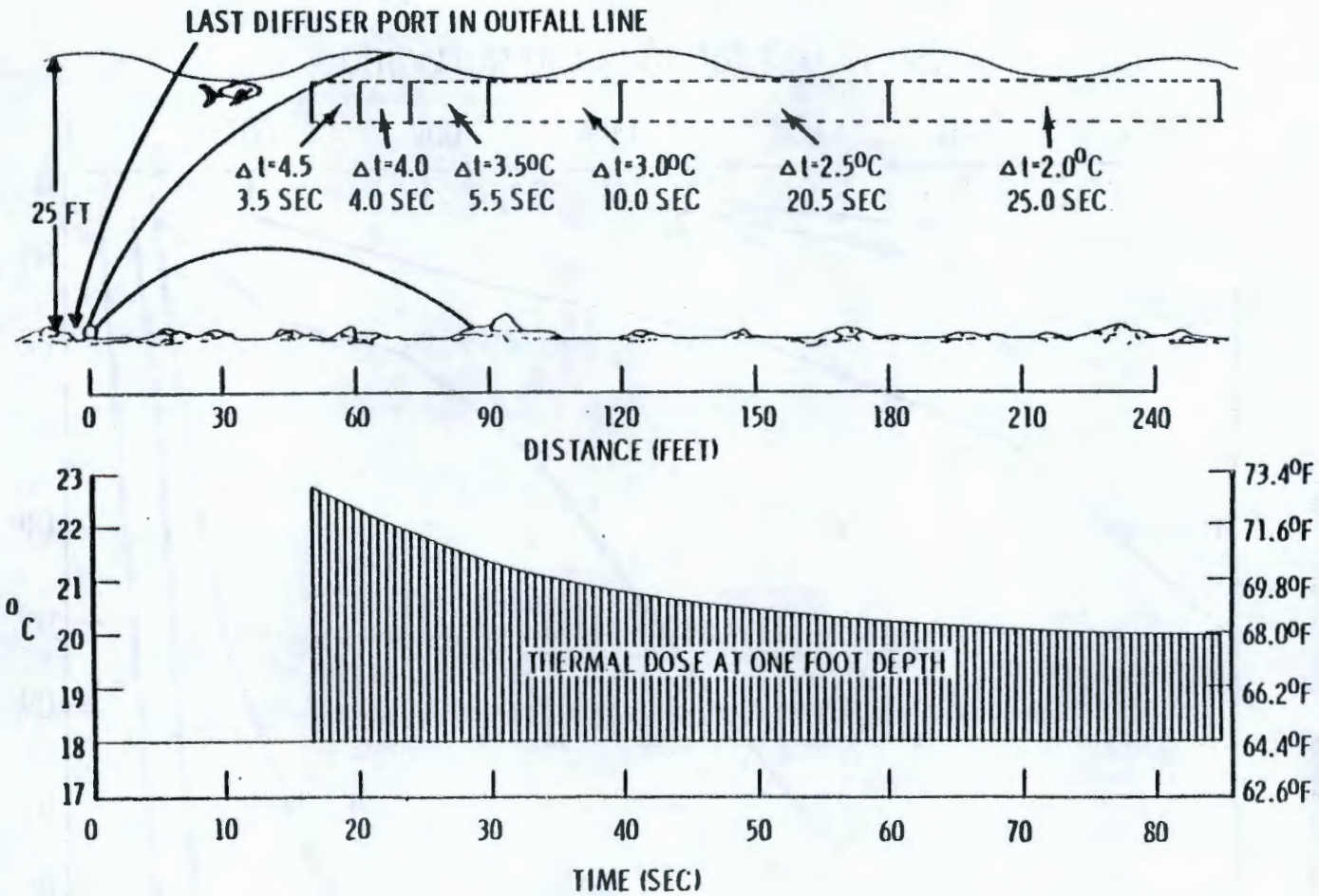

Figure 4.3-2
Time-Temperature Profile through
HGP Plume for Low River Flow and
High Ambient River Temperature

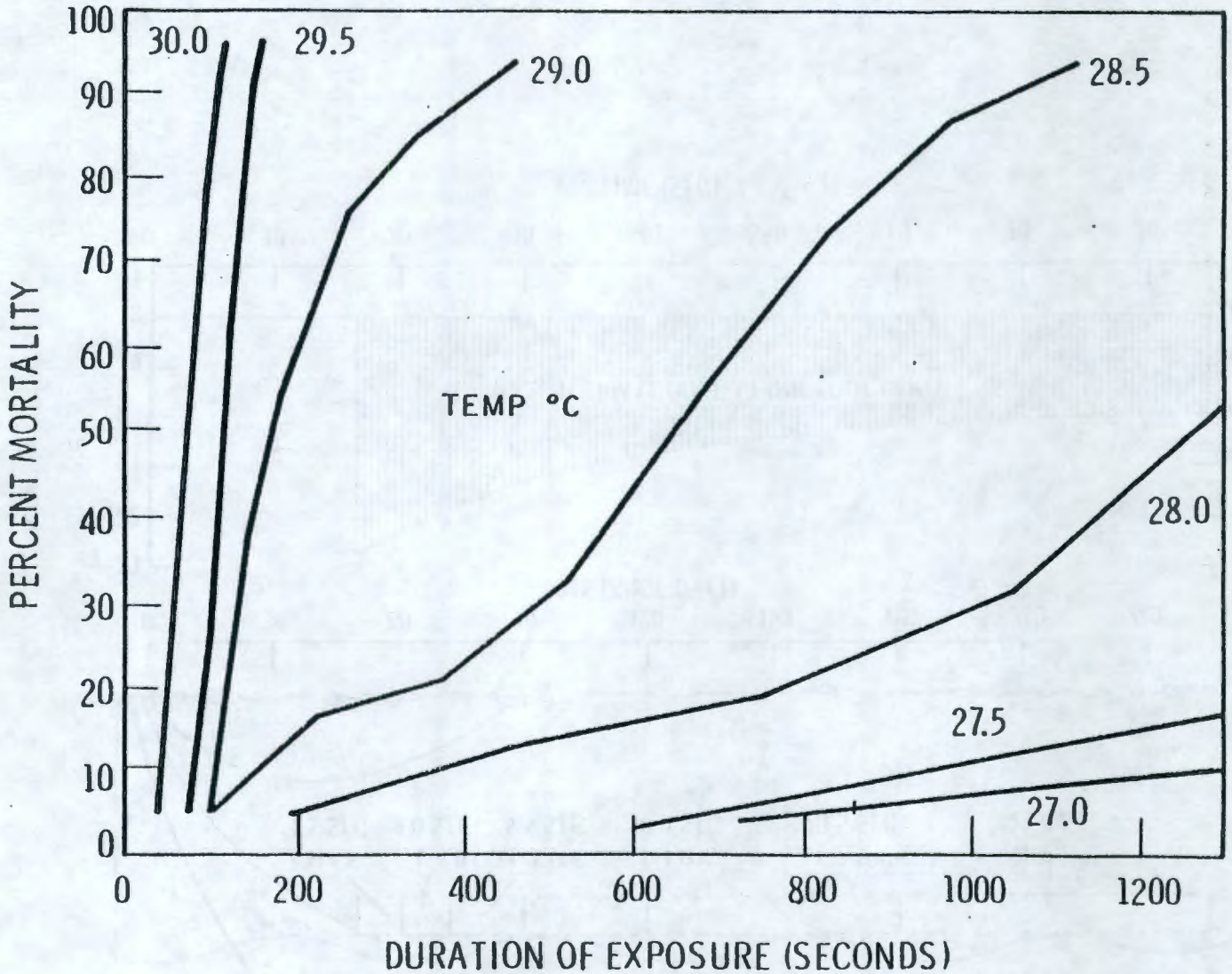

Figure 4.3-3
Juvenile Chinook Mortality as
Related to Thermal Exposure

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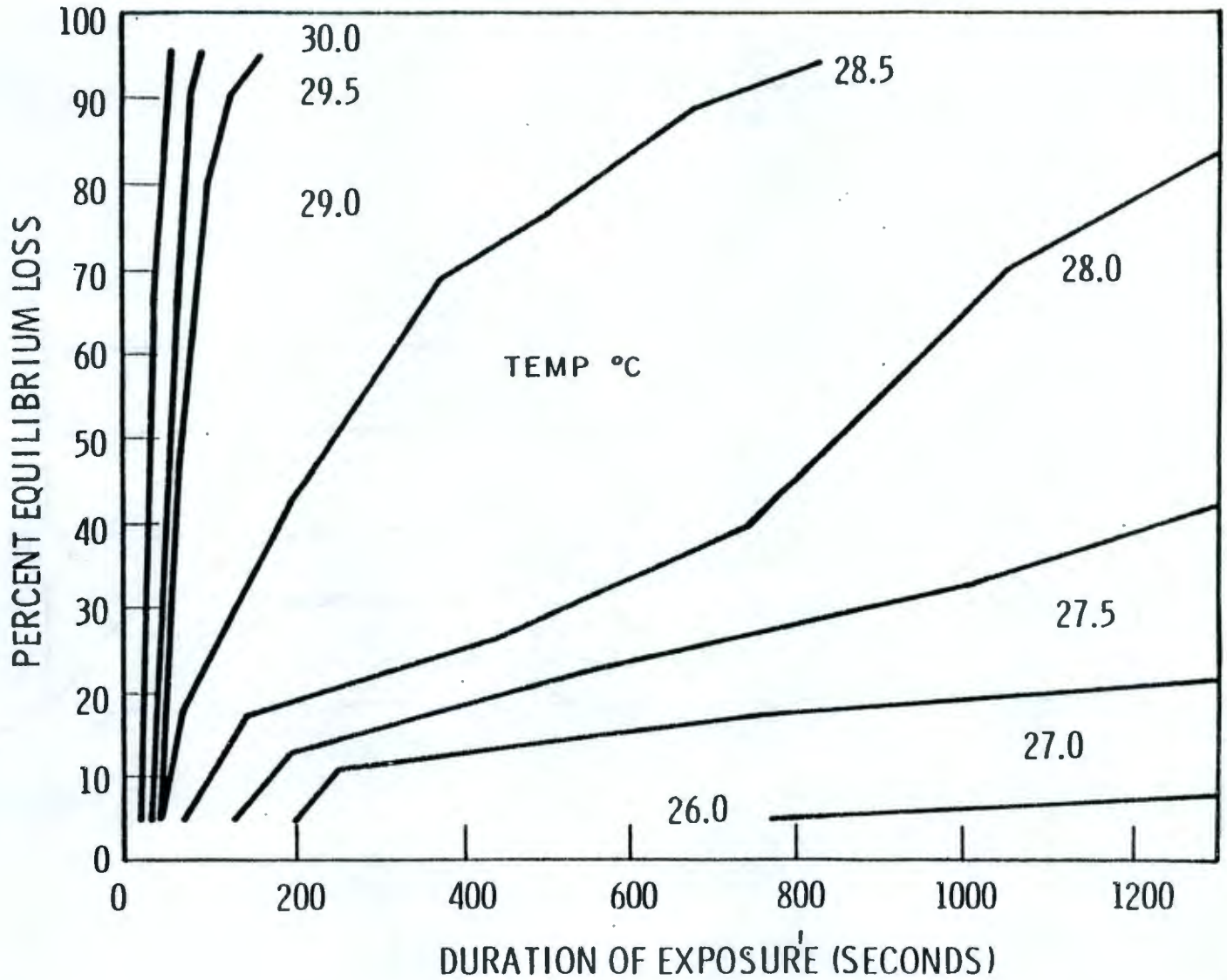

Figure 4.3-4
Juvenile Chinook Equilibrium
Loss as Related to Thermal Exposure

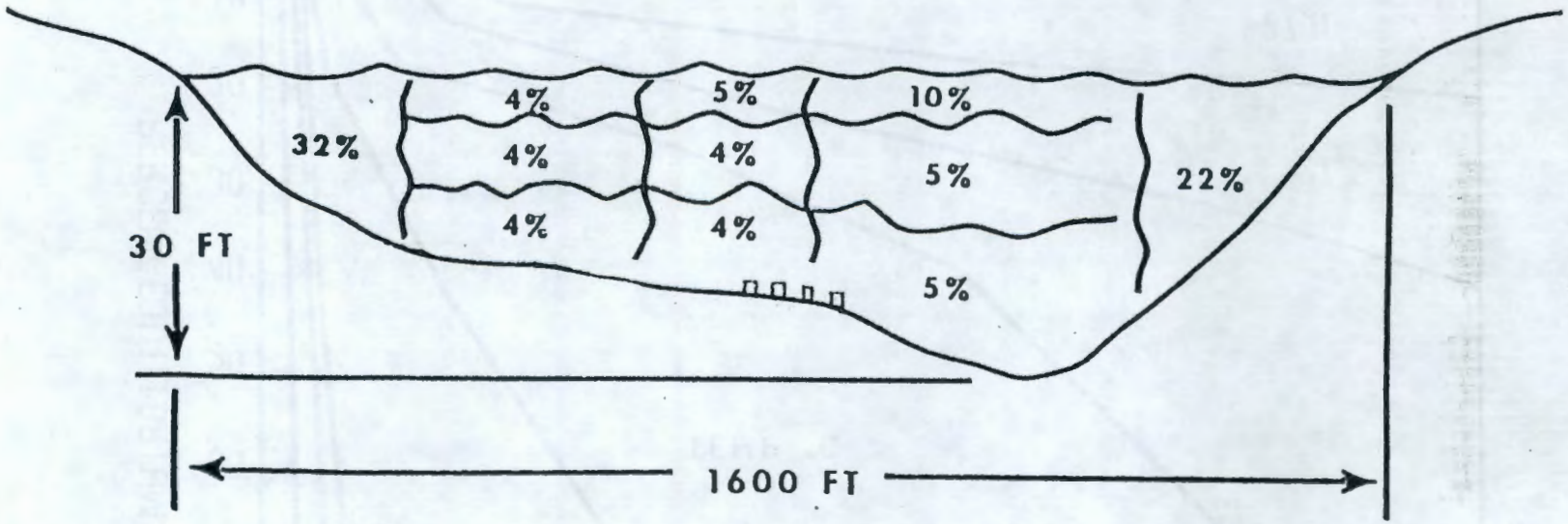

Figure 4.3-5
Distribution of Migrating Juvenile
Chinook in Columbia River

fish is exposed for a long enough period of time. But, the important point is that the exposure time to these higher temperatures is extremely short, on the order of a second. The entire exposure time from the warmest point in the plume, 17.5°C above ambient to the point at which the plume reaches the surface at 4.5°C above ambient is only 20 seconds. According to figures 4.3-3 and 4.3-4 this period of exposure is insufficient to cause death or loss of equilibrium. One set of data (4-24a) indicates that loss of equilibrium occurs at 29°C (84.2°F) immediately with no fish recovering when returned to cooler water. This data appears to conflict that provided in reference 4-24. If fry were migrating downstream in deep water and were subjected to the centerline plume they would experience temperatures exceeding 29°C (84.2°F) for about 2 seconds before being swept along into cooler waters. Given the small spatial extent of the plume when it first exits the discharge it is not anticipated that a significant fraction of the fry would be so exposed.

During times of the year when the Columbia River temperatures are below about 7.2°C (45°F) a reduced coolant flow rate is used which results in a greater temperature rise across the condenser and a discharge of about 25°C (45°F) above ambient river temperature. Downstream migrants which may pass through the thermal plume centerline will not encounter temperatures greater than 26°C for more than a few seconds. Hence, no effect such as death or loss of equilibrium would be reasonably expected.

During late summer, Columbia River temperatures may exceed 20°C (68°F). Exposure of fish passing through the plume to temperatures greater than 26°C will occur for relatively short times, on the order of seconds. No effects such as death or loss of equilibrium would be reasonably anticipated.

The above analysis was done using a river flow rate of 44,000 cfs. Licensed minimum flow of the Columbia River is 36,000 cfs in the vicinity of HGP and this low flow is occasionally experienced during the late summer, fall and early spring. Occurance of flows lower than 44,000 cfs will result in slightly longer exposure times to higher

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temperatures than listed in Table 4.3-1. However, analysis of the effects of the lower flow as it related to the old WNP-1 project (see the introduction to Chapter 3) showed that the exposure times are still on the order of tenths of seconds and seconds. No effects such as death or loss of equilibrium would be reasonably anticipated.

Exposure of Adults to the Thermal Plume

Adult salmonids migrating upstream possess sufficient swimming power and sensory capability to direct their position in the river with respect to the thermal plume. Sonic tracking studies have been conducted with upstream migrants passing through the Hanford stretch.[4-25,4-26] In these studies fish were tracked from Richland to Priest Rapids Dam. The route selected by the fish was the north or east shoreline of the river. The selection became more pronounced in the area of the operating reactors which were located on the opposite shoreline. These studies indicate that the discharge of heated waters into the Columbia River does not pose a barrier to upstream migrating fish. The portion of the river affected by HGP's plume is sufficiently small and occupies a portion of the river's center so as not to block the passage of these shore oriented migrating fish.

Cold Shock

Another possible impact at HGP comes from the cessation of thermal discharge upon plant shutdown. In some cases the thermal plume issued from a power plant may act to attract aquatic organisms, particularly fishes. These organisms reside in the artificially heated waters for long periods of time, becoming acclimated to the elevated temperatures and, in fact, dependent upon them for survival. While fish mortalities have occurred at several power plants following shutdowns, these took place in the southern and eastern U.S. and involved species of fish with thermal requirements completely opposite that of salmonids. "Cold Shock", as this effect is called, is not reasonably expected to occur at HGP due to its location on a swiftly flowing reach of the Columbia River with the discharge in the mid-channel section of the

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river. For fish to become acclimated to the warmer temperatures of the plume, fish would have to occupy these waters for several days. This would require a considerable expenditure of swimming effort in the river currents. It is not expected that fish would find the elevated water temperatures so attractive as to put forth this effort. Limited sampling above and in the plume in 1973-74 did not indicate that fish attraction was a problem.[4-7] Fish populations downstream from the area where the river has become thermally homogeneous, will experience only a slight elevation in temperature. The removal of the heat source during plant shutdown will result in an insignificant change (less than $1^{o}F$) in the thermal environment.

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Spawning and Incubation

In the early days of Hanford the spawning of fall chinook was observed by Hanford ecologists. At that time some spawning grounds were influenced by a number of production reactors. Starting in 1947 aerial counts were made of the spawning redds. The results show that an increase has occurred in the number of fall chinook salmon using this area for spawning.[4-27] During this period of increasing salmon spawning in the Hanford reach, a number of changes have occurred in the Columbia River which explain these increases.[4-28] Most important of these is the construction of additional hydroelectric projects which have resulted in the inundation of spawning beds in other places on the Columbia River. As more and more areas were covered by reservoirs the salmon were displaced to other areas acceptable to them. The discharge of reactor effluent did not deter large numbers of salmon, apparently displaced by dams from customary spawning grounds, from spawning in the Hanford Reach area. Continued spawning indicates that these areas are still quite acceptable to the salmon.

Although the numbers of spawning pairs of salmon tended to increase over the years in waters downstream from the reactor areas it was not known how the slightly warmer water affected the fertilized eggs and resulting fry. A series of experiments were conducted in which spawn was taken from fall chinook and maintained at $2^{o}F$ intervals above the ambient river temperature throughout incubation, hatching, and early

fry stages.[4-29] The survival at temperatures simulating those measured in the spawning beds downstream from reactor discharges were well within those acceptable under normal hatchery operations, i.e., 10-12% mortality. Exposure to sublethal temperature increases resulted in accelerated growth rates, with a 2°F increment increasing growth by a factor of 1.4 times. These studies concluded that developmental stages of fall chinook can safely withstand slightly elevated water temperatures and that these temperatures favor eggs and fry survival of late spawners. Slight temperature increases during the incubation period may be to the advantage of the fry since it is known that the larger the size of the young at time of release from the hatcheries, the greater the numbers of returning adults.

The closest major downstream salmon spawning area is located 8 miles downstream from HGP at River Mile 373. This area has been used by approximately one third of the fall chinook salmon spawning between Richland and Priest Rapids Dam during the years 1966-1975. The continued use of this area as a major spawning area by fall chinook indicates that the effluent from HGP does not detrimentally affect the spawning ability of adults or the survival of eggs and fry.

Disease

Pathogenic disease agents appear to be more of problem to adults than to juveniles during migration.[4-30] Columnaris has been subjected to the greatest investigation, especially with regard to adult salmon. Natural outbreaks of columnaris disease have been linked to high water temperatures in excess of 60°F. Adult salmon are exposed to columnaris whenever they are in the river. However, exposure occurs mostly at fish ladders with resident coarse fish providing a source of infection. Columnaris disease infections generally fail to develop at 50°F and are not lethal at 62°F. Columnaris is generally most severe in the Snake River and in the Columbia River for some distance below its confluence with the Snake River.[4-31]

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Furunculosis and dermocystidium are diseases which have been associated primarily with fish hatchery operations. In 1965 dermocystidium was shown to cause heavy mortalities at the Priest Rapids Spawning Channel.[4-32]

A number of studies have demonstrated that these fish diseases found in the Columbia River become more infectious with increasing temperatures. However, the disease "cause and effect" relationship is understood only in general terms of stress factors, one of which is temperature. Other factors including the general condition of fish, nutritional state, size, presence of toxicants, level of anti-body protection, exposure to nitrogen supersaturation, level of dissolved oxygen, and perhaps other factors inter-relate in the infection of fish by diseases.

Higher temperatures in the river due to the HGP discharge, may aggrevate the already existing problems associated with the incidence of infection and severity of fish diseases for two reasons. First, the time that temperatures over 50°F are experienced in the river will be lengthened a few days by the HPG discharge. Second the temperatures in the river will be increased by a few tenths of a °F by the HGP discharge. Both of these perturbations are relatively small when compared to natural variations in river temperature.

Elimination of the HGP's discharge would not reasonably be expected to significantly decrease the problems associated with fish disease. Most salmon are exposed to the disease in fish ladders far downstream from the HGP discharge where the effect of the HGP on river temperature is immeasurable. Natural river temperatures are such that the conditions for the propagation of the disease will still exist.

Benthic

A recent study of the benthic community[4-7] in the vicinity of HGP showed two changes immediately below the HGP discharges when compared to areas just outside the plume. First, the number of organisms within the thermal influence of the discharge was statistically differ-

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ent from the colder water areas of the river. Second, the winter reduction in numerical abundance appeared delayed when compared to the cooler areas. This study also found that greater abundance of benthos occurred near the shoreline than in mid-river. The study concluded that the "discharge of heated water by HGP was not a significant impact to benthos populations downstream from the site".

4.4 HUMAN ENVIRONMENT

The effect of operation of HGP and the functionally related facilities on the human environment are considered in this section. Effects are considered at two levels, regional and local. At the regional level the consideration is the potential for effect from continuing to provide electrical energy. At the local level the relationship between the HGP and the human elements of the environment are considered.

4.4.1 Regional

Regional environmental impacts associated with the proposal result indirectly by the economic and population growth supported by the provision of electrical energy to the region. The provision of electrical energy to a region is an enabling rather than a causative factor for economic and population growth. A number of factors are necessary for growth to occur. Some of these factors, such as markets for products, availability of raw materials, labor, utilities and transportation and community attitudes as expressed in zoning laws effect economic growth. Other factors such as the availability of jobs, the quality of schools, recreation and shopping facilities and the general environment of the area effect population growth. The topic of the effects of providing energy supply for a region has been explored in a recent Supply System EIS Supplement.[4-33] While that document considered providing 2,400 MW of generating resource from new facilities, it is relevant to a proposal to continue to provide 860 MW from the existing HGP. The impacts associated with providing this energy from HGP are reasonably anticipated to be less then with 2,400. The proposals differ in magnitude and time frame, with the HPG proposal including

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1978, 79 and the early 1980's while the cited document focuses on the mid 1980's and on. Summary material from the cited document is quoted below. These conclusions appear valid for the HGP proposal as well as for the proposed action considered in that document.

> "The most significant changes are increases in urban and residential land use, with concommittant reduction of some agricultural, forest or currently vacant land. Since the energy provided by the Proposed Action is a relatively small part of the total electric energy supply of the area, these additional land-use changes related to the Proposed Action are less than the changes attributable to growth enabled by all other factors. With existing land-use and pollution control legislation, most of the adverse impacts of these land-use changes can be mitigated by the appropriate governmental units."
>
> "It is not reasonably anticipated that the Proposed Action would result in measurable changes or impacts in the vicinities of the already existing principal industrial users of electric energy. The Projects would not induce major expansion of these existing industries or broaden existing areas of environmental impact. Most of the energy from the Projects would be used by these industries as a replacement source for non-firm energy."
>
> "The regional impact analysis was performed using predictions based on a number of economic growth scenarios from 1975 to 1990. The scenarios established a reasonable range within which future events can be expected to occur. That portion of the growth which can be attributed to the Proposed Action to the increase in electrical demands 1975 to 1990. The impacts associated with the Proposed Action are bounded by the scenarios analyzed."
>
> "It is not reasonably anticipated that the portion of total growth of the region which may be enabled in part by an adequate supply of electrical energy will have significant effects on existing social and economic structures and on the physical environment of the region or the Participants' service areas. Such growth is anticipated to provide more employment, higher income levels and greater productivity; it will also support extended and improved public services. The increase of the regional population and the diversification of the region's economic base may be accompanied by increased production of air and water pollutants and changes in land-use. Many of the potential impacts are beneficial and most potentially adverse impacts are subject to mitigation."
>
> "The most important beneficial economic impacts of regional growth include increases in employment, personal income, and value added. Potentially adverse economic impacts include increasing costs of public services and population growth brought about by employment opportunities."

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"The impacts of growth on social institutions are closely related to increases in population. Among others, they include changes in demographic characteristics, increasing use of limited cultural resources, and the effects of urbanization and greater population densities. The latter encompasses the improved delivery of services as well as greater problems with noise, congestion, and other adverse aspects."

"Potential physical environmental impacts related to growth include greater production of air and water pollutants, increased and more intensive use of water resources, and changes in land-use. Mitigation of these impacts will incur economic costs. The portions of growth related environmental impacts which are attributable to the energy provided by the Proposed Action represent relatively small parts (in the order of 15%) of the total impacts attributable to the total availability of new electric energy in the region."

As described in Section 3.2.1, energy from HGP operation, under certain circumstances, can be supplied to Southern California over existing BPA transmission lines. When this is done environmental benefits will occur. The rate of oil burning, with its associated air pollution burden, will be reduced in an area of serious air quality problems. For each day of HGP Operation, when the total amount of energy is sent to California, approximately 30,000 barrels of oil will be saved. Typically, this reduction in oil-fired plant operation will reduce the amount of pollutants released into Southern California air each day by the following amounts:

SO_2	60 tons/day
NO_x	140 tons/day
particulates	4 tons/day

The reduction in the rate of U.S. oil importation made possible by this action may reasonably be expected to be insignificant. However, the direction of the change would generally be considered desirable.

4.4.2 Local

Because HGP is an existing operating facility the proposal will not change local demands on the human environment. The Tri-Cities, where most of the HGP and related facilities staffs are located is a

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community experiencing a high population growth rate. The local Governments feel stressed to provide the level of services they deem appropriate for this growing population. The proposal does not affect this situation in that there is no anticipated increase in population resulting from continued operation of the HGP. (See Section 8.1 for further discussion of this topic.)

4.5 NPR IMPACTS

Continued operation of the NPR is required for the proposed continuation of HGP. However, continued operation of the NPR-by ERDA has utility for production of plutonium independent of the HGP and continued operation of the NPR may occur regardless of any decision by the Supply System as to continued operation of HGP. The environmental impacts of NPR are presented here as an other issue which does not pertain to any element of the environment listed in Table 3.0-1, but which is relevant to the proposal. The impacts on the environment are discussed in detail in ERDA-1538.[4-34] An environmental assessment is being prepared by ERDA relating to the operation of the NPR and will be published in 1977.

4.5.1 Intake

The cooling water intake for the NPR is described in Section 2.5. To date, no known studies have been made to quantify the impact of the NPR cooling water intake on the aquatic environment. When both NPR and HGP are operating, the NPR intake volume is 290,000 gpm. This results in a velocity through the 1/8-inch screens of 1.25 fps. From studies at HGP it is not likely that the NPR intake facility, with a 1/8-inch mesh screen, will have a problem with fish entrainment. However, it is possible that there will be impingement on the screens. At the present time neither the rate of impingement of fish on the screens nor the mortality of impinged fish has been quantified.

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4.5.2 Discharge

During normal NPR operation with HGP on line approximately 460 megawatts of heat are dissipated by NPR to the river. The 290,000 gpm of water is discharged through a 102-inch line to the center of the river. The temperature of the discharged water depends upon the ambient river temperature and pumping operation. The maximum discharge temperature is 83.4°F. Both the flow and the temperature rise of the NPR discharge are smaller than the HGP discharge. It is therefore reasonably anticipated that the impact of the NPR discharge is smaller than the impact of HGP discharge. Investigations on the HGP discharge show that there is no significant impact on the aquatic environment (see Section 4.3). Since the NPR discharge is located in and affects the same area of the river as the HGP discharge it is reasonably anticipated that there is no significant impact to the aquatic environment from the discharge of the NPR facility. At most, the fully-mixed discharge from NPR would raise the river temperature about 0.27°F, during the minimum river flow of 36,000 cfs. At the average river flow of 120,000 cfs, the increase in river temperature from the NPR facility would be only about 0.08°F.

4.5.3 Radiological Impact

Detailed studies have been conducted to determine pathways leading to the exposure of man from the release of radioactive materials from the NPR and these are presented in ERDA-1538.[4-34] All significant environmental exposure pathways were evaluated, including submersion in the plume, drinking water, foodstuff irrigated with Columbia River water, atmospheric iodine - pasture - cow - milk - pathway, etc. The methods employed were expected to provide the best estimate of the doses associated with the different exposure pathways.

More recent dose calculations were provided by ERDA for the "hypothetical maximum individual" with reference to NPR as well as the "hypothetical maximum individual" with reference to the fuel fabrication facilities at the 300 Area just north of the City of Richland. For the NPR it is assumed that this "individual" resides continuously 5.5 miles

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northwest of NPR. For the 300 Area facilities it is assumed that this "individual" lives 2,000 meters east of the fuel fabrication facility. These "hypothetical maximum individuals" are non-existent persons whose dietary and recreation habits maximize the doses received. These habits are described in detail in ERDA-1538, Page III.1-1.

The calculated whole body dose potentially received during 1975 by the hypothetical maximum individual from effluent released from NPR during 1975 was 0.16 mrem. This compares with a natural background dose of about 100 mrem. The dose received was primarily the result of external radiation from ^{41}Ar released into the atmosphere. The dose potentially received by the thyroid of the hypothetical maximum infant (one year old) is calculated to be 1.2 mrem from the effluents released by NPR during 1975. This dose was primarily due to ^{131}I in milk. Essentially, all the dose would have been received during 1975, since ^{131}I has an 8-day half-life. The 50-year whole body dose commitment to the hypothetical maximum individual from 1975 effluents is calculated to be 0.17 mrem. This compares with a 50 year dose commitment due to natural background of 5,000 mrem. This additional 0.01 mrem received after 1975 was due primarily to the intake of ^{90}Sr in drinking water, fish and foods irrigated during 1975. Calculations were also made of whole body population dose received during 1975 by the total population within a 50-mile radius of NPR. This calculated whole-body population dose received by the approximately 250,000 people during 1975 was 0.64 man-rem. This compares with a whole body population dose due to natural background of 25,000 man-rem.

Uranium is the only radioactive material handled in the United Nuclear Industries 300 Area fuels production facility. Although process wastes have been disposed of in the ground in the 300 Area since operations began, no concentrations of uranium above background have been observed at the 300 Area forebay, which supplies drinking water for the 300 Area. This forebay is about 0.3 miles downstream of any potential entry of process waste produced in the 300 Area by the fuel fabrication facility. In addition, samples obtained at the Richland Pumping Plant

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show no detectable concentrations of uranium above background level. Calculation of a whole body dose to the hypothetical maximum individual as a result of the 300 Area Fuels production facility during 1975 show a dose of 2.0×10^{-4} mrem. Assuming 250,000 people reside within a 50-mile radius of the facility, the average first-year whole body dose to the individual is calculated to be 2.1×10^{-6} mrem.

Table 4.5-1 presents an estimate of health effects resulting from the operation of NPR and fuel fabrication facilities at Hanford during 1975. The techniques used to calculate these health effects and the difficulties in using these techniques are described in detail in Section III.1.1.6 of ERDA-1538. Since the number of health effects are all far less than one, it may be concluded that there will be no observable health effects due to NPR operations in 1975. The naturally-occuring radiation background whole body dose is over 30,000 times larger than the dose contributed from NPR operations in 1975.

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4.5.4 Fuel Cycle

At the present time, spent fuel from the NPR facility is being stored in the 105-KE building. No fuel processing is being performed and no wastes from fuel processing are being disposed. Further, no spent fuel is being transported off of the Hanford Reservation. It is anticipated that processing of the spent fuel will begin in 1978, which will result in the extraction of plutonium from the spent fuel as well as other byproducts and waste requiring disposal. The environmental aspects of processing spent fuel for the NPR is given in ERDA-1538.

4.5.5 Other Impacts

Non-radioactive gaseous emmissions from the NPR are small in volume and consist primarily of combustion products from an auxiliary boiler and emergency diesel generators. On the order of five million gallons of fossil fuels are used annually. It is reasonably anticipated that no impacts from the NPR on the atmosphere or terrestrial environment will occur due to the absence of significant discharges.

TABLE 4.5-1

MAXIMUM POTENTIAL HEALTH EFFECTS DUE TO 1975 OPERATION OF NPR

	Calculated 50 Year Population Dose Commitment (man-rem)	Maximum Number of[a] Health Effects
Mortality		
Whole Body	.66	.00013 cancer deaths
Lung	.43	.000022 cancer deaths
Thyroid	4.0	.000020 cancer deaths
Morbidity		
Whole Body	.66	.00026 cancer cases
Thyroid	4.0	.000080 cancer cases
Genetic Damage[b]	.66	.00020 genetic effects
Background	1,250,000	

(a) Total number of health effects through all future years resulting in operation of UNI facilities during 1975.

(b) The genetic organ doses was conservatively estimated to be the same as the whole body dose.

The fuel fabrication facility uses on the order of 640,000 gallons of oil annually. The small volume of the effluents associated with this use is not reasonably expected to impact the air quality or terrestrial environment near the facility.

Land areas associated with waste management operations are discussed in Reference 4-34. About 3% of the Hanford Reservation is used for structures and waste disposal sites, but only a fraction of this area is directly associated with the operation of NPR.

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CHAPTER 5

THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The Proposal is to continue to provide up to 570 average MW of electrical energy to loads in the Pacific Northwest. The demand for this energy presently exists and is expected to exist in the future due to a growing population, expanding industry and commerce, and an increasing per capita demand for electrical energy. In this chapter the short-term uses of man's environment resulting from the operation of HGP are identified along with the possible long-term productivity of the environment. "Short-term uses of man's environment" refers to those uses which may cause impacts identifiable during the operation of HGP under the present proposal, or from the present to about 1995. "Long-term" refers to uses which may cause impacts to appear in the environment due to the operation of HGP and which will continue to exist after the HGP is closed down.

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5.1 LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT

Continued operation of HGP provides energy for existing loads in the Pacific Northwest and significantly increases the cumulative probability of meeting energy loads in the near-term critical period (See Section 3.2.3. In the event that the Pacific Northwest hydroelectric system is not constrained by critical water periods, energy can be transmitted to the Pacific Southwest to forego consumption of fossil fuels. Thus, fossil fuels, particularly oil, can be saved for future needs.

Employment at HGP provides 46 jobs directly. About another 850 are related to NPR operation. Thus, continued operation of HGP contributes to the economic welfare and stability of the local area.

Continued operation of HGP increases the probability of meeting both firm and interruptible industrial energy loads. Thus, stable regional employment in industries with interruptible energy loads is promoted.

The environmental effects associated with alternative means of providing energy in lieu of HGP are avoided by continued operation. The environmental stresses associated with construction of HGP occurred more than 10 years ago and are now a sunk 'cost.'

5.2 LONG-TERM PRODUCTIVITY

Operation of the cooling water system, in particular the intake and discharge structures, are not reasonably anticipated to effect the salmonid fish populations in the Columbia River in the vicinity of the HGP site. The impacts are generally short-term in nature and impact relatively small numbers of individual fish rather than fish populations as discussed in Section 4.3. In-plant modification to mitigate impacts on fish are described in Section 8.3.

The environmental impacts associated with the continued operation of HGP are discussed in detail in Chapter 4. These include the loss of less than 1,000 downstream fall chinook fry at the HGP intake, minor shifts in the benthic community below the discharge, and incremental increases in the river temperature during late summer. These impacts effect relatively small numbers of individual fish but do not adversely impact fish populations. Minor gaseous discharges are emitted from the HGP with no anticipated adverse impacts on the surrounding terrestrial environment.

Impacts associated with the NPR intake have not been quantified. The discharge of heated water from NPR is reasonably anticipated to have less adverse impacts than the HGP discharge. Other non-radioactive discharges from the NPR are minor and are not expected to cause an adverse impact.

Radioactive effluents from NPR during steam generation for HGP do not pose hazards to human health. The annual whole body dose to the public from the total Hanford reactor area operations is considerably

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lower than natural background dose. Long-lived radioactive by-products are created as a result of continued operation of the NPR. Waste materials are contained in spent fuel and in liquid effluents and should not pose a public health hazard.

Continued operation of the HGP and NPR results in the consumptive use of resources. The HGP uses about 12,000 gallons of petroleum fuels annually. The NPR and associated fuel support facilities use about 5.7 million gallons of petroleum fuel annually. In addition the NPR uses about 700,000 lbs. of metallic uranium annually.

Land areas associated with waste management activities are presented in reference 4-34. About 3% of the Hanford Reservation is used for structures and waste disposal sites, but only a fraction of this area is directly associated with the operation of NPR.

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CHAPTER 6

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

Those natural resources which are utilized in substantial quantities during the operation of HGP or NPR are identified in Chapter 5.2 above. All of the resources utilized by the HGP and NPR are relatively plentiful in that the quantities utilized do not preclude development of other actions or processes which require these resources.

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CHAPTER 7

ADVERSE ENVIRONMENTAL IMPACTS WHICH MAY BE MITIGATED

The adverse impacts associated with the continued operation of HGP are identified in Chapter 4 and summarized in Table 7.0-1. Mitigating measures for each of these adverse impacts are also summarized in Table 7.0-1. Each alternative listed in Table 7.0-1 is evaluated in Chapter 8 (Section 8.3) in terms of its effect upon the environment, its technical feasibility, and its economic practicability. The alternatives listed in Table 7.0-1 are not considered reasonable in that they do not approximate the proposal's objective with a lower environmental cost or decreased level of environmental degradation. In addition to the mitigating measures identified in Table 7.0-1, the impacts associated with continued operation could be avoided by shutdown of HGP if the NPR were also shutdown. However, the NPR might well be operated whether HGP is operated or not. Cessation of operation of the NPR requires a decision by ERDA based on the national requirements for plutonium. The alternative of discontinuing HGP operation is discussed under the "no action" alternative in Section 8.1.

Energy conservation is discussed in detail in Section 8.1.1.

In pre-draft consultation the Department of Fisheries and Department of Game asserted that the continued operation of the HGP presented a potential risk to salmonid populations using the Hanford reach. In addition, they asserted that, further studies should be conducted because of their perception that there is limited knowledge about the impacts of the HGP's heat dissipation system. The Supply System believes that a rather large and comprehensive body of knowledge exists that defines in both general and specific terms the impacts associated with HGP's heat dissipation system. The references presented in Sections 3.1.5 and 4.3 cover a wide range of discussions on salmonids which are relevant to this proposal. While there is "potential risk" to salmonids from HGP operation, this risk, as shown in Chapter 4, can reasonably be judged to be negligible to the salmonid populations which are the important species of concern.

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TABLE 7.0-1

ADVERSE IMPACTS WHICH MAY BE MITIGATED

Impact	Mitigation Measure	Responsible Agency
HGP		
1) Removal of less than 1,000 fry	a) Modify intake (see Section 8.3.1) b) Use offstream cooling (see Section 8.3.1) c) Do not operate in the spring (see Section 8.3.3)	Supply System
2) Passage of less than 1% of drifting organisms through condensers	a) Use of offstream cooling (see Section 8.3.1)	Supply System
3) Minor shift in bottom community	a) Modify discharge structure (see Section 8.3.1) b) Use offstream cooling (see Section 8.3.1)	Supply System
4) Incremental increase in river temperature in late summer	a) Use offstream cooling (see Section 8.3.1) b) Do not operate in the late summer (see Section 8.3.3)	Supply System
NPR		
1) Radioactivity released to river	Provide additional effluent treatment (see Section 8.3.2)	ERDA
2) Radioactivity released to air	Provide additional effluent treatment	ERDA
3) Cooling water flow	Incorporate changes similar to HGP (see Section 8.3.2)	ERDA

The Departments of Ecology, Fisheries, and Game also asserted in pre-draft consultation that the use of a closed cycle cooling system would mitigate the impacts of the HGP's cooling system. The alternative of installing cooling towers is considered in Section 8.3.1. This alternative is not considered reasonable because of the already low impacts associated with the HGP once-through cooling system. In addition, off-stream cooling is not required for the HGP under the U. S. Environmental Protection Agency's Effluent Guidelines.

The Department of Ecology (DOE) identified a number of potential impact areas and mitigating actions in pre-draft consultation. DOE discussed the disposal to land of debris washed from the intake screen. This debris is presently returned to the river. Very little debris is caught on the intake screens and the majority of the debris that is caught is tumbleweeds. The return of this debris to the river is not reasonably expected to cause a significant impact. DOE also stated that an oil spill prevention plan should be developed. An oil spill plan has been developed and is discussed in Section 2.4.3

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CHAPTER 8

ALTERNATIVES TO THE PROPOSAL

The proposal is to provide up to 570 average MW of electrical energy to the Pacific Northwest power grid through the continued operation of HGP. Alternatives to this proposal can be divided into three broad categories:

- Not act on the proposal and shutdown HGP
- Act on the proposal for continued operation of HGP, but require periodic reviews
- Act on the proposal but make plant facility or operating schedule changes

Not all of these alternatives are reasonable in that they do not all approximate the proposal's objective with a lower environmental cost or decreased level of environmental degradation. However, they are all presented here for the interested reader. In the discussions the following points are considered:

- Environmental impacts of the alternative as related to HGP
- Environmental impacts of the alternative related to other actions which may occur
- Human environmental effects
- Effect on power costs

The environmental impacts related to HGP and included under the first item above are generally impacts which the Supply System has the authority to control. Those impacts described under the heading "related to other actions which may occur" and "human environmental effects" are generally impacts over which the Supply System has no direct authority and cannot, under present institutional constraints, mitigate. The discussions included under "economic effect on power costs" do not pertain to any of the elements of the environment listed in Table 3.0-1. This discussion is included throughout Chapter 8 because it represents an "other issue" which is relevant to the proposal.

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8.1 THE "NO ACTION" ALTERNATIVE

Taking no action on the proposal would result in closing down the HGP by June 1978. This would reduce the resources of the Pacific Northwest by up to 5 billion KW-hr per year or 570 average MW. This represents about 4% of the energy resources projected to be available in the region in 1978-79 and 2.5% of the resources in 1986-87.[8-1] Should the no action alternative be implemented three methods are available to balance loads and resources:

- o Encourage and/or require conservation
- o Proceed to develop replacement generating resources
- o Purchase energy as needed from outside the region

Implementation of any of these alternative methods would require action by numerous local, state and regional entities other than the Supply System. Each of these alternatives have certain unique impacts and effects. They also have a number of common impacts. These common impacts are addressed below while those which are unique are discussed in the following subsections along with the specific alternative.

The general impacts and effects of the "no action" alternative are:

Environmental Impacts Related To HGP

With the "no action" alternative the impacts related to HGP (identified in Chapter 4 and summarized in Section 1.2) would not continue to occur.

A decision to discontinue HGP operation would have both positive and negative human environmental impacts on the Tri-City area. Within a period of up to about 5 years approximately 50 people would need to find other employment (approximately 900 people if ERDA decided to also shut down the NPR). At the beginning of this period some unemployment would occur. While some people would probably be unable to market their skills locally and would be forced to relocate, others might reasonably be expected to rejoin the Tri-City labor force.

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The loss of primary jobs and the associated losses of secondary jobs may ease the demand for housing and city services that the Tri-City community is presently having difficulty meeting. The construction labor force impacts expected might be alleviated partially by these 50 (or 900) people competing for other jobs in the area and reducing in-migration. Those leaving the area would provide some slight extra capacity in the community to absorb in-migrating construction workers.

A decision to discontinue HGP operation would have an adverse effect on the individuals employed by HGP particularly in the short term. The community infrastructure, however, would realize a reduction in demand during a potentially stressful period.

Environmental Impacts Related to Other Actions

If the "no action" alternative is selected, increased pressure may be expected on Pacific Northwest utilities to purchase varying amounts of replacement energy from outside the region. The impacts and effects associated with this action are similar to those discussed in Section 8.1.3 relating to purchase of the entire 570 average MW from outside the region. In addition, during high water years in the Pacific Northwest the resources of HGP, when not needed in the Northwest, would not be available to the Southwest. This would have the impacts discussed in Section 4.4 relating to the generation of electricty in the Southwest using oil.

Human Environmental Effects

The Pacific Northwest faces an increased probability of an electrical energy deficit during the years 1978-1984 if operation of HGP is discontinued and regional loads increase as projected by the West Group forecast (see Section 3.2.3).

During the period of time from 1978 through 1985 deficits of between 1300 and 2500 average MW are forecast during a critical year without the HGP. If HGP were operating these deficits would be reduced

by 570 average MW. In 1973, at the height of the electrical energy crisis, a deficit of almost 1700 average MW was projected. The impacts which occurred in that year were short lived since early rains in the fall of 1973 relieved the shortage. The impacts were primarily confined to the industries which purchase interruptible power.

The extent to which the industrial sector would have to cut back in the case of an energy deficit is unknown at this time. At a minimum the sale of interruptible energy will be curtailed. This would reduce the energy requirements by about 1000 MW. The savings possible without cutback of production would be implemented next. Some estimates have concluded that this may be on the order of 5 to 30%.(8-2,8-3,8-4) This would most likely result in savings on the order of 200 MW. If these savings are not sufficient to relieve the shortage, the industrial sector may be requested or required to reduce production to meet set quotas. Assuming output and power consumption at this stage of the cutback are directly proportional and that Northwest industries were required to reduce electrical energy consumption by another 1000 MW, a decrease of output by 35 percent would result. The industrial sector may feel the effects of not being able to obtain adequate power supplies before an actual deficit situation is reached. Energy-intensive industries require some assurance of an adequate power supply before investing capital in new plant construction. Some industries have deferred plans to locate in Washington State because of their inability to receive firm commitments for electric power. The net effect of this is to lower employment opportunities in the area, causing either an out-migration or an increase in unemployment.

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Economic Effects on Power Costs

If the HGP is shut down, power costs in the Pacific Northwest would be affected by three factors, decommissioning costs, cost of purchasing replacement energy, if required, and the loss of revenue from the sale of energy from the HGP. Monies required to retire the bond debt on HGP are already included in the Northwest's cost of power so no increase would be necessary to pay off the bonds.

Decommissioning costs associated with the HGP can range widely depending upon the mode of decommissioning selected. If the plant were partially dismantled and usable equipment sold at auction, then net revenues may be obtained from decommissioning. Minor cost would be incurred if the HGP were shutdown, disconnected from all power supplies, drained of all liquids and simply abandoned. Another alternative would be to put the plant into a condition where it could be reactivated at a future date. It is estimated that it would cost about $500,000 to "mothball" the HGP and about $100,000 per year to maintain it in that state. Complete removal of the HGP and the associated transmission lines and restoration of the site to match the surrounding area would involve the expenditure of considerable funds.

If ERDA chooses to shutdown the NPR, the Supply System is obligated to pay ERDA about $9.2 million between 1977 and 1980 for costs associated with placing the NPR in a standby status. Payment of these monies may be delayed in the new contracts being negotiated between ERDA and the Supply System.

8.1.1 Conservation

Conservation programs might be developed to reduce the probable energy loads by an amount equivalent to the HGP. The development and implementation of an energy conservation program requires the following:

- Identification of conserving actions and their effectiveness.
- Selection of an implementing program.
- Designation of responsible agencies/organizations for implementation.

Two types of conservation, short term or immediate savings and long term savings, must be implemented to replace the HGP. The immediate savings would be needed to replace HGP during the 1978-1985 time frame, and the long term savings would be required for longer times.

Some immediate savings in electrical energy use can be accomplished primarily by changes in personnel habits. Actions which can be taken in the residential, commercial and industrial sectors fall into the following categories:

- o reduced lighting (residential, commercial, industrial)
- o thermostat setback (residential, commercial, industrial)
- o reduced hot water use (residential, commercial, industrial)
- o cut back on industrial output (industrial)
- o reduced operating hours (commercial, industrial)
- o reduced air circulation (commercial)

Long term savings in electrical energy use can be accomplished by investment in materials and equipment which would reduce energy requirements. These include:

- o increased insulation in buildings
- o increased efficiencies of appliances
- o increased efficiency of industrial processes
- o installation of supplemental energy sources (solar, wind)

The effectiveness of each of the immediate and long term savings actions listed above have been estimated for the Pacific Northwest based on varying assumptions.[8-3,8-4] Unfortunately, it is not possible to precisely determine the extent to which some of these actions have already been taken by consumers in the Northwest.

Three general categories of programs are available for implementing the conserving actions; educational, incentive, and mandatory programs.[8-3] Any comprehensive program developed could be expected to contain features of each of these categories. These implementing programs may be described as follows:

a) Education Programs inform consumers of the benefits of saving electrical energy and provide them with sufficient information to allow them to take the conserving actions discussed. This

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is accomplished primarily through media advertising, and free or low cost classes and workshops, and public recognition of savings achieved.

b) Incentive Programs encourage consumers to save energy through recognition, monetary awards, or rates structure. This is accomplished through contests with cash prizes, low interest loans or loan guarantees and tax credits for energy savings related purchases, and special electrical rates.

c) Mandatory Programs require consumers to conserve electrical energy or to take certain actions which will result in energy savings. This is accomplished by the establishment of electrical consumption quotas, limiting the end uses for which electricity can be purchased, requiring certain energy efficiencies for buildings, appliances, and industrial equipment and processes.

Generally, all utilities in the Pacific Northwest, including entities such as the Supply System, can legally implement educational conservation programs. Utilities are presently running advertisements on the savings of energy through wise use and reduction of waste. Private utilities and municipal lighting departments may be able to conduct incentive conservation programs. Public utilities and agencies such as the Supply System do not presently have the legal authority to implement incentive conservation programs. Mandatory programs may only be implemented by governmental bodies empowered with legislative authority. These bodies include cities, counties, state, and Federal governments.

A short-term or immediate savings program could be implemented to reduce the electrical loads in the Pacific Northwest by 570 MW or approximately four percent in 1978-79. For example, residential and commercial reductions in electrical space heating of 10% by thermostat setback and reduction in hot water use of 15%, coupled with an industrial sector reduction on the order of 3% would reduce the loads on the order of 570 MW. Implementation of this program would most likely require incentive and mandatory measures to ensure its success. Governmental bodies with legislative powers would be the responsible agencies for implementing these measures. A long term savings program could

also be implemented using the conserving actions described above. This program would also most likely require incentive and mandatory measures with governmental bodies being the responsible implementing agencies. It should be noted that these conserving actions must be implemented above and beyond those already being accounted for in the West Group forecast.

Environmental Impacts Related to HGP

See discussion in Section 8.1.

Environmental Impacts Related to Other Actions

If the energy conservation program did not reduce the loads sufficiently to replace HGP then it is reasonable to expect that some energy would be purchased from the Pacific Southwest. The impacts of this action are discussed in Section 8.1.3.

If the conservation program were more successful than necessary to replace HGP, then alternate generation could be displaced and/or construction of new generation resources delayed.

Human Environmental Effects

Under this alternative it is assumed that the loads identified in Section 3.2.3 would be reduced by 570 MW through a conservation program. This would reduce the probability of an electrical energy deficit accordingly, but would not eliminate it completely. Depending on the nature of the conservation program adopted, the people's freedom of choice in the use of electrical energy will be reduced. The demand will no longer be determined primarily by availability or cost of production and delivery but instead to some degree by legislative and administrative decree.

Effect on Power Costs

With this alternative power costs in the Pacific Northwest will be affected incrementally by the decommissioning costs of HGP and NPR and the loss of revenue from sale of HGP energy. See the discussion under Section 8.1.

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8.1.2 Replacement Generating Resources

Large central station generating resources which can be developed to serve Pacific Northwest loads have been described in numerous reports.[8-4,8-5,8-6] Generally, the conclusions of these reports state that nuclear fission and coal plants can be constructed now for use in the 1985-1990 time frame.

Oil or gas fired plants are not reasonable alternatives because of the uncertainty, cost, and limited availability of oil and gas. It is national policy to move away from use of these fuels for generating electricity. Geothermal and new undeveloped hydro are limited by resource availability and environmental considerations. Emerging technologies such as synthetic fuels (coal gasification, oil shale development, methane production), solar energy (central station), wind, ocean thermal gradients, wave and tidal power are limited by present technology to small scale operation. While the principles are understood, the scale up of these methods to large central plants is not economical nor technologically practical at this time.

The earliest a new generating resource could be developed to replace HGP would be gas turbines in the early 1980's with the attendent fuel supply problems. Nuclear fission and coal plants could be available in the late 1980's. Other technologies, if they turn out to be practicable, would be unavailable until well into the 1990's.

Environmental Impacts Related to HGP

See the discussion under Section 8.1.

Environmental Impacts Related to Other Actions

Each of the generating resources described above have impacts associated with them. It is not reasonable to present specific impacts because many of them depend on the site and design features of a plant. Generalized impacts associated with the various generating resources are summarized in Table 8.1-1.

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TABLE 3.1-1
Impacts of Generating Alternatives

Residuals	Nuclear	Coal[1]	Oil[2]	Gas[3]
Extraction and Processing[4]				
Water Pollutants ($Tons/10^{12}BTU$)				
Acids				
NO_x	1.65×10^{-1}			
Other	4.1×10^{-1}			
Suspended Solids		8.94×10^{-1}		
Organics		4.43×10^{-1}		
Thermal($BTU/10^{12}BTU$)			2.35×10^{-1}	
				1.03×10^{-11}
Air Pollutants ($Tons/10^{12}BTU$)				
Particulates	9.88×10^{-2}	2.60×10^{-1}	1.72×10^{-1}	4.32×10^{-1}
NO_x	2.28×10^{-1}	3.96	4.39	$3.35 \times 10^{+2}$
SO_x	1.73×10^{-1}	2.41	3.57×10^{-1}	5.26×10^{-1}
Hydro Carbons	4.94×10^{-3}	1.91	$3.35 \times 10^{+1}$	$2.78 \times 10^{+2}$
CO	1.23×10^{-3}	3.30	2.98	4.40
Aldehydes, etc	4.14×10^{-3}	4.11×10^{-1}	7.94×10^{-2}	2.19×10^{-1}
Solids ($Tons/10^{12}BTU$)	$5.62 \times 10^{+2}$	$7.37 \times 10^{+2}$		
Land ($Acre\text{-}yr/10^{12}BTU$)	6.51	$3.32 \times 10^{+1}$	3.58×10^{-1}	1.47×10^{-2}
Occupational Health (Per $10^{12}BTU$)				
Deaths	9.68×10^{-4}	7.75×10^{-2}	1.15×10^{-4}	3.41×10^{-5}
Injuries	2.31×10^{-2}	6.36×10^{-1}	6.54×10^{-3}	3.83×10^{-3}
Man-Days lost	1.49	5.78×10^{-1}	2.13×10^{-1}	1.51×10^{-1}
Electrical Generation[5] [6]				
Water Pollutants ($Tons/10^{12}BTU$)				
Acids				
NO_x		2.57×10^{-1}		
Other	7.44	9.31×10^{-1}	7.44	7.44
Suspended Solids	7.09×10^{-1}	5.34	7.09×10^{-1}	7.09×10^{-1}
Organics	1.35×10^{-2}	2.71	1.55×10^{-2}	1.55×10^{-2}
Thermal($BTU/10^{12}BTU$)	$5.90 \times 10^{+11}$	$5.26 \times 10^{+11}$	$5.26 \times 10^{+11}$	$5.26 \times 10^{+11}$
Air Pollutants ($Tons/10^{12}BTU$)				
Particulates		3.22×10^{-1}	2.72×10^{-1}	7.26×10^{-1}
NO_x		3.59×10^{-2}	3.57×10^{-2}	1.91×10^{-2}
SO_x		2.02×10^{-3}	1.01×10^{-2}	2.93×10^{-2}
Hydro-carbons		6.15	5.31	1.36×10^{-2}
CO		$2.05 \times 10^{+1}$	1.22×10^{-1}	1.50×10^{-1}
Aldehydes, etc.		1.03×10^{-1}	3.40	3.42
Solids ($Tons/10^{12}BTU$)		$5.05 \times 10^{+3}$		
Land $Acre\text{-}yr/10^{12}BTU$	2.15	3.49	2.48	1.42
Occupational Health (Per $10^{12}BTU$)				
Deaths	1.52×10^{-4}	1.11×10^{-3}	4.29×10^{-4}	3.36×10^{-4}
Injuries	1.53×10^{-2}	1.06×10^{-1}	5.99×10^{-2}	5.87×10^{-2}
Man-Days Lost	3.0×10^{-1}	4.41	2.50	2.36
Cost $\$/10^{12}BTU$				
Fixed	$4.19 \times 10^{+5}$	$3.22 \times 10^{+5}$	$3.19 \times 10^{+5}$	$2.12 \times 10^{+5}$
Operating	$3.99 \times 10^{+4}$	$7.92 \times 10^{+4}$	$4.80 \times 10^{+4}$	$5.59 \times 10^{+4}$
Total	$5.05 \times 10^{+5}$	$4.01 \times 10^{+5}$	$3.67 \times 10^{+5}$	$2.59 \times 10^{+5}$

1) Assumes Northwest coal source
2) Assumes National average, pipe line
3) Assumes using liquified gas, via tanker
4) Impacts derived for a process input of fuel equivalent of $10^{12}BTU/yr$.
i.e. in extracting this means $10^{12}BTU$ of resource in the ground.
5) Nation Averages assumed on all alternatives
6) All figures assume an input fuel equivalent of $10^{12}BTU/year$

Source: HIT-593, Hittman Assoc., Inc. November 1974

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Since none of the generating resources can be built until the 1980's, it is reasonable to expect that conservation programs would have to be implemented and energy would have to be purchased from the Pacific Southwest to replace that lost from HGP. The impacts of these actions are discussed in Sections 8.1 and 8.1.3 respectively.

Human Environmental Effects

With this alternative the Pacific Northwest faces an increased probability of an electrical energy deficit until the new generating resources are constructed (see Section 3.2.3).

See the discussion in Section 8.1.

Effect on Power Costs

With this alternative, power costs in the Pacific Northwest will be affected by three factors, the cost of decommissioning HGP and NPR, the cost of purchasing power outside of the Pacific Northwest, if required and the loss of revenue from HGP energy sales. See the discussion in Section 8.1 and 8.1.3.

8.1.3 Purchase of Energy from Outside of Region

Purchase of 570 average MW of energy from outside of the region may be possible on a near term basis but does not represent a reasonable alternative to the proposal. Purchase of energy is possible only when another region has an energy supply in excess of its needs and when transmission capability is available to transport the surplus energy. Transmission capability presently exists between the Pacific Northwest and two other regions, the Pacific Southwest and Western Canada. Neither of these regions have sufficient resources available to assure the supply of 570 average MW to Pacific Northwest on a reliable basis.

However, during some years it is expected that the Pacific Northwest could purchase energy from the Pacific Southwest. The following discussion assumes that 570 MW of energy are purchased for a given year:

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Environmental Impacts Related to HGP

See the discussion in Section 8.1.

Environmental Impacts Related to Other Actions

Most electrical energy generated in southern California is from oil fired plants. The generation of 570 average MW of energy requires about 30,000 barrels of oil to be consumed daily. The environmental impacts of oil fired generation are summarized in Column 3 of Table 8.1-1.

Human Environmental Effects

If 570 MW are available for purchase from outside the region, then no human environmental effects would occur in the Pacific Northwest.

Effect on Power Costs

With this alternative, power costs in the Pacific Northwest will be effected by three factors, the cost of decommissioning HGP and NPR, the cost of purchasing power outside of the Pacific Northwest, if required and the loss of revenue from HGP energy sales. See the discussion in Section 8.1 for decommissioning costs.

The cost of energy imported into the region depends on many factors. These costs would range upward from 23 mills/kW-hr, the incremental fuel cost for an oil fired unit. Using this cost of 23 mills/kW-hr, the price for 570 average MW would be $115 million per year.

8.2 OPERATION OF HGP WITH PERIODIC REVIEW FOR CONTINUATION

An alternative to the proposal would be to make a decision at this time not to operate the HGP indefinitely, but only for a limited period of time after which the continued operation would be reviewed. This alternative would allow HGP to provide energy during those years

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which are presently forecasted to have the greatest energy deficits in the Northwest. During the years 1981 through 1985, a number of new generating projects are scheduled to come on line. These generating projects do not "replace" the HGP. Energy deficits are projected for every year out to 1996.[8-7] It must be recognized that this alternative does not differ considerably from the proposal. This alternative could lead to later extension of HGP operation if warranted, as could the proposal lead to shutdown in the future.

Environmental Impacts Related to HGP

The environmental impacts discussed in Chapter 4 and summarized in Section 1.4 would continue to occur until shutdown. After shutdown these impacts would no longer occur.

Environmental Impacts Related to Other Actions

No other environmental impacts have been identified.

Human Environmental Effects

The short term human environmental effects which may occur if HGP were shutdown would not be expected to occur with HGP continuing operation. Long term effects would depend upon the actual loads experienced after shutdown and the actual construction schedules obtained with the new generating projects. Shutdown of the plant may stress the power supply system after the period of 1983 if construction schedules have slipped.

Effect on Power Costs

There would be no changes in the operating costs of HGP nor in regional power costs under this alternative until shutdown. After shutdown the decommissioning costs for HGP would be incurred. If power is required beyond that time frame, then costs associated with the purchase of energy outside the region would be incurred.

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8.3 PLANT FACILITY AND SCHEDULE MODIFICATIONS

If a decision is made to continue operation of HGP for either a limited or indefinite period of time, then a number of alternatives are available to modify the physical plant structures or to schedule plant operations. Such alternatives may be reasonable in terms of the proposal's objectives, depending upon the cost of such modifications and the period of operation assumed. However, none of the alternatives are considered reasonable in terms of lower environmental costs or a decreased level of environmental degradation, due to the absence of discernible, significant, adverse impacts. Modifications could be considered by the appropriate owners for both the HGP and the NPR.

8.3.1 Modifications to HGP Plant Facilities

The major interactions between HGP and the environment are related to the once-through cooling of the HGP's condensers. These interactions may be changed by making modifications to the intake structure, changes in the discharge structure, or use of off-stream cooling.

Alternative Intake Structures

The present intake system is estimated to remove less than 1000 downstream fall chinook fry each year through impingement (see Section 4.3.1). The number of fry affected by the intake may be reduced by either constructing a larger intake with a reduced approach velocity to the screens or by constructing a new offshore intake submerged close to the bottom in the Columbia River.

Construction of additional intake area along the shoreline was previously studied.[8-8] This alternative considered the construction of two additional pump bays on the northeast side of the intake structure. The effect of this construction would be to approximately halve the intake velocities experienced at the screens. Since two of the pumps in the existing facility would be moved into the new facility, no additional pumps would be required.

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An alternate to the above system would be the construction of an offshore intake in the bed of the Columbia River. This system would have two advantages over the existing shore based system. First, it could be located well offshore where downstream chinook fry would not be expected to congregate. Hence, the exposure of the fry to the intake would be minimized. Secondly, the system, consisting of perforated pipes lying just off the bottom, could also be designed to have low intake velocities (less than 0.5 feet per second). Intake systems similar to this are being designed for use on three other Supply System projects.[8-9,8-10] These intake systems have been evaluated in the Nuclear Regulatory Commission Final Environmental Statement[8-11] and determined by Nuclear Regulatory Commission to be an acceptable alternative to the river bank intake system. One disadvantage of this intake system would be the extremely large size of the perforated pipes required to handle the flows at HGP.

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Environmental Impact Related to HGP

Construction of either of the new intake facilities described above would have beneficial impacts in that fewer downstream migrant fry may interact with these intakes than the present system. However, since the present system is estimated to remove less than 1000 downstream migrant fry per year from the river the benefits would be small.

Adverse impacts associated with the new intakes would include increased turbidity and destruction of the river shoreline and bottom during the construction phase. Historically, a considerable amount of construction has been done on this reach of the Columbia River without significant long-term detrimental effects. The construction impacts would be temporary and would not be reasonably expected to harm the salmonid populations.

Environmental Impacts Related to Other Actions

No other environmental impacts have been identified for this alternative.

Human Environmental Effects

No human environmental effects have been identified for this alternative.

Effect on Power Costs

In 1972 the cost for constructing an additional intake adjacent to the existing structure were estimated to be $3 million and would lead to an annualized installed cost of $200,000. These changes represent $4.5 million capital investment and $300,000 annual operating costs if escalated at 7½% to 1977. This would represent an increase in power cost of between 0.05 and 0.1 mils/kwhr.

Cost estimates for a perforated pipe intake of the size required for HGP have not been developed. Installation of such a system for HGP would be expected to cost considerably more than the intake expansion discussed above.

Alternative Discharge Structures

The present discharge structure passes approximately 60 percent of the cooling water effluent through the last of the four ports on the discharge line. This causes higher temperatures to be experienced in the river below that port than exist below the other three ports. It would be possible to modify the discharge line to make the flow exit uniformly through each of the four ports. This would increase the dilution of the heated water discharged in the near field close to the ports. It would not change the far field characteristics of the discharge plume significantly. Obtaining uniform flow could be accomplished by the installation of additional baffles within the large 11 foot discharge line. This would force equal amounts of water through each exit.

A completely new discharge diffuser system could be designed and installed which would significantly affect the near field temperature region. The diffuser system could be made wider than the 150 foot

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width of the present system. For example, if the diffuser were designed to be 750 feet wide and have uniform flow discharged, dilution on the order of 1:15 could be reasonably expected within the first 500 feet downstream.

Environmental Impacts Related to HGP

No significant beneficial environmental impacts could be reasonably expected with either proposed alternative modification of the discharge. The present system exposes less than 4% of the downstream migrant fry to the hottest portion of the plume. Analysis of the temperature-time exposure shows that no detrimental impacts are reasonably anticipated (See Section 4.3.3). Some data exists to indicate that loss of equilibrium may occur to fish exposed to the centerline of the plume directly below the last discharge port. Increasing the flow out of the other ports or using a different diffuser system which causes the plume to diffuse faster would increase the initial mixing of the plume and decrease the exposure times that downstream migrants may be exposed to higher temperatures. However, it would increase the cross sectional area of the river influenced by the plume. It is not clear that these changes would reduce impacts on the downstream migrants.

Temporary adverse impacts would be expected during the construction phase of a new diffuser system.

Environmental Impacts Related to Other Actions

No other environmental impacts have been identified for this alternative.

Human Environmental Effects

No human environmental effects have been identified for this alternative.

Economic Effect on Power Costs

Costs associated with either modification of the present diffuser system are estimated to be on the order of one million dollars. This would represent an increase in power cost of less than 0.05 mils/kwhr.

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Alternative Cooling Systems for HGP

Another alternative available for minimizing the interaction of the HGP with the environment would be the installation of offstream cooling. Several alternative systems for closed cycle cooling were evaluated in 1972.[8-8] The results of these evaluations are shown in Table 8.3-1. Of the 5 alternative off stream cooling systems evaluated (which included helper as well as completely closed cycle off stream cooling systems) the mechanical draft wet cooling tower system appeared to be the best alternative choice from both an economic and environmental standpoint. Installation of a system of this nature would, compared to present HGP operations, decrease the amount of water withdrawn from the river by approximately a factor of 20 and decrease the amount of heat discharged back to the river by a factor of 100. Approximately 7 acres of land would be required for installation of the cooling towers. It would take three to four years to complete installation of cooling towers.

At the present time the applicable regulations for effluent guidelines for stream electric generating plants do not require the installation of off stream cooling by plants such as HGP. State water quality standards for the Columbia River would require off stream cooling only if a limited mixing zone for temperature were imposed upon the projects discharge.

Environmental Impacts Related to HGP

Utilization of off stream cooling reduces the HGP's interaction with the aquatic environment since compared to the present operation, about 1/20th of the volume of water is removed from the River and 1/100th of the heat load is returned to the River. Therefore, intake velocities would be negligibly small and impingement would be nil. Mixing of the discharge effluent in the present diffuser would be extremely rapid and would be undetectable ($<0.5^{o}F$) within a very short

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TABLE 8.3-1

COST OF ALTERNATIVE COOLING SYSTEMS FOR A NEW 1200 MW PLANT USING THE EXISTING HGP TURBINES*

(Millions of 1972 dollars)

	On-Stream	Mechanical Draft Wet Tower	Natural Draft Wet Tower	Power Spray Module	Open Pond	Dry Towers
Estimated Investment	Base	19.52	21.59	22.59	39.38	52.88
Capital Cost of Energy Due to High Back Pressure	1.34	8.30	11.43	6.29	7.81	36.42
Capital Cost of Pump Energy	1.73	3.63	4.29	2.51	3.74	1.93
Capital Cost of Energy for Terminal Heat Sink	-	1.56	-	2.76	-	8.11
Capital Cost for Water and Treatment	-	0.58	0.57	0.59	0.59	-
Capital Cost for Operation and Maintenance	0.19	2.21	1.43	3.37	.58	6.00
Capacity Penalty	1.39	8.02	11.38	6.31	7.72	36.74
Total Evaluated Cost	4.65	43.82	50.69	44.42	59.82	142.08

* Taken From Reference 8-1

distance downstream. No significant beneficial environmental impacts could be reasonably expected with this alternative because of the low level of impacts at present. The existing intake system removes less than 1000 smolts annually and the discharge system is not reasonably expected to impact fry. Some data does exist to indicate that with the present system loss of equilibrium may occur to fish exposed to the centerline of the plume directly below the last discharge port. It is not anticipated that a significant fraction of fish are impacted in this manner with the present system.

Increased terrestrial impacts would be expected with construction and operation of mechanical cooling towers. Approximately seven acres of land would be required for both cooling towers. Some of this land would come from inside the present fenceline. Atmospheric emissions of evaporative cooling water and salt drift could impact the surrounding vegetation. Analysis of the effects of salt drift from other Supply System projects on the Hanford Reservation indicate that the terrestrial impacts are not reasonably expected to be significant.[8-11]

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Environmental Impacts Related to Other Actions

No other environmental impacts have been identified for this alternative.

Human Environmental Effects

No human environmental effects have been identified for this alternative.

Economic Effect on Power Costs

The capital cost of installation of a mechanical draft cooling system was estimated in 1972 at $43 million. This would be $62 million escalated at 7½% per year to 1977. This would represent an increase in power cost of 1-2 mils/kwhr. Additional costs would be incurred for purchase of energy during construction and loss of generating capacity due to higher turbine back pressure.

8.3.2 Alternative NPR Effluent Treatment Facilities

NPR effluent treatment alternatives have been evaluated and described in the Hanford Waste Management Operations Final Environmental Statement.[8-12] A summary of the five alternatives, included continuing present operations, is shown below in Table 8.3-2. Alternatives 2, 3 and 4 listed in Table 8.3-2 are modifications for which funding has been requested by ERDA.

Intake and discharge alternatives similar to those described in Section 8.3.1 for HGP may be considered for the NPR. The impacts and costs would be similar to those presented in Section 8.3.1 because the two systems are similar.

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Environmental Impacts Related to HGP

No environmental impacts related to HGP have been identified with this alternative.

Environmental Impacts Related to Other Actions

The reduction in radionuclide discharges is shown in Table 8.3-2.

Human Environmental Effects

No human environmental effects have been identified with this alternative.

Economic Effect on Power Costs

The economic effects are shown in Table 8.3-2.

8.3.3 Schedule Modification for HGP

Another alternative to the continued operation of HGP is to place limitations on the schedule within which HGP is operated. These limitations could be either seasonal or annual in nature.

TABLE 8.3-2

N REACTOR EFFLUENT TREATMENT ALTERNATIVES*

Alternatives	Radionuclides Discharged, Ci/yr >66 hr half-life: To Crib (Soil) Total[a]	To Crib (Soil) $^{60}Co + ^{90}Sr + ^{137}Cs$	To River Total[a]	To River $^{60}Co + ^{90}Sr + ^{137}Cs$	Costs, FY-77 $: Capital	Annual Incremental Operating	Installation Time, Months After Funding
1. Continue Present Operations	5,400	410	206	<1	-	-	-
2. Reinject Rupture Monitor Bleed Loop	4,300	330	205	<1	600,000	-	12
3. N Fuel Basin Closed Loop Cooling	3,900	240	204	<1	2,200,000[b]	40,000	24
4. Provide both Reinject Rupture Loop and Closed Loop Cooling	2,800	150	203	<1	2,800,000[c]	40,000	24
5. Total Effluent Treatment plus N Basin Closed Loop Cooling	300	<1	200	<1	22,000,000	600,000	36

(a) Includes 200 Ci/yr tritium which moves directly with the bulk water effluent.
(b) The July 1975 cost estimate is 4 million dollars.
(d) The July 1975 cost estimate is 4.6 million dollars.

* Source: ERDA-1538[8-12]

Seasonal Limitations

The proposal envisions the continued operation of the HGP to produce up to five billion kilowatt hours annually. If the HGP is operated at full power of 860 megawatts, the five billion kilowatt hours is generated in a period of 242 days. Assuming four refueling outages of approximately 10 days each and 23 days of unscheduled outages, then 305 days are required to generate the energy from HGP. That leaves approximately 60 days during the year when HGP would be shutdown. At the present time HGP is shut down during the summer when excess water is available in the rivers and the less expensive hydro generation can be utilized to provide energy for loads in the Pacific Northwest.

One alternative to this mode of operation would be to schedule the 60 days outage during the spring (primarily during April and May) so that HGP is not operating when fry are in the river. Another alternative is to schedule the 60 days outage during the late summer (primarily during August and September) when Columbia River temperatures are highest. A third alternative is to split the 60 days outage so that HGP is not operating for about 30 days in either the spring or the late summer.

If HGP is shutdown during either the spring or fall, it may be desirable to not operate the HGP during the high flow periods of late May, June and July. If this occurs, the HGP would produce less than the full 5 billion KW-hr. If the project were operated during the high flow period, it is reasonably expected that in a year with average water there would be more power available in the Northwest than could be either consumed regionally or exported. If this occurred, then less generation would be provided by the hydro facilities with a resultant spillage of additional water.

Environmental Impacts Related to HGP

Shutdown of HGP during late March, April and May would eliminate impingement at the intake of fall chinook dry emerging from the gravel between HGP and Priest Rapids Dam. According to the analysis in Section 4.3.1 an average of less than 20,000 per year may be inpinged at the HGP intake screens with less than 1,000 of these fry being lost. Also minor

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passage of fry behind the screens may occur. This loss is not reasonably anticipated to effect salmonid populations in the Hanford Reach. Shutdown during the spring would also eliminate an interaction between the discharge and the fry emerging between HGP and Priest Rapids Dam. The analysis in Section 4.3.3 shows that exposure to the plume is not expected to significantly impact the downstream migrant fry. Some data exists which indicates that if the fry were going downstream at the bottom of the river and were fully exposed to the center of the plume coming out of the end port of the discharge, loss of equilibrium may occur. It is not reasonably anticipated that loss of these fish would constitute a significant impact to the salmonid populations in the Hanford Reach.

Shutdown of the HGP during the late summer and early fall (August and September) would eliminate thermal additions to the Columbia River when river temperatures are highest. The temperature increase of the Columbia River once the HGP discharge is fully mixed is shown in figure 4.1-9 as a function of the river flow rate. The frequency of occurence of river temperatures with and without the heat discharge is shown in figures 4.1-10 and 4.1-11 for points downstream of the discharge. Over the 30 year period of record from which figures 4.1-10 and 4.1-11 were developed, the use of once through cooling is calculated to increase the time the river temperature exceeds 68°F (20°C) at North Richland from 0 to .2 percent and at the Washington/Oregon border for 2.0 to 2.7 percent. This would correspond to an average increase of from 0 days to 0.7 days in North Richland and from 7.3 days to 9.9 days at the Washington/Oregon border, although in some years the increase would be shorter and in other years a longer period of time. This alternative would reduce stresses on fish during the August-September period to the extent that an increase in river temperature tends to aggravate those stresses. Passage through the plume during August and September of fry spawned upstream of Priest Rapids Dam is not expected to impact the fish significantly. Although some data shows that loss of equilibrium to fish passing directly through the plume below the end discharge port may suffer a loss of equilibrium.

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Environmental Impacts Related to Other Actions

If HGP were shutdown in the spring and/or fall but operated during the high water time of the year as well as in a year when average flows occur, additional spillage of water at the Columbia and Snake River dams would be required. This would be beneficial for fry migrating downstream at that time. However, it could result in increased nitrogen supersaturation below the dam.

If HGP were shutdown for the spring and/or fall and also not operated during the high-flow months, then the full 5 billion KW-hr could not be produced. During average or better water years when some energy is generated above the needs of the Pacific Northwest, less energy would be available for export outside the region, primarily to California. This would require more generation in California using oil fueled plants. The impacts of this action are discussed in Section 8.1.3.

Human Environmental Effects

No human environmental effects associated with this alternative have been identified.

Effects on Power Costs

Under the present arrangements between the Supply System and ERDA, the Supply System is obligated to pay for sufficient steam to generate up to the maximum number of KW-hr specified, if steam is available from the NPR, regardless of whether HGP generates the power or not. If these same conditions are in the new contract and if HGP were to produce less than 5 billion KW-hr the total cost would remain the same and the cost per KW-hr would

be increased proportionately. If replacement power were purchased for the region (as would be the case in a low water year,) then there would be an additional charge for the replacement power.

Annual Scheduling Limitation

Another alternative for operation of HGP is to maintain the HGP as a "critical year resource." Under this concept the HGP would be operated only if a low water year were to occur and an energy deficit were projected for the coming year or two. A decision on this could be made each year in the early summer; if operation for the following year were then necessary, the HGP would be started. If sufficient water were available in the reservoirs and in the rivers to carry the Northwest loads through the year, then HGP would remain shutdown.

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Environmental Impacts Related to HGP

With this alternative the impacts associated with the present operation of HGP and described in Chapter 4 would only occur during critical water years.

Environmental Impacts Related to Other Actions

Energy generated by HGP and sold to California in some years would not be available for export from the region. This would require California to generate electrical energy using oil fired plants. The environmental impacts of this action are discussed in Section 8.1.3.

Human Environmental Effects

No human environmental effects related to this alternative have been identified.

Effects on Power Costs

The annual cost of maintaining the HGP in a "cold standby" condition is on the order of $10 million. Costs for maintaining NPR in a "cold standby" condition are not known at this time.

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CHAPTER 9

UNAVOIDABLE ADVERSE IMPACTS

Adverse impacts associated with continued operation of the HGP are:

- o removal of less than 1,000 fry annually
- o passage of less than one percent of the drifting organisms through the condensers
- o minor shifts in the bottom community directly below the discharge
- o incremental increase in Columbia River temperature

Adverse impacts associated with the continued operation of the NPR may arise from radioactivity released to the air and river, long term waste storage and cooling water flow.

Before decisions are made to adopt mitigating measures a value judgement must be made as to whether the adverse impacts are significant enough to warrant the impacts and costs associated with those mitigating measures. The adverse environmental impacts associated with the continued operation of HGP are judged to be not significant. The interactions of the HGP with the environment cause only minor damage to individuals in the ecosystem and do not cause changes in the populations. Operation of the HGP for some ten years has shown no discernable interference with the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in the Columbia River. The present proposal does not include adoption of those mitigation measures discussed in Chapter 7.

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CHAPTER 10

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APPENDIX A

GLOSSARY

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APPENDIX A

GLOSSARY

Aquatic Organisms - Organisms which live and grow in the water.

Background Radiation - The level of radioactivity in an area which is produced by sources other than the one of specific interest: in the Hanford region the background radiation is produced by naturally occurring radioactive materials in the crust of the earth, cosmic radiations, and the fallout from nuclear weapons tests.

Background Dose - The dose received by individuals or population due to background radiation.

Benthic Organisms (Benthos) - Those organisms which are attached to or live on the bottom of a body of water.

BPA - The Bonneville Power Administration which is an agency in the United States Department of Interior and is responsible for marketing power from federal facilities in the Pacific Northwest. BPA also provides services such as transmission of electrical energy for other utilities.

Capacity - The total amount of power which can be produced at any one time by an electrical generating system, normally measured in units of megawatts.

Capital Cost - The costs associated with installation and construction of generating capacity and transmission.

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Coliform Count (Number) - A measure of the bacterial content of water. A high coliform count indicates potential contamination of a water supply by human wastes.

Columnaris - A bacterial disease which infects Salmonids in the Columbia River.

Critical Water Year - A year when the flows in the Columbia River system are extremely low. These low flows reduce the ability of the hydro-electric system to produce electric energy. The critical water year is used in planning new generating capacity.

Discharge Structure - A structure or port in the middle of the river through which effluents from the plant are discharged and mixed with the river.

Dissolved Oxygen (and Gases) - Oxygen, nitrogen or other gases which have been absorbed by the water and become dissolved in the water. The amount of dissolved gas (percent saturation) depends on the water temperature. High dissolved gas content can cause stress to fish.

Decommission - The removal of a facility from operation and placing of it in a standby condition or the process of removing a closed facility from the site.

Dermocystidium - A fungus disease that infects salmonids in the Columbia River.

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Dose - A general term indicating the amount of energy absorbed from incident radiation by a specific mass. More particularly describes the amount of radiation received by humans.

Dose Committment - The integrated dose which results from the intake of radioactive material when the dose is evaluated from the beginning of intake to a later time. (usually fifty years); also used for the long term integrated dose to which people are considered committed because radioactive material has been released to the environment.

Ecology (Ecosystem) - The science which deals with relationships between living organisms and their environment. An ecosystem is the biological community along with its habitat.

Energy - As used in this EIS, this refers to electrical energy measured as kilowatt-hours.

ERDA - The United States Energy Research and Development Administration.

Entrainment - The drawing into the thermal plume of drifting organisms.

Far field - That area of the thermal plume greater than approximately a thousand feet downstream from the discharge.

Fry - Juvenile fall chinook salmon of the zero year age class. Fry generally do not possess significant swimming ability.

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Once through cooling - The direct use of river water pumped through the condensers and returned directly to the river at a higher temperature.

Pacific Northwest - As used in this EIS, generally refers to the states of Washington, Oregon and Idaho and the western portion of Montana.

Passage - The flow of water and drifting organisms through the intake screens, through the condenser of the plant and back to the river.

Pathogenic - Capable of causing a disease.

Periphyton - Organisms that live attached to underwater surfaces.

pH - A measure of the relative acidity or alkalinity of a solution. A neutral solution has a pH of 7, acids have pH's of 7 to 1, and bases have pH's of 7 to 14.

Phytoplankton - Microscopic plants that live drifting in a body of water. Algae are phytoplankton.

Plume - The detectable effluent from the discharge as it mixes with the river downstream.

PNUCC - Pacific Northwest Utilities Conference Committee. This committee develops the West Group forecast of loads and resources annually.

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Population Dose - The summation of individual radiation doses received by all those exposed to the source then being considered.

Radiation - Particles and electromagnetic energy emitted by nuclear transformations which are capable of producing ions when interacting with matter. Gamma rays and alpha and beta particles are primary examples.

Radioactive Material - Material which undergoes spontaneous nuclear transformations (radioactive decay) and produces radiation.

Rem - A unit of measure for the dose of radiation which an individual may receive. The dose of one rem has the same biological effect as one roetgen of X-rays. The term mrem is also used to describe 1/1000th of a rem.

Salmonid - This term is used to describe those species of fish such as salmon and steelhead which use the Columbia River for migration and spawning.

Terrestrial Organisms - Those plants and animals which live on land.

Turbidity - A measure of the degree to which sediments and other foreign matter are suspended in water (cloudiness).

Water table - The upper boundary of an unconfined aquafer surface below which saturated ground water occurs.

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West Group - The West Group includes the states of Washington and Oregon, portions of Northern Idaho, those portions of Southern Idaho and Western Montana served by BPA, and small portions of Wyoming, Utah, Nevada and California.

Whole body dose - The radiation dose received by the entire body of an individual. This distinguishes it from the dose received by a specific organ such as bone or thyroid.

Zooplankton - Microscopic animals that live drifting in a body of water.

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APPENDIX B

RESPONSES TO COMMENTS

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WASHINGTON STATE
HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

Highway Administration Building
Olympia, Washington 98504 (206) 753-6008

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Response to Comments
Highway Commission
Page 1

December 2, 1976

Thank you for your review.

Mr. R. A. Chitwood, Manager
Licensing and Environmental Programs
Washington Public Power Supply System
P. O. Box 968
Richland, Washington 99352

Washington Public Power Supply System
Continued Operation of Hanford
Generating Projects
Draft Environmental Statement

Dear Chitwood:

We have completed our review of the Draft Environmental Statement for the above project, as requested in your letter of November 12.

The proposal does not appear to conflict with existing or planned highway facilities in the area.

Thank you for the opportunity to review this information.

Sincerely,

RUSSELL ALBERT
Assistant Director for
Planning and Research

By: R. B. DAVIDSON
Environmental Planner

RAtch
RBD/BH

cc: R. C. Schuster

CO-1

GOVERNOR
DANIEL J. EVANS
COMMISSIONERS:
MRS. B. DOMASKIN
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WILFRED B. WOODS
DIRECTOR:
CHARLES H. ODEGAARD

WASHINATAN STATE PARKS

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WASHINGTON STATE
PARKS & RECREATION COMMISSION
LOCATION: THURSTON AIRDUSTRIAL CENTER PHONE 753-5755
P. O. BOX 1128 OLYMPIA, WASHINGTON 98504

November 23, 1976

IN REPLY REFER TO:

35-2650-1820

Draft EIS -
Continued Operation
of the Hanford
Generating Project

(E-733)

Mr. R. A. Chitwood, Manager
Licensing and Environmental Programs
Washington Public Power Supply System
P.O. Box 968
Richland, Washington 98352

Dear Mr. Chitwood:

The Washington State Parks and Recreation Commission has reviewed the above-noted document and does not wish to make any comment.

Thank you for the opportunity to review and comment.

Sincerely,

David W. Heiser

David W. Heiser, Chief
Environmental Coordination

S9

Response to Comments
Parks and Recreation Commission
Page 1

Thank you for your review.

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DEC 1976

December 14, 1976

State of Washington Department of Ecology

Washington Public Power Supply System
Post Office Box 968
3000 George Washington Way
Richland, Washington 99352

Re: Draft EIS on Continued Operation of the HGP

Attn: R.A. Chitwood, Manager
Licensing and Environmental Programs

Dear Mr. Chitwood:

Thank you for the opportunity to review your document. Review by our staff has produced the attached comments. We hope the comments will be useful to you. Since an EIS is a decision making tool to ultimately decide on a proposal, the completeness and adequacy of addressing the proposal is most vital.

We appreciate the opportunity to have reviewed your statement. If we can be of further service to you, please feel free to contact us.

Sincerely,

Donald O. Provost
Assistant Director
Office of Comprehensive Programs

DOP:bjw

Attachment

cc: Tom Meeker, Department of Fisheries
Dave Guffer, Department of Game
Fred Hahn, Department of Ecology
George Hanson, Department of Ecology
John Stetson, Department of Ecology
Dave Thompson, Department of Ecology
Robert Stamnes, Environmental Protection Agency

Daniel J. Evans, Governor John A. Biggs, Director Olympia, Washington 98501 Telephone (206) 753-2800

December 14, 1976

Department of Ecology Comments:

Draft Environmental Impact Statement --
Continued Operation of the Hanford Generating Project

1. As we mentioned in the pre-draft consultation response, WPPSS presently possesses a State of Washington Waste Discharge Permit for the HGP, whereas your statement on page 1-1 infers it to be an NPDES permit. 1

2. On page 1-2 this statement is made, "However, the continued operation of the NPR has utility independent of the HGP and may occur regardless of the decision by the Supply System on HGP." Would this in fact be the case? It would appear the NPR could not operate without HGP unless total off stream cooling were provided. This seems quite remote! 2

3. Page 3-30, table 3.2-2 - Possibly some clarifications of assumptions used and conclusions drawn from this power forecasting method could be incorporated. Knowing the basis for these tables would assist one to realize what is intended rather than what one should assume. The energy impact of HGP in the power grid for both the West Coast and Washington State would be beneficial. The specifics such as the amount of excess reserve type energy used in the energy balance when it shows a deficit would be helpful. 3

4. Very little discussion was provided concerning what had been done regarding spill prevention and containment for any hazardous substances. What were the certain changes made to reduce probability of oil and other hazardous substances reaching the water if a spill occurred? Also, where are the areas where there is still a potential risk of these materials entering state waters? 4

5. Analysis of seasonal limitations could be very informative toward realizing when and how long a shut-down would occur to meet water quality standards and river temperature limitations. If HGP were down for varying times of 4, 6, or 8 weeks during periods in August and September, what would be the effect to river temperatures and dilution zones that vary from 300 feet to 1,000 feet at 200-foot intervals? 5

6. Information on other off-stream cooling alternatives, such as spray ponds and/or large cooling ponds on either or both sides of the river, could be included. What is the feasibility, costs, etc.? 6

7. Numerous times throughout the document the statements "No significant environmental impacts" and "No significant beneficial environmental impacts could be reasonably expected," are used. What criteria or judgment was utilized in defining "significant"? Depending on ones perception, it could take on may interpretations. 7

1. The Supply System was issued NPDES Permit No. WA002487-2 on January 2, 1975 by the Washington State Dept. of Ecology pursuant to the Federal Water Pollution Control Act Amendments of 1972, Public Law 92-500.

2. See response numbers 1 and 2 to comments by U.S. Environmental Protection Agency.

3. The West Group Forecast is a regional forecast used by northwest utilities as a planning document for scheduling future generation resources. The assumptions used in that forecast are presented in detail in References 3-28, 3-29, 3-30, and 3-33. The interested reader is referred to these documents for a further discussion of methodology. Discussions related to other forecasting methodologies for the northwest are given in the references 3-29 and 3-31.

4. A discussion of oil spill prevention and containment at HGP has been added to Section 2.4.3.

5. Additional detail has been included in Section 8.3.3 concerning seasonal limitations.

6. Additional detail has been included in Section 8.3.1 covering the spray ponds and large cooling ponds.

7. SEPA Guidelines require that the responsible official determine which elements of the environment will be significantly effected by a proposal. Recognizing that what may be insignificant to one individual might be considered significant by another, the following guidelines were used:

9313043.0555

A. An action is considered significant whenever there is a probability of more than a moderate effect on the quality of the environment.

B. An impact is considered significant if the plankton or benthic communities are changed such that the balanced indigenous population is appreciably harmed or threatened or endangered species are adversely impacted.

C. An impact is considered significant if fish communities suffer appreciable harm.

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Office of Community Development

RECEIVED
DEC 23 1976

December 17, 1976

Mr. R. A. Chitwood, Manager
Licensing and Environmental Programs
Washington Public Power Supply System
P. O. Box 968
Richland, Washington 99352

Dear Mr. Chitwood,

Re: Draft EIS, Continued Operation of the Hanford Generating Plant

Dear Mr. Chitwood,

I have reviewed the above draft for the Office of Community Development (Planning and Community Affairs Agency). The proposal is apparently compatible with local land use policies and plans. We therefore have no substantive comments on the proposal or the draft EIS.

Sincerely yours,

Joseph E. La Tourrette
Community Planning Division

JEL:aa

Response to Comments
Office of Community Development
Page 1

Thank you for your review.

RECEIVED
DEPARTMENT
OF GAME

600 North Capitol Way, Olympia, Washington 98504

December 17, 1976

Mr. R. A. Chitwood
Manager, Licensing & Environmental Programs
Washington Public Power Supply
P. O. Box 968
Richland, Washington 99352

Dear Mr. Chitwood:

We apologize for our late response. The Draft Environmental Impact Statement--Continued Operation of the Hanford Generating Project--was reviewed by our staff as requested. Comments follow.

The Washington State Department of Game does not concur with statements in the draft stating or implying that there are no adverse environmental impacts from the operation of the Hanford Generating Project (HGP), and that mitigating measures are not necessary. Additional comments follow according to section heading.

Summary

Any release of radionuclides and concentration in fish and wildlife should be mentioned and waste disposal should be discussed. In the estimate that less than 1% of drifting organisms are exposed to passage through condensers, is it assumed that drift organisms are equally distributed throughout the river? (Page 1-1) 1 2

The heated plume can affect littoral plant and animal associations, and fish may be impacted as they swim out of the plume or during shutdown. A sudden drop of water temperatures as small as 2° C can result in unstable swimming movements in fish, and a 6° C drop can cause death in some fish. Fish could adapt to the warmer temperatures of the plume, swim upstream, and suffer shock from the drop in water temperatures. Similar problems could occur during shutdown. (Page 1-2, top paragraph) 3 4

What security problems exist with plutonium? What radioactive fission products would be produced? Is it accurate that the highest doses of radiation to all humans from the Hanford Generating Project would be 0.16 mrem.? (Page 1-2, paragraph 2) 5 6

1. A detailed discussion of the radionuclide uptake and doses for terrestrial and aquatic organisms is given in Section 3.1.2 of LRDA-1538.

2. The distribution of drifting organisms in the river is shown in Reference 3-9 to be uniform. Additional discussion relating to the calculation has been provided in Section 4.3.2.

3. The HGP plume is confined primarily to the center of the river and does not significantly affect littoral zones.

4. The subject of "cold shock" is discussed in Section 4.3.3. As noted in Section 4.3.3, there is not a reasonably anticipated significant adverse impact due to cold shock.

5. A detailed discussion of the security regulations used in the handling and shipment of plutonium by the U.S. Government is beyond the scope of this final EIS. The reader is referred to the U.S. Energy Research and Development Administration, Richland Operations Office, P.O. Box 550, Richland, WA 99352 for further information.

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Fission products which are produced by the NPR and are considered in the processing and storage of wastes are discussed in detail in ERDA 1538.

6. The radioactive effluents from the NPR are projected to give a dose of 0.16 mrem per year to a hypothetical maximum individual, a non-existent person, who could live as close as possible to the NPR and has dietary and recreation habits which maximize the dose received. The closest point where an individual could live in an unrestricted area is 5.5 miles to the northwest of NPR. Higher radiation doses may be received by "radiation workers" who work at the NPR facility. Doses received by these individuals are governed by ERDA Manual Chapter 0500.

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What security problems do the New Production Reaction (NPR) cause, especially if it is manufacturing materials for atomic explosives? 7
Is weapon grade plutonium produced at HGP? (Page 1-4, paragraph 1) 8

We do not concur with your statement that impingement, entrainment, and thermal pollution result in a lack of impacts, and that cooling towers are not reasonable. (Page 1-4, paragraph 3) 9

What data do you have on radionuclide concentration in anadromous and resident fish, aquatic organisms, insects, and wildlife found in the Columbia River and basin? 10
Can it be stated that any discharge of radioactive effluents is negligible? (Page 1-5, paragraph 1) 11

We cannot agree with your statement that present impacts are small and mitigating measures need not be taken. (Page 1-5) 12
It is unlikely that the only fish lost from the operation of Hanford are 1,000 chinook salmon. Even if only 1,000 chinook are lost, we consider it a major loss. (Page 1-5, paragraph 4) 13

Description of the Proposal

Would fish that travel up the screen suffer any stress and possibly succumb to disease once they are released to the Columbia River? (Page 2-13, paragraph 3) 14

Description of the Existing Environment

We do not concur with the statement, "since no elements of the environment are significantly affected, all of the elements of the environment should be marked 'not applicable'". (Page 3-1, paragraph 2) 15

In what ways do the thermal plume, with increased temperatures, contribute to C. Columnaris diseases in fish? (Page 3-23, paragraph 5) 16

What months, and for how long was HGP shut down over the last nine years? 17
At what percent of capacity did it operate on the average? 18
What is HGP doing to encourage conservation? (Page 3-33, paragraph 2)

Environmental Impacts of the Proposal

We do not concur that elements of the environment should be marked "Not Applicable". (Page 4-1, paragraph 1) 19

What was the largest fish sucked onto the intake screen? (Page 4-14, paragraph 2) 20

It would be helpful to know what months impingement and entrainment studies were conducted. Steelhead peak spawning occurs in May, and emergent fry come out of the gravel in June, July, and August. Have studies been performed on the impacts of impingement and entrainment in those months? (Page 4-15, paragraph 2) 21

7. Security for the NPR is handled by ERDA. See response number 5 to comments of Dept. of Game above.

8. No plutonium is produced at the HGP. The NPR produces a number of different grades of plutonium. One possible grade from NPR is "weapons grade" plutonium.

9. The impacts associated with impingement, entrainment, and thermal discharge are discussed in Section 4.3. The alternative of using cooling towers is discussed in Section 8.3.1.

10. Date on radionuclide concentrations in anadromous and resident fish and wildlife found in the Columbia River and basin are presented in the annual reports on environmental surveillance sponsored by the U.S. Energy Research and Development Administration. The latest data is given in the document BNWL-1979 (Rev), Environmental Surveillance at Hanford for CY-1975, Battelle, Pacific Northwest Laboratories, Richland, WA, June 1976.

11. The statement on page 1-5, paragraph 1 is that "The present discharge results in negligible doses," not that "any discharge of radioactive effluent is negligible." The statement as it is presented in the draft EIS is correct.

12. The magnitude of the impacts are discussed in Chapter 4 of the draft and final EIS. Based upon this discussion the Supply System judges the present impacts to be small. The loss of 1,000 chinook salmon fry is related to operation of the intake structure at HGP. This is not a major loss because it represents a very small fraction of the total number of downstream migrants.

13. See response number 7 to comments by the Dept. of Ecology for a discussion of what constitutes a significant impact.

14. The studies conducted to determine the mortality of fish impinged on the traveling screens included holding fish for 96 hours (4 days) after impingement occurred. Holding and observing fish for 96 hours to determine mortality is a standard and reasonable experimental method used by fisheries biologists. At the end of the 96 hour period the behavior of fish which had been impinged was observed to be similar to behavior of those fish used as controls. No obvious stresses such as descaling or physical damage were observed on those fish released after 96 hours.

15. See response number 7 to comments by the Dept. of Ecology for a discussion of significant impact.

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16. The impact of temperature increases in the Columbia River on C. columnaris is discussed in Section 4.3.3.

17. The HGP has generally operated between mid August of one year to the end of April the following year. During May, June and July, high water in the Columbia River system provides sufficient power that HGP's operation is not required. The average capacity factor (defined as the actual kilowatt hours produced divided by the number of kilowatt hours which could be produced if HGP operated 365 days a year at 860 MW) for the last five years is 45%.

18. See response number 17 to comments by Mr. Robert G. Walton.

19. See response number 7 to comments by the Dept. of Ecology for a discussion of significant impacts.

20. The largest fish found impinged on the HGP intake screens was a badly decomposed chinook salmon with a fork length of 71.5cm.

21. Sampling of the intake screens has been conducted for every month of the year except July. The HGP is normally shut down during July due to the lack of need for power from HGP at that time.

Is it accurate to state that a fish leaving the plume would not encounter loss of equilibrium? Changes of temperatures as low as 2° C have resulted in equilibrium problems for some fish. (Page 4-25, paragraph 1) | 22

With alternative spawning grounds eliminated, it may not be accurate to state that continued spawning indicates that those areas are still quite acceptable to salmon. They have nowhere else to go. (Page 4-29, paragraph 1) | 23

Where is the closest steelhead spawning occurring? (Page 4-30, paragraph 2) | 24

Are any fish attracted to the plume to feed? (Page 4-30, paragraph 3) | 25

While secondary impacts may not be as great as those caused by other factors, they should not be played down. The Game Department considers any loss of wildlife habitat to be significant. (Page 4-31, paragraph 2) | 26

Studies should be conducted on fish impingement at the NPR facility. It may be faulty to reason, because NPR is smaller than HGP, it produces no significant impact to the aquatic environment, especially when both operated at the same time. (Page 4-34, paragraph 1 and 2) | 27

It is unlikely that burning of 640,000 gallons of oil would produce no impacts to air quality. (Page 4-38, paragraph 1) | 28

Adverse Environmental Impacts Which May Be Mitigated

We do not feel the plume models adequately assess impacts to salmonids, and that no potential risk to salmonid populations using Hanford reach still exists. (Page 7-1, paragraph 3) | 29

We still recommend a closed cycle cooling system. (Page 7-3, paragraph 1) | 30

Alternatives to the Proposal

It may be inaccurate to state a lack of growth means an increase in unemployment, and imply that growth would mean a decrease in unemployment. (Page 8-4, paragraph 1) | 31

Does it necessarily follow that if HGP is shut down, electricity would need to be purchased elsewhere? | 32
If HGP were shut down, what amount currently spent on security could be saved? (Page 8-4, paragraph 2) | 33

We concur with your section on conservation. (Pages 8-5, 8-6, 8-7) | 34
What is the expected life of HGP? (Page 8-12) | 35

22. The discussion on page 4-25 relates to the exposure of fish which have been acclimated at one temperature to a higher temperature. Loss of equilibrium depends upon many things including the acclimated temperature, the magnitude of the temperature change, the time the fish is exposed to the higher temperature, and the species of fish. For the conditions presented in Section 4.3.3 it is not reasonably anticipated that fall chinook fry would encounter loss of euqilibrium.

23. The continued spawning of salmon in the Hanford Reach over a period of generations indicates that the spawning grounds are adequate for salmon reproduction and are still quite acceptable to the salmon.

24. Specific individual steelhead spawning areas have not been identified in the Hanford Reach.

25. Limited studies have been done to determine if fish are attracted to the plume area. These studies concluded that attraction would not appear to be a problem. Minor shifts in the benthic community in the plume below the discharge have been detected. These changes may increase food availability in the plume for certain fish that feed off the bottom.

26. No attempt has been made by the Supply System to play down secondary impacts. The impacts discussed in Section 4 are presented at a level of detail related to the significance of the possible impacts. Since the HGP is an existing facility, loss of habitat associated with continued operation should be minimal. See response number 7 to comments by the Dept. of Ecology for a discussion of significant impact.

27. Fish impingement at the NPR facility is a potential impact of which ERDA is aware. It is our understanding that ERDA has had discussions concerning the NPR intake facilities with various state and federal agencies (see page 3 of National Marine Fisheries Service letter). In the draft and final EIS, the Supply System has not reasoned that the NPR intake produces no impact.

28. The draft EIS did not state that the burning of 640,000 gallons of oil would not produce any impacts to air quality. Instead, the impacts are not expected to be significant due to this relatively small volume of fuel consumed annually.

29. The analysis performed in Chapter 4 is based not only upon plume models but on direct field measurements and laboratory experiments over a wide range of conditions. The techniques used are reasonable methods for assessing the impacts of the HGP thermal discharge.

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30. The alternative of installation of a closed cycle cooling system is discussed in Section 8.3.1.

31. The statement in paragraph 1 on page 8-4 refers to the location of new industries in the State of Washington. Given the increasing number of persons of employment age in the State of Washington, even without in-migration of new personnel, the conclusion that fewer employment opportunities would cause either an outmigration or an increase in unemployment is correct.

32. It is necessary to balance electrical loads and resources in the Pacific Northwest. If the HGP were shut down and electricity were required, it would need to be purchased from outside the Pacific Northwest.

33. If HGP were shut down it is not anticipated that there would be any changes in the security required by ERDA. If the NPR were shut down limited savings in security may be possible due to fewer numbers of personnel being employed at the Hanford Reservation.

34. Thank you.

35. HGP became operational in 1966 and bonds were sold to be paid off in 30 years (by 1996). The HGP is expected to have an useful operating lifetime in excess of 30 years.

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We urge you to make the modifications to intake structures, changes in discharge structures, and use of off stream cooling. (Page B-14, paragraph 1) Beneficial environmental impacts would occur from off stream cooling. (Page B-18, paragraph 2) 36

Great concern should be given to the environment of all states; however, should the States of Washington and Oregon suffer environmental degradation and risk of nuclear accident to postpone another--in this case--California from coming to grips with its energy/conservation problems? (Page B-2, paragraph 3) 37

Thank you for sending the draft. We hope you find our comments helpful.

Sincerely,

THE DEPARTMENT OF GAME

Bob Zeigler

Bob Zeigler
Applied Ecologist
Environmental Management Division

BZ:cm

36. The discussion in Chapter 4 and Section B.3.1 indicate that present impacts are not significant and in many cases not discernable and that modifications of intake and discharge structures and the use of offstream cooling would not approximate the proposal's objective at a lower environmental cost or a decreased level of environmental degradation.

37. The objective of the proposal is not to supply California with power until it can come to grips with energy/conservation problems. The objective of the proposal is to maintain existing electrical generating resources which can continue to provide a base load energy resource for consumers in the Pacific Northwest. In those years when high water occurs and the energy is not needed in the Pacific Northwest, the energy can then be transmitted to California. In our judgement the continued operation of the HGP will not cause the states of Washington and Oregon to suffer significant environmental degration.

Your Seattle City Light

Gordon Vickery Superintendent

RECEIVED
DEC 27 1976

December 11, 1976

Mr. R. A. Chitwood, Manager
Licensing and Environmental Programs
Washington Public Power Supply System
P. O. Box 968
Richland, Washington 99352

Dear Mr. Chitwood:

The Washington Public Power Supply System's Draft Environmental Impact Statement on Continued Operation of the Hanford Generating Project, issued on November 10, 1976, has been reviewed by the Department of Lighting's Engineering Division, Office of Environmental Affairs and Corporation Counsel and has been judged to be complete and sufficient in detail.

I wish to commend you for having done a thorough job on this Draft EIS.

Sincerely,

Gordon Vickery

GORDON VICKERY
Superintendent

CSH:ct

City of Seattle Department of Lighting, City Light Building, 1015 Third Avenue, Seattle, Washington 98104, (206) 625-3000

Response to Comments
Seattle City Light
Page 1

Thank you for your review

DEPARTMENT OF FISHERIES
ROOM 115, GENERAL ADMINISTRATION BLDG
OLYMPIA, WASHINGTON 98504
Phone: 753 6600

DANIEL J. EVANS
GOVERNOR

DONALD W. MOSS
DIRECTOR

December 23, 1976

RECEIVED
DEC 29 1976

Mr. R. A. Chitwood, Manager
Licensing and Environmental Programs
Washington Public Power Supply System
3000 George Washington Way
Richland, Washington 98352

Dear Mr. Chitwood:

We have reviewed the Draft Environmental Impact Statement on Continued Operation of the Hanford Generating Plant and have the following comments regarding the salmon resource:

pp. 3-21 - final paragraph. Reference to the chinook spawning should be in terms of numbers of redds rather than number of chinook spawning. | 1

pp. 3-23, 2nd paragraph. All fall chinook fry have not emerged from the gravel by March. | 2

pp. 4-1, Heated Effluent Distribution. This Department does not condone the continued discharge of heated effluents into the Columbia River which could have an adverse effect on the salmon resource. | 3

pp. 4-14, final paragraph. Once again, we emphasize that the fry do not emerge from the gravel primarily in February and March. | 4

pp. 4-15, final paragraph. The statement regarding chinook losses at the HPG intake is misleading. In 1976 a total of 12,000 chinook fry were impinged during the test period. The tests regarding survival were conducted in a completely protected environment. Whereas wild fish that have been impinged will be much easier prey for predators, they will be descaled and more subject to disease and, in addition, they may have received physical damage so severe that they will cease feeding and migration. | 5

The statement does not address fish passage through the screens. During the first two years of study at the screens large numbers of chinook fry passed the screens. During the last two years of study, investigations to determine the magnitude of passage through the | 6

1. The appropriate changes have been made in the final EIS.

2. The appropriate changes have been made in the final EIS.

3. Section 4.3.3 discusses the impact of the HGP's discharge on aquatic biota. The discussion in Section 4.3.3 does not indicate that there is an adverse effect on the salmon resource.

4. Emergent fall chinook fry have been observed in the Hanford Reach as early as December and fry have been observed still in the gravel as late as April. However, emergence occurs primarily in February and March.

5. See response number 14 to comments by the Department of Game.

6. Passage studies were conducted on April 26, 1976. The results of those studies are summarized in reference 4-6 and conclude, "The small numbers of fish observed behind the HGP traveling screens on 26 April 1976 compared to impingement rates on the days immediately preceeding...indicate that screen passage was low compared to impingement".

screens were not undertaken. Fry were found behind the screens but the magnitude of this loss was reported as uncertain.

The 1976 mortality figures were not extrapolated to estimate the total loss. During 1975, the mortality for the period March 18 to April 28 was 8-9% of the total migration of 311,000 chinook and extrapolated to 15-18% mortality of the migration to May 9. Even though the plant shut down earlier than usual during 1976, the mortality should be extrapolated to the date that the plant usually shuts down to obtain realistic mortality figures.

When these factors are considered your estimated yearly average mortality figure of 1,000 chinook juveniles is ridiculously low. This Department cannot condone the continued operation of intake screens that have been shown during four years of studies to have a significant adverse impact on the salmon resource. 7

These same comments apply to pp. 8-14, Alternative Intake Structures, first sentence, pp. 8-15, Environmental Impact Related to HGP, second sentence, pp. 8-18, Environmental Impacts Related to HGP, 1st paragraph first sentence, pp. 9-1, first adverse impact listed.

pp. 4-16 to 4-30. We cannot agree with the majority of your statements regarding the effects on salmon. Much of the evidence on effect or lack of effect on the salmon resource is inferred from limited field studies, laboratory experiments or the literature. Data exists that shows that heated effluents have an adverse effect on salmon. 8

pp. 7-3, 1st paragraph - The statement is made that installation of cooling towers is not considered reasonable because of the low impacts associated with the once through cooling system. We reiterate that the continued operation of the plant poses a potential risk to the salmon resource and those risks cannot be adequately defined without further studies. 9

pp. 9-1, final paragraph. It is stated, "The adverse environmental impacts associated with the continued operation of HGP are judged to be not significant". What criteria were used to make these judgements? We don't understand how these judgements can be made without sufficient data regarding the effects on the salmon resource. 10

We appreciate the opportunity to review this draft EISs

Sincerely,

Donald W. Moos
Director

sc
cc: Dave Gufler - WDG, Olympia
Dave Thompson, DOE, Olympia
Fred Cleaver, NMFS, Portland

7. The discussion in Section 4.3.1 of the final EIS has been expanded to include additional detail on the estimated numbers of fry impacted.

8. The Supply System believes that a rather large and comprehensive body of knowledge exists that defines in both general and specific terms the impacts associated with the HGP heat dissipation system. The references listed in Section 4.3 cover a wide range of data and discussions on salmonids which are relevant to the proposal. While data does exist to show that heated effluents may have an adverse effect on salmon, analysis of this data as applied to the HGP discharge (see Section 4.3.3) shows that no significant adverse impact on salmonid population is reasonably anticipated due to the HGP's discharge.

9. The alternative of installing cooling towers is discussed in Section 8.3.1. See also response number 8 above.

10. See response number 7 to comments by the Department of Ecology for a discussion of what constitutes a significant impact.

ROBERT W. STRAUB
GOVERNOR

RECEIVED 14-6-3
DEC 21 1976

DEPARTMENT OF ENERGY

528 COTTAGE STREET N.E. • SALEM, OREGON • 97310 • Phone 378-5584

December 20, 1976

Mr. R. A. Chitwood
Manager, Licensing and Environmental
Programs
Washington Public Power Supply System
P. O. Box 968
Richland, Washington 99352

Dear Mr. Chitwood:

The State of Oregon enforces stricter regulations on the Columbia than are currently imposed on the Hanford Generating Project (HGP). The stated policy of the Oregon Departments of Energy, Fish and Wildlife, and Environmental Quality is to require off stream cooling for energy facilities.

Under the existing permit, thermal effluents are of major concern. The amount of heat discharged to the Columbia by the HGP is 100 times that of the Trojan Nuclear Plant in Oregon. The allowed temperature difference at HGP is over two times the maximum allowable for Trojan. The mixing zone for the HGP extends 3,000 feet downstream, ten times longer than the allowed mixing zone for Trojan. Furthermore, the HGP mixing zone includes the surface of the river, whereas Trojan's ends a foot below the surface. 1

A second area of particular concern is the discharge of chlorine to the Columbia. Chlorine in very small quantities has been shown to be detrimental to fish. The existing NPDES permit for the HGP allows concentrations as high as .5 ppm chlorine in very large flows of water to the Columbia. This is compared with Trojan's limit, which is set at no detectable chlorine in flows that are less than one-tenth as large. 2

Our concern is that fish passing through the thermal and biocide plume are weakened. Possible consequences could be increased predation and disease. Considerable numbers of fish spawn in the area. It is not possible to determine whether the numbers would be larger if the plant were not present. 3 4

1. A number of essential geographical, hydrological, and biological differences exist between the HGP and Trojan sites. Current effluent guidelines for thermal power plants, such as HGP, that were operating prior to January 1, 1970 do not require the use of offstream cooling. The analysis given in Section 4.3 of this EIS shows that the thermal plume has no significant impact on the aquatic biota of the Hanford Reach of the Columbia River. The HGP discharge has no discernable effect at the Washington-Oregon border.

2. As stated in Section 2.4.2, the chlorination system has never been used at HGP during operation of the project. It should be noted that the conditions in the HGP NPDES permit are in compliance with the effluent guidelines established for units such as HGP.

3. The impacts associated with the passage of fish through the HGP plume are discussed in Section 4.3.3. This discussion shows a lack of significant impact to fish passing through the plume.

9313043.0568

4. The impacts of the HPG discharge plume on adult passage and spawning are discussed in Section 4.3.3. This discussion concludes that impacts on spawning are not significant. The thermal plume does not interact with known spawning areas until after it is mixed with the river water. It is highly speculative to suggest that the number of fish spawning would be greater since the HGP plume does not impact any known spawning areas.

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The benefit derived from off-stream cooling depends largely on how long the plant is to operate. If, within the near future, the reactor were to be closed down, the economic cost of off-stream cooling would not be warranted. On the other hand, if the NPR and HGP were to operate for some longer period, the cost of installing off-stream cooling would be justified. This important alternative to the proposed action can not adequately be considered without assessment of the likelihood of continued operation of the NPR. If, in the absence of operation of HGP, NPR were also to stop, then impacts from both need to be considered in this EIS. 5

It is highly desirable to use NPR for electrical generation if it would be operating regardless of HGP. Relative to the cost of a new facility of equal size, the cost of off-stream cooling for the Hanford Generating Project is small. For a single plant, HGP could be adversely affecting fish life in the Columbia. This impact could largely be eliminated through off-stream cooling.

Very truly yours,

David Philbrick

David Philbrick
Environmental Specialist

DPh:sj

cc: Irv Jones, Fish & Wildlife
Steve Willingham, DEQ
Department of Ecology, Washington State
Janet McLennan

5. This EIS considers operation of the HPG on a continuing basis into the 1990s. The alternative of offstream cooling is discussed in Section B.3.1. Installation of offstream cooling would have little beneficial affect on the environment because of the lack of significant impacts associated with the present system. The shutdown of HGP does not imply that NPR would also cease operation. See response number 1 to comments by the U.S. Environmental Protection Agency.

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION X
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

RECEIVED
DEC 16 1976

REPLY TO ATTN OF: 10FA - M/S 623

DEC 15 1976

Mr. R. A. Chitwood, Manager
Licensing & Environmental Programs
Washington Public Power Supply System
P. O. Box 968
Richland, Washington 99352

Dear Mr. Chitwood:

The Environmental Protection Agency has completed its review of your recently issued Draft Environmental Impact Statement on the "Continued Operation of the Hanford Generating Project." We have the following comments and suggestions to offer for your consideration in the preparation of a Final Environmental Statement.

General Comments

There seems to be a real question with regard to whether the New Production Reactor (NPR) would continue in operation without the sale of steam for power generation to the WPPSS Hanford Generating Project (HGP). It appears that the demand for steam and the revenue associated with its sale could be a significant factor in ERDA's decision on whether to continue operation of the NPR. 1

A corollary factor in ERDA's decision on continuing operation of the NPR would be the terms of its current NPDES discharge permit. The permit is written so that the NPR cannot be in compliance with the effluent limits without selling its waste steam to the HGP. Thus, the sale of steam appears to be a key causal factor in the continued operation of the NPR and its associated fuel cycle (uranium mining/milling, enrichment, fuel assembly, burnup, spent fuel reprocessing and waste disposal). 2

1. The Supply System requested information from the U.S. Energy Research and Development Administration, Richland Operations Office relating to ERDA's policy with regard to the continued operation of NPR and its relationship to HGP. The Richland Operations Office of ERDA responded that the only reason for operation of the NPR is the production of plutonium and that NPR will continue to operate to produce plutonium if plutonium is required by the Federal Government. It would be presumptuous of the Supply System to speculate on ERDA's actions for NPR should the HGP cease operation.

2. ERDA is continuing to monitor the environmental aspects associated with operation of the NPR (see response number 2 to comments by ERDA). See also response number 1 above.

It would therefore be appropriate for the HGP environmental statement to discuss the environmental impacts associated with the continued operation of the NPR and its associated fuel cycle facilities, with particular attention being paid to on-site and near-site impacts. The discussion could be a summary based on other environmental statements/reports such as the Hanford Waste Management EIS issued by ERDA. The discussion could then refer the reader to these source documents for additional detail. Given the integrated nature of the operation of these facilities, we believe such a discussion is necessary in order to provide both lay and professional readers with a full understanding of the environmental effects of the proposed action. Detail equivalent to that provided on the HGP may be appropriate.

Detailed Comments

1. The expanded discussion of the impacts of continued NPR operations should pay particular attention to the following questions and issues: (a) effects of the intake structure and thermal discharges on aquatic biota and water quality; (b) whether water quality standards violations could or would be induced by either the NPR or the HGP discharge or the combined effects of the two discharges; (c) radioactive waste storage and disposal; (d) whether fuel reprocessing would be postponed until 1983 if the joint operation of NPR/HGP were continued until then; (e) the effects of NPR operation on the Columbia River in the absence of HGP operation (assuming the proposed action is not implemented). 3

2. Reference is made to the renewal of the WPPSS NPDES permit as an identifiable action on page 1 (and several other pages) of the DEIS. The Agency does not consider the existing State-issued permit to be a currently valid NPDES permit because (1) DOE did not follow appropriate procedures and allow EPA to express comments before the permit's issuance, and (2) the existing permit does not require compliance with State Water Quality Standards (and thermal mixing zones) as interpreted using DOE's mixing zone policy dated January 12, 1974. Until these problems are corrected, EPA does not consider the HGP to have a validly issued NPDES permit. The application is for an original permit, not for a renewal. 4

3. The DEIS creates some confusion about the mixing zone for the HGP. 5

At page 4-12, the DEIS states that water quality standards for chemical effluents are met at the edge of the "dilution zone." Yet the dilution zone is not described.

3. Approximately ten percent of the discussion relating to impacts is devoted to impacts of the NPR. Much of the discussion in Section 4.1, 4.2 and 4.3 relating to nonradiological impacts of HGP also applies to the NPR. However, since the NPR intake volume and discharge of heat is considerably smaller than that of the HGP (when both plants are operating) the impacts of NPR should be smaller. Radiological impacts are discussed in detail in ERDA-1538 and the reader has been referred to that document in the final EIS as suggested. Detail equivalent to the HGP treatment appears unwarranted because the NPR impacts related to nonradiological affects are reasonably anticipated to be smaller than those of HGP and the radiological impacts are discussed in detail in ERDA-1538. The effects of the intake structure and thermal discharge on aquatic biota and water quality are summarized in Section 4.5.1 and 4.5.2. Additional detail has been added to Section 4.1 to discuss the combined impacts of HGP and NPR discharges. Radioactive waste storage and disposal is covered in detail in ERDA-1538. Fuel reprocessing is briefly summarized in Section 4.5.4. The impacts of NPR operation on the Columbia River in the absence of HGP operation is not the subject of this proposal. It is reasonable for ERDA, pursuant to NEPA, to review the environmental factors related to a proposal for continued operation of NPR (see response number 2 to ERDA comments).

4. The Supply System considers its present discharge permit to be a valid NPDES permit issued by the Washington State Dept. of Ecology (see also response number 1 to comment by DOE). See response number 7 to EPA comments below for a discussion of DOE's mixing zone policy.

5. The mixing zone is defined in the HGP NPDES permit for turbidity, total coliform organisms, dissolved oxygen and total dissolved gas. The statement on page 4-12 has been revised to better define this mixing zone.

The first full paragraph on page 8-18, on the other hand, indicates that State water quality standards might require off-stream cooling "if a mixing zone were imposed...." If the mixing zone discussed is not the same as the dilution zone on page 4-12, that fact should be made clear. 6

In any case, the discussion on page 8-18 appears to indicate that no mixing zone will be imposed on the HGP. Yet the DOE mixing zone policy (copy enclosed) would require the imposition of a mixing zone of 300 feet in length. The EIS should discuss whether a mixing zone will be imposed, its anticipated length, and if it is anticipated as being longer than 300 feet, how the WPPSS expects to establish an exemption from the DOE mixing zone policy portion of the State water quality standards. 7

4. The combined effects of the thermal discharges to the Columbia River from the HGP and the NPR should be described. A diagram of the two thermal plumes (horizontal and vertical) on the same sheet would aid the reader in determining whether any "overlap" problems are likely. This description should indicate whether the combined plumes would be able to comply with DOE's "mixing zone" policy, referenced in comment #3 above. 8

5. NPR flows with HGP operating are given as 270,000 gpm (page 2-7) and 315,000 gpm (page 4-34). The difference between these two figures should be explained. 9

6. The analysis of the impact of HGP discharges upon juvenile and adult fish is fairly complete. However, a more quantitative discussion of the impact of increased river temperatures upon spawning and incubation and the incidence of temperature dependent disease is necessary. In particular, (on page 4-29) the statement indicates that the impacts of the HGP discharge on spawning and incubation will be less than the impacts of past discharges from multiple-nuclear production reactor operations. This is information of little utility. What the reader needs to know is what will be the impact on spawning and incubation (10-12% loss as modeled??) and whether such a loss should continue to be considered acceptable in light of the increasing pressures on this fishery resource. Similarly, the statement should describe, quantitatively, the increase in disease incidence and mortality due to the HGP discharge. 10 11

7. The EIS should describe the quantity of pollutants discharged from low volume waste sources and in the once through cooling water. 12

6. The mixing zone discussed on page 8-18 refers to temperature. This statement has been revised to clarify this point.

7. The Department of Ecology mixing zone policy referred to is the used by DOE personnel of draft guidelines for the establishment of dilution zones when developing permit conditions. It should be noted that this policy:

   (1) Has never been developed to the point of becoming regulation.

   (2) Provides that the permit writer is to use his discretion in applying the guidelines on a case by case basis.

   (3) Is based on "draft guidelines" for developing mixing zones that have no obvious scientific basis for widespread application and have not undergone public comment.

   The Supply System does not believe that a mixing zone is required for HGP for temperature to protect the aquatic environment (see the discussion in Section 4.3.3). If a mixing zone were imposed upon the HGP discharge such as to preclude the use of once through cooling the Supply System would use such administrative and judicial remedies as are available at that time.

8. A discussion of the combined affects of the two plumes has been added to Section 4.1. A vertical profile of the HPG discharge has been added as Figure 4.1-8. See response number 7 above for a discussion of DOE's mixing zone policy.

9. The appropriate changes have been made in the final EIS.

10. Thank you.

11. The discussion on spawning and incubation fairly indicates that the impact associated with HGP operation in the past have not been significant. Additional discussion of temperature effects on disease incidents are provided in Section 4.3. The ten to twelve percent mortality refers to hatchery experience, not to any modeling.

12. The maximum values for the quantity of pollutants that may be discharged in the low volume waste sources and the once through cooling water are given in Table 2.4-2.

A comparison should be made between these quantities and the limitations established by the Steam Electric Power Generating Point Source Category Effluent Guidelines and Standards, Chapter 1, Subchapter N, Part 423. 13

8. The discussion of the impacts from NPR fuel production wastes, on pages 4-35 to 4-36 should be expanded to include a description of the effects on local groundwater. 14

9. Figures 4.1-1 through 4.1-6 are meaningless without a specification of the discharge flows and temperatures (of the discharge) used. 15

10. Figure 3.1-2 should show river mile points in order to help the reader locate the area under consideration. 16

11. A Graphic showing the vertical temperatures in the discharge plume would give the reader a better picture of the mixing which takes place in the river. 17

12. Given the uncertainties in current power planning, it would not be surprising if WPPSS decided at some later date to propose continuing operation of the NPR/HGP complex beyond 1983. This seems likely because of the rather low key efforts aimed at promoting or requiring energy conservation and because of the long lead times necessary for the successful planning and construction of large base loaded power plants. It would therefore seem appropriate for this statement to discuss the long-term effects of the continued operation of the NPR/HGP complex, in conjunction with other thermal electric power plants planned or under construction in this area, on the Columbia River system's long-term water quality. 18 19

13. The discussion of the economic costs of alternative mitigation measures is misleading in that it does not convert this total capital and O & M costs to a bussbar cost per kilowatt. This should be done and these figures should be compared to current costs per kilowatt and the costs projected for future nuclear and coal-fired power plants in the 860 860 MWe size range. 20

We hope that these comments and suggestions will help you prepare a final environmental impact statement which provides a complete discussion of the environmental effects of continuing the operation of the NPR/HGP complex. We have attached a copy of EPA's comments on ERDA's Hanford Waste Management EIS for your use in evaluating what portions of this statement should be used and referenced in the Hanford Generating Project FEIS. If you have any questions about our

13. The environmental impacts associated with the continued operation of the HGP are not considered to have a direct relationship to the effluent guidelines given in Chapter 1, Subchapter N, Part 423 of the Code of Federal Regulations. However, for the readers information, the comparison is given below.

Pollutant	Maximum Daily Quantity from NPDES Permit (See Table 2.4-2)	Maximum Daily Measured Quantity
Total Suspended Solids	535 lbs/day	9.31 lbs/day
Oil and Grease	107 lbs/day	30.7 lbs/day
Iron	0.8 lbs/day	0.335 lbs/day
Chlorine	0.5 mg/l	0
pH	Between 6.0 and 9.0	6.9-8.5

14. As stated on page 4-35 the calculation of doses and dose commitments are primarily due to atmospheric releases not to ground water releases. Hence, impacts associated with ground water are expected to be minimal. A detailed description of NPR discharges to ground as well as ground water impacts from fuel reprocessing is given in ERDA-1538.

15. Flows and temperatures of the discharge have been added to the discussion in Section 4.1.1.

16. River mile indices have been added to Figure 3.1-2.

17. A figure showing the vertical and near field temperature profile of the HGP plume downstream from the end port has been added as Figure 4.1-8.

18. The proposal considers continued operation of the HGP for an indefinite period of time at least into the 1990s. The present negotiations between the Supply System and ERDA contemplate a contract of five years duration. See response number 17 to comments by Mr. Robert G. Walton for a discussion of conservation.

19. A discussion of the impacts of HGP in conjunction with other thermal electric power plants on the Columbia River has been added in Section 4.1.

20. Costs per kilowatt have been included in the alternative Section 8.3.1.

comments and suggestions please contact me or Mr. Daniel Steinborn of my staff, at (206) 442-1595.

Sincerely,

Alexandra B. Smith

Alexandra B. Smith
Director
Office of Federal Affairs

cc: J. E. Cowan
L. Reed
R. Rulifson
B. Stannes
C. Wilson
J. Yearsley

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX C-3755
SEATTLE, WASHINGTON 98124

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DEC 21/76

NPSEN-PL-ER

17 DEC 1976

R. A. Chitwood, Manager
Licensing and Environmental Programs
Washington Public Power Supply System
Post Office Box 968
Richland, Washington 99352

Dear Mr. Chitwood:

We have reviewed the draft environmental impact statement on Continued Operation of the Hanford Generating Project with respect to the U.S. Army Corps of Engineers' areas of responsibility for flood control, navigation and hydropower. Confirming your telephone conversation with Ms. Jean McManus of my staff, the due date for submitting comments was extended from 15 December 1976 to 21 December 1976.

We would like to advise you that a Department of the Army permit is required for all work in navigable waters of the United States, and for all discharge of dredged or fill material into navigable waters and their adjacent wetlands. 1

Thank you for the opportunity to comment on this statement.

Sincerely yours,

Sidney Kinston

SIDNEY KINSTON
Acting Chief, Engineering Division

1. The proposal does not anticipate any work in navigable waters.

1

UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
RICHLAND OPERATIONS OFFICE
P. O. BOX 550
RICHLAND, WASHINGTON 99352

December 17, 1976

Mr. William Waddel
Washington Public Power Supply
System
3000 George Washington Way
Richland, WA 99352

Dear Mr. Waddel:

ERDA COMMENTS ON DRAFT ENVIRONMENTAL IMPACT STATEMENT ON CONTINUED OPERATION OF THE HANFORD GENERATING PROJECT

The discussions of the operation and environmental impacts of N Reactor are very brief in your draft EIS. We recommend that a statement be included which would direct the readers to ERDA 1538 for a more detailed description of these subjects. Thus, we feel many of the discussions of N, if not all, could be deleted. In addition, it should be made emphatically clear early in the draft EIS that N is an ERDA, not a WPPSS, reactor and that it operates in compliance with NEPA requirements and all applicable local, State, and Federal environmental standards. 1

We also suggest that you point out that ERDA has continually reevaluated the operation and environmental impacts of N Reactor since ERDA 1538 was published, and an environmental assessment will be published in 1977 which describes these evaluations. 2

Our comments on specific parts in the draft EIS are enclosed.

Very truly yours,

O. J. Elgert, Director
Nuclear Fuel Cycle and
Production Division

SAF:JAZ

Enclosure:
Comments on Hanford
Generating Plant
Draft EIS

Response to Comments
U.S. Energy Research and
Development Administration
Page 1

1. Reference has been made ERDA-1538 in the final EIS.

2. The Supply System will consider ERDA's environmental assessment of the N Reactor when it is available.

ERDA COMMENTS ON HANFORD GENERATING PLANT DRAFT EIS

Page 1-2, Paragraph 3 - First sentence should state that plutonium is produced for national defense and research purposes.

Page 1-2, Paragraph 3 - "Hypothetical maximum individual" should be used instead of closest individual for consistency with Hanford dose calculations.

Page 1-5, Sentence 2 - This sentence would be more meaningful if the following were added to the end of the sentence: "The practicality of these reductions was discussed in detail in 1538, Page 1-6."

Page 2-2, Paragraph 2, Sentence 1 - Add national defense and research purposes.

Page 2-7 - Table 2.4-1 should state that the maximum cooling water flow is 390,000 GPM, the normal cooling water flow is 290,000 GPM, the intake screen velocity is 0.8 to 1.25 ft/sec, and the discharge water temperature is dependent upon the intake water temperature. The 83.4° maximum is a discharge limitation in our NPDES permit.

Page 2-18 - A comparison of the numbers in Tables 2.4-1 and 2.4-2 reveals differences in discharge water temperatures.

Page 2-18 - The reference to "other issues" should be clarified for the reader. If it has significance within the framework of SEPA, perhaps this should be discussed.

Page 2-20, Paragraph 2 - Last sentence should be corrected to say: "During screen operation, trash is washed from the screens by water jets to a trough from which the trash is removed and disposed of on land."

Page 2-20, Discharge System - A better description of the system would be: "The circulating raw water for N Reactor is discharged at two points: (1) at the mid-point of the river through a single port at the end of a 102" line, and (2) at the shoreline from a flume." The last sentence doesn't really add anything to the description of normal operations; it describes an emergency feature and probably could be eliminated since emergency systems are not discussed elsewhere.

The appropriate changes have been made in the final EIS.

Page 2-20, Last Paragraph - This paragraph would more correctly describe NPR systems if it were written as follows: "Other nonradioactive liquid effluents are released from NPR via the main 102" line, the shoreline flume, several minor overflow lines and the sanitary tile field. Radioactive liquid effluents are released via the riverbank springs and the 102" line. Nonradioactive gaseous effluents are released from the oil-fired boilers. Radioactive gaseous effluents from the reactor ventilation systems are released via the main reactor ventilation stack and several smaller vents at the steam generator building. Radioactive and nonradioactive effluents from NPR are described in detail in ERDA-1538."

Page 3-11, Ground Waters, Paragraph 1, Sentence 1 - Rather than say the unconfined aquifer is bounded by Gable Butte and Gable Mountain, it would be more appropriate to say that the ground-water flow is impeded by these structures.

Page 3-13 - Figure 3.1-5 is not the most recent ground-water table contour map. For a more recent map (January 1975) see ERDA-1538, Vol. 2, Page II.3-23, Figure II.3-15.

Page 3-14, Paragraph 1, Sentence 1 - Ground-water quality is monitored regularly, not continuously.

Page 3-14, Paragraph 1, Sentence 2 - Two miles northeast of the HGP the nitrate ion does reach 49 ppm, not 80 ppm. See BNWL-1970 which is the ground-water status report for CY 1974.

Page 3-14, Paragraph 1, Sentence 5 - The most recently published temperature data was taken in January 1974. See ERDA-1538, Vol. 1, Page II.3-27, Figure II.3-18. The CY-1975 ground-water report (BNWL-2034) which will be issued in the near future will have a temperature map developed from data taken in November-December 1975.

Page 3-14, Paragraph 1, Last Sentence - Ground-water temperature varied from 15° to >21°C. Delete the words "and depth" at the end of the sentence.

Page 4-33, NPR Impacts - It should be stated that the impacts of NPR are discussed in detail in ERDA-1538, Section III.

Page 4-34, Paragraph 2, Last Sentence - This sentence would more accurately describe what is known about the impact if it read: "At the present time the rate of impingement on the NPR screens has not been quantified; but due to the lower

The appropriate changes have been made in the Final EIS.

flow rate of the NPR intake, impingement on the NPR screens is expected to be lower than impingement on the HGP screens. The mortality of the impinged fish has not been quantified."

Page 4-34, Paragraph 3, Sentence 2 - 83.4° is a maximum temperature limitation in our NPDES permit. Temperature and flow rates are dependent upon ambient river temperatures and pumping operations. These parameters are discussed in ERDA-1538, Page III.1-34.

Page 4-34, Paragraph 3, 2nd to Last Sentence - 0.25°F should be changed to 0.27°F.

Page 4-34, Paragraph 4, 1st Sentence - "General studies" should be changed to "detailed studies" to reflect the extensive work that has been done on radiological impacts.

Page 4-35, Paragraph 2 - The discussion of the closest individual should be revised to be consistent with the concept of the "hypothetical maximum individual" as used in Hanford dose calculations. The discussion should emphasize that this "hypothetical maximum individual" is a nonexistent person whose dietary and recreational habits maximize the doses he receives. These habits are described in ERDA-1538, Page III.1-1.

Page 4-35, Paragraph 3, Last Sentence - The natural background whole body population dose for 1975 is 25,000 manrem. The 1,250,000 manrem used is the 50-year dose commitment.

Page 4-36, 1st Sentence - Would be more correct if it read, ". . . no concentrations of uranium above background have been observed . . . ."

Page 4-36, Paragraph 1 - Use "hypothetical maximum individual" for consistency with Hanford dose calculating.

Page 4-36, Paragraph 2, Last Sentence - This needs to be rewritten after Table 4.5-1 is corrected to say the Calculated Population Dose Commitment is for a 50-year period based on effluents from N-Reactor during CY 1975.

Page 4-36, Paragraph 3, Sentence 3 - The words "materials arising from the spent fuel" should be deleted, because if we are not reprocessing fuel, these materials cannot be sent off plantsite.

The appropriate changes have been made in the final EIS.

Page 4-36, Paragraph 3, Last Sentence - The words "weapons grade" should be removed since they imply a single grade of plutonium is produced. This is not necessarily the case.

Page 4-37, Table 4.5-1 - The title would be more accurate if it were changed to read "maximum potential health effects due to 1975 operation of NPR. The techniques used to calculate these health effects and the difficulties in using these techniques is described in Section III.1.1.6 of ERDA-1538. The presentation of such data needs to be accompanied by an adequate explanation and qualification of its use and a statement evaluating the numbers given for health effects. It should be clear that any number of health effects <1 indicates no adverse effects are expected.

Page 5-2, Paragraph 4 - First sentence should read, "Impacts associated with the NPR intake have not been quantified but are expected to be relatively small."

Page 5-3, Paragraph 1, Sentence 2 - All liquid effluents are not contained on the Hanford Reservation, but it is true that there are no adverse health effects resulting from those not contained.

Page 7-2, Table 7.0-1 - Item 3 under NPR should be omitted since it is not discussed in the text and long-term waste management is beyond the scope of this document.

Page 8-3, Paragraph 2, Last Sentence - The sentence is unclear.

The appropriate changes have been made in the final EIS.

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Environmental & Technical Services Division(FNW5)
P.O. Box 4332, Portland, Oregon 97208

December 29, 1976

RECEIVED
DEC 1976

Mr. R.A. Chitwood, Manager
Licensing and Environmental Programs
Washington Public Power Supply System
P.O. Box 968
Richland, Washington 99352

Dear Mr. Chitwood:

Thank you for sending us a copy of your Draft Environmental Impact Statement on Continued Operation of the Hanford Generating Project. This statement was written under the authority of State Environmental Policy Act (SEPA). The National Marine Fisheries Service has reviewed this statement and has several comments.

General Comments

National Marine Fisheries Service (NMFS) is familiar with the operation of the Hanford Generating Project through meetings with the Washington Public Power Supply System (WPPSS) and with the Environmental Research and Development Administration (ERDA).

We are opposed to once-through cooling systems in the Columbia River and prefer offstream cooling because of its reduced impacts to the aquatic environment. While there may be no regulatory requirement for the installation of offstream cooling for an existing facility, we would recommend that it be seriously considered. 1

Specific Comments

CHAPTER 1
SUMMARY
1.2 SUMMARY - ENVIRONMENTAL IMPACTS OF THE PROPOSAL

Page 1-1, paragraph 3. There appears to be an error in this paragraph. We assume the DEIS refers to fry in this paragraph and not smolts. On page 4-15, WPPSS refers to the 1,000 fall chinook fry lost per year on the screens, whereas this paragraph indicated 1,000 fall chinook smolts are lost. 2

Response to Comments
National Marine Fisheries Service
Page 1

1. The alternatives of off-stream cooling is discussed in Section 8.3.1.

2. The appropriate change has been made in the final EIS.

CHAPTER 2
DESCRIPTION OF THE PROPOSAL

Page 2-19, TABLE 2.4-2. We believe that it is important to know the percent of saturation or total dissolved gas immediately below the discharge and not at a point 3,000 feet below the discharge. We recommend that these concentrations be listed since they could be crucial to fish life. 3

CHAPTER 3
DESCRIPTION OF THE EXISTING ENVIRONMENT
3.1 PHYSICAL ENVIRONMENT
3.1.5 Aquatic Ecology

Page 3-22, Figure 3.1-6. Yolk sac fry are present in the gravel at least through April 10. We recommend that the figure show sac fry in the gravel through April. 4

Page 3-23, paragraph 1. Midway Bar is a major fall chinook spawning area which is located approximately 3 miles below Priest Rapids Dam and 14 miles above the HGP intake. There are several other fall chinook spawning areas above and below the HGP intake. 5

Page 3-23, paragraph 2. We recommend changing the sentence which states "...in February and March." to "...February, March, and April." 6

CHAPTER 4
ENVIRONMENTAL IMPACTS OF THE PROPOSAL
4.1 PHYSICAL IMPACTS
4.1.1 Water
Heated Effluent Distribution

Page 4-1, paragraph 3. Poor diffusion, such as indicated in this paragraph, compounds the problem for fish. The coolant flow discharge to the river should be equal from each port, not 60 percent from one port and 10 percent from another port. Modifications are needed to the existing diffuser, or perhaps, a new type of discharge diffuser is required. 7

Page 4-8, paragraph 4. Figure 4.1-8 should indicate how far downstream the effluent becomes fully mixed with river water. We are primarily concerned with adverse effects to fish life within the mixing zone and not as concerned after the effluent has been fully mixed with river water. 8

4.3 IMPACT ON AQUATIC RESOURCES
4.3.1 Impingement

Page 4-14, paragraph 3. The sentence which states "...fork length 9

3. Dissolved gas measurements above and below the discharge were made in 1973. The results of these measurements are given in the table below.

			Oxygen		Nitrogen	
	Date	Temp. °C	mg/l	% sat.	mg/l	% sat.
Ambient, Above HGP Discharge	3-29-73	5.0	14.67	115.1	23.43	111.1
	4-6-73	6.0	13.46	108.3	23.48	113.9
	3-16-73	7.9	13.25	111.4	22.28	112.7
	5-3-73	10.1	12.59	111.9	21.33	113.6
	5-8-73	10.4	13.65	122.0	20.50	109.7
Plume Center - Approximately 200 ft Downstream of Discharge	3-29-73	5.0	14.54	113.7	23.00	108.8
	4-6-73	6.4	13.55	109.7	23.23	113.5
	4-16-73	8.5	12.70	108.7	22.10	113.6
	5-3-73	10.5	12.52	112.3	21.22	113.9
	5-8-73	11.2	13.00	118.3	19.97	108.6

4. While some sac fry may be present in the gravel in April, the fry emerge from the gravel primarily in February and March.

5. The appropriate change has been made in the final EIS.

6. See response number 4 to comments above.

7. The alternative modifications of the discharge diffuser are discussed in Section 8.3.1.

8. The effluent becomes fully mixed with the river between 3 and 4 miles downstream of the discharge as shown in Figure 4.1-7(b). We appreciate your value judgement that once the effluent has mixed fully with the river it is of lesser concern.

9. See response number 4 to comments above.

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primarily during February and March." should be changed to read "...February, March, and April."

Page 4-18, paragraph 2. This model, which measures the plume approximately 60 to 100 feet from the point of discharge and 30 inches below the surface of the water, does not necessarily relate well to fall chinook fry distribution since they could occur below 30 inches. We recommend considering the effects on fall chinook fry at all depths and distances from the port and at a variety of flow conditions. 10

We believe that Figure 4.3-1 needs to be discussed considerably more in the DEIS. The method used to estimate the cumulative exposure time in seconds for fish should be discussed more extensively since this is a very crucial portion of the analysis. However, NMFS studies show that once temperatures exceed 29 degrees centigrade immediate tetany and cessation of respiratory movements can occur, and it is doubtful that juvenile chinook could escape from the danger area (Snyder and Blaha, August 1970).1/ Mortalities to juvenile chinook can occur within a period of four seconds at 90°F.2/ 11 12

Page 4-25, paragraph 3. We believe that the yolk sac fry are distributed more equally throughout the water column than is indicated in Figure 4.3-5. Page 4-14 of the DEIS states "Many fry are displaced downriver after emergence due to the strong directional flow of the current." This would tend to indicate that the newly emerged fry are more equally distributed throughout the water column than is indicated in Figure 4.3-5. We believe that many of these fry would be swept downstream through the plume, and that mortalities would be encountered at that time. Until it can be demonstrated that fall chinook fry are not equally distributed throughout the water column, we cannot accept the statement found in paragraph 2 on page 4-27 which states "No effects such as death or loss of equilibrium would be reasonably anticipated." 13

4.5 NPR IMPACTS
4.5.1 Intake
Page 4-34, paragraph 2. NMFS and State fishery agencies are presently negotiating with ERDA to correct any fish problems which may be encountered with the NPR intake and discharge systems.

1/ Snyder, George R. and Ted H. Blaha, Survival Times of Juvenile Salmonids Exposed to Water Temperatures Causing Thermal Shocks, Technical Advisory Committee, Columbia River Thermal Effect Study, August 1970.

2/ Snyder, George R. and Theodore H. Blaha, Effects of Increased Temperature on Cold-Water Organisms, J. Water Pollution Control Federation, 1971.

10. The exposure of fry to conditions different from those used in the analysis is described subsequent to page 4-18. This discussion includes fry moving in deeper water. The conclusion of that analysis is that the exposure time is sufficiently short so as to preclude death or loss of equilibrium.

11. Figure 4.3-1 was developed from field measurements and mathematical models of the HGP plume. While actual conditions may deviate slightly from the curve presented in the figure, rapid dilution has been documented by field measurements at numerous river flows.

12. Juvenile chinook can easily "escape from the danger area" since they would be swept downstream by the river current. The analysis in Section 4.3.3 indicated that no juvenile chinook will be exposed to 90°F for a period of four seconds.

13. Reference 4-10 indicates the fry prefer the shorelines and the surface and are not equally distributed throughout the water column. If the fry were equally distributed throughout, fewer than 4% would experience temperatures greater than 72°F.

9313043.0584

CHAPTER 7
ADVERSE ENVIRONMENTAL IMPACTS WHICH MAY BE MITIGATED

Page 7-1. Fish mortalities encountered in the thermal plume area should be considered an adverse environmental impact which may be mitigated. 14

CHAPTER 8
ALTERNATIVES TO THE PROPOSAL
8.3 PLANT FACILITY AND SCHEDULE MODIFICATIONS
8.3.1 Modifications to HGP Plant Facilities
Alternative Intake Structures

Page 8-14, paragraph 3. We believe that the construction of an offshore intake does have merit but should not be installed at the HGP intake until it has been tested. WPPSS No. 2 plant will provide the data needed to prove whether this system should be utilized or not. It may be advantageous to increase the existing screen area by adding two pump bays since this will reduce the intake velocities experienced at the screens. NMFS recommends a maximum approach velocity of .5 foot per second and 1/8-inch screen mesh in order to protect fish life. With the screens, a fish bypass system should be provided to reduce impingement and entrainment. 15

Alternative Discharge Structures

Page 8-16, paragraphs 3 and 4. We believe that a new discharge diffuser should be installed at the HGP plant. This diffuser should be designed to give maximum diffusion of the waters. Biological reasons are given in several previous comments. 16

Alternative Cooling Systems for HGP

Page 8-17. Offstream cooling would provide the best protection for fish life. We recommend that this be considered.

CHAPTER 9
UNAVOIDABLE ADVERSE IMPACTS

Page 9-1, paragraph 1. Mortality of an unknown number of smolts resulting from increase in Columbia River water temperatures should be included as an adverse impact. 17

Sincerely,

Fred Cleaver, Chief

cc: Washington Department of Fisheries
Washington Department of Game
Fish and Wildlife Service, Olympia

14. The analysis presented in Section 4.3.3 does not indicate that fish mortality will occur in the thermal plume.

15. The present intake system at HGP was designed to meet the requirements specified by fisheries agencies at that time. Recent modifications have been made to reduce the impact of the intake on downstream migrant fry. Studies referenced in Section 4.3.1 have shown that the present intake configuration does not significantly effect salmonid populations.

16. The discussion presented in Section 4.3.3 shows that the present discharge system does not significantly impact salmonid populations.

17. The incremental increase of Columbia River temperatures is listed in Chapter 9 as an adverse impact.

RECEIVED
DEC 17 1976
DIRECTOR'S OFFICE

SIERRA CLUB
WASHINGTON ENERGY COORDINATOR

408 West 3rd St.
Aberdeen, Wash. 98520
December 14, 1976

Mr. J.J. Stein
Washington Public Power Supply System
P.O. Box 968
Richland, Washington 99352

Dear Mr. Stein:

The Sierra Club would like to offer the following comments on the Draft Environmental Impact Statement on Continual Operation of the Hanford Generating Project. Once again we are disappointed with the System. After reviewing a WPPSS EIS, we always hope the next one, no matter what the proposal, will be better; we like to believe that our comments aren't totally ignored. After reading this dEIS, we can still hope that someday WPPSS will make an attempt to develop and analyze viable alternatives for its proposals, analyze them to the same extent that the proposed action is studied.

At present, the SEPA process is the main, and virtually only, route for public input into the System's decision making process. It is vitally important that this process be made to work. In this case, only a few pages are devoted to the conservation alternative, and the analysis, if it can be called that, is below that used for the proposed action.

For the reader to make a decision on the course of action to be taken, all alternatives, not just the proposed action, must be given in sufficient detail to allow comparitive evaluations to be made. Since the conservation alternative isn't presented in depth the SEPA process is short-circuited. This implies that WPPSS did not seriously consider alternatives to the proposed action and will not listen to public input. 1

We agree with the BPA conservation study that large amounts of electrical energy can be saved in the Pacific Northwest. Conservation can replace the power produced at HGP at lower environmental and economic costs. There are widespread doubts about the accuracy of the forecasts used by WPPSS. We therefore feel that continued operation of HGP is not in the best interests of the people or the environment of the Pacific Northwest. We urge that the conservation alternative be chosen instead.

General Comments

The distribution of this document is an indication of the lead agencies reluctance to include the public in the planning process. 2

Proposed Action Section 2.1
It is stated here, and in several other places, that the proposal

Response to Comments
Sierra Club
Page 1

1. The Supply System prepared this Environmental Impact Statement in accordance to the guidelines presented in WAC 197-10. Those guidelines require the Supply System to consider all reasonable alternatives which might approximate the proposal's objective but at a lower environmental cost or decreased level of environmental degradation. The alternatives are to be described and objectively evaluated in light of the objective of the proposal. The alternative of conservation as one method of balancing loads and resources should operation of the HGP not be continued was presented in Section 8.1.1. In that section a number of methods of conservation are identified, implementation programs which could be used to bring about the conservation methods are described, and the environmental impacts associated with the conservation alternative are also described. In addition, a program which could be used to reduce electrical loads by the equivalent amount of energy produced by HGP and an implementing program is identified. The Supply System believes that this level of detail is appropriate for treatment of the conservation alternative. It should be noted that the objective of the proposal is to maintain existing electrical generating resources which can continue to provide adequate, reliable, and economical electrical energy to consumers in the Pacific Northwest. While the conservation alternative per se does not meet this objective, it was considered because of its importance in the Pacific Northwest in the coming years.

2. The Supply System would welcome the Sierra Club's recommendations for individuals and organizations which should be included in future EIS distribution lists.

is to continue providing "up to" 5 billion kwh of electrical energy per year. "Up to" is not a very precise term. Production figures for the last several years should be given and an average figure used. The reasons for HGP's failure to meet this 5 billion kwh production level should be discussed. Since HGP actually produces less power than implied, the insignificance of its loss would be less than stated. This section should give a more detailed description of the contracts with ERDA. 3 4

Licenses and Schedules Section 2.3
Identify the five private utilities; do they receive equal shares of HGP power? 5

NPR Section 2.5
How will the proposed action affect any decision to extend the operational life of the NPR? 6

Other NPR Systems Section 2.5.2
Identify "other liquid effluents". Please provide a summary of the discussion of NPR radioactive effluents as described in ERDA# 1538. 7

Water Section 3.1.2
There is no listing of ambient river temperatures at the Hanford site; this important information should be included here. What is the composition of the water from NPR disposed to the ground? 8 9

Human Environment Section 3.2.1
How often and in what amounts does Northwest hydro power replace Southern California oil-generated electricity? How often is HGP power actually sent to California?; in what amounts? With the arrival of Alaskan oil, will these power exports have any impact on foreign oil imports? 10 11

Need for Power 3.2.3
A brief review of the methodology of the West Group Forecast and a summary of the Bonneville forecasting method are needed. This section should also include an in depth discussion of the weaknesses of these forecasting techniques, as detailed in reference 3-29. The tendency of West Group to overforecast should be examined. The NERA econometric model and its results should be presented in much greater detail. A more realistic figure for HGP power production, based on actual experiences, should be used on p. 3-31. The statement that HGP could significantly reduce energy deficits contradicts the statement on page 3-1 and Table 3.0-1 that HGP has an insignificant impact on power supplies. 12 13

What is the probability of meeting total regional energy loads during the 1978-1983 period, considering such factors as the probability that the West Group Forecast is too high, recent Federal energy conservation legislation, and the fact that the states are preparing conservation plans? 14

Other Forecasts p. 3-32
The "Other Forecasts", references 3-31 and 3-32 should be discussed in much greater detail, especially since they present a far different picture of future power needs than the West Group 15

Response to Comments
Sierra Club
Page 2

3. The present contract between the Supply System and ERDA provides for the production of "up to" 4.6 billion kilowatt hours. It is anticipated that any new contract between the Supply System and ERDA would increase the amount of power production from up to 4.5. billion in kilowatt hours per year to up to 5 billion kilowatt hours per year. In the past five years the HGP has produced the following amounts of energy.

Year	Energy, Billions of Kilowatt Hours
1975	3.3
1974	3.9
1973	4.4
1972	2.9
1971	2.5

4. The existing contracts between the Supply System and ERDA, identified in Section 2.3, are a matter of public record and can be obtained from the Supply System for the cost of reproduction. New contracts which may be executed between the Supply System and ERDA, if it is determined to continue operation of HGP, are expected to be substantially the same as previous contracts with the exception of economic considerations. This EIS addresses the environmental aspects of the continued operation of HGP including those aspects of the contract such as scheduling and level of energy production which may be related to the HGP's impacts on the environment. The various forms of contracts not related to environmental impacts are not discussed. Therefore, a more detailed description of possible future contracts is not a proper subject for inclusion in this EIS.

5. The five private utilities are Puget Sound Power and Light, Washington Water Power, Pacific Power and Light, Portland General Electric, and Montana Power. Each utility receives an equal share of HGP output.

6. See response number 1 to comments by EPA.

7. Other liquid effluents include backflush from pump inlet screens, overflow from filtered water and raw water storage tanks, condensate from medium pressure steam system, filter backwash, filtered water overflow, waste from floor drains, turbine condenser cooling water and graphite heat exchanger cooling water. Liquid radioactive effluents are given in Table III.1-2 of ERDA-1538. This table is reproduced below for the reader's benefit.

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RADIONUCLIDES RELEASED TO THE COLUMBIA RIVER WITH LIQUID EFFLUENTS AT 100-N IN 1972[a]

Nuclide	Ci/Yr	Nuclide	Ci/Yr
^{3}H	7000	^{95}Nb	4
^{24}Na	500	^{99}Mo	21.1
^{32}P	160[b]	^{103}Ru	0.4
^{51}Cr	25.3	^{106}Ru	4.
^{54}Mn	40	^{124}Sb	0.8
^{56}Mn	600	^{131}I	41.9
^{59}Fe	10	^{133}Xe	10.
^{58}Co	2	^{134}Cs	0.5
^{60}Co	20	^{137}Cs	5.05
^{65}Zn	440[b]	^{140}Ba	5.25
^{89}Sr	0.05	^{140}La	5.25
^{90}Sr	0.95	^{239}Np	90
^{95}Zr	4.		

(a) Includes both the discharge from the 102-in. pipeline and riverbank seepage from disposal to the 1301-N crib. The annual discharges have been reduced to <200 Ci/yr tritium and <15 Ci/yr of all other radionuclides after CY-1973.

(b) Estimated from concentration measured in whitefish in 1972 and historical data relating water concentrations to fish concentrations.

8. Ambient Columbia River temperatures are given in Figure 3.1-1.

9. Water disposed to ground from the NPR is described in detail in the document ERDA-1538. The composition of this water as it reaches the river is given in Table III.1-24 of ERDA-1538 as follows:

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CHEMICAL CONCENTRATIONS AT 100-N AREA,
AUGUST 1972

	Riverbank Springs (mg/ℓ)	Ambient River Concentration (mg/ℓ)
Sulfate	5.5	4.5
Calcium	24.5	17.
Chromium	20.0	0.1
Nitrate	2.7	81.
Aluminum	0.050	0.080
Iron	0.025	0.075
Magnesium	3.	3.
Ammonia	<0.1	<0.1
Nitrate	<0.002	<0.002
Strontium	0.080	0.120

Radioactive concentrations from riverbank seepage is included in response number 7 to comments above.

10. The HGP is a base load plant which produces energy for distribution to the Pacific Northwest power grid. It is impossible to distinguish between hydro generated and HGP generated electricity when it is sent to California. In calendar year 1975 approximately 9 billion kilowatt hours of energy was sent to California. Most of this energy was sent to California during March through July 1975, a period of time when the HGP was not operating.

11. Disposition of Alaskan oil has not, to the Supply System's knowledge, been determined as of this date. If a "glut" of oil on the West Coast does develop this may limit the impact on foreign oil imports from power exports from the Northwest to California.

12. The purpose of this document is to describe the environmental impacts associated with continued operation of HGP and to evaluate the alternatives to that proposal. Since the HGP is an existing resource and none of the forecasts made to date predict a decrease in the absolute level of demand for electrical energy, the addition of more detail on forecasting methodologies is unwarranted. The appropriate studies are referenced in Section 3.2.3 to allow the interested reader to pursue the subject.

13. Table 3.0-1 was essentially taken from WAC 197-10-365 which asks the following questions:

"(15) Energy

Will a proposal result in:

(a) use of substantial amounts of fuel or energy?
(b) demand upon existing sources of energy or require the development of new sources of energy?"

In the context of these questions it is not contradictory to indicate that HGP has insignificant impact on power supplies even though it could significantly reduce energy deficits.

14. Recent Federal Energy Conservation legislation proposes a 5% reduction in total energy used in the year 1980. No goals were set for any period of time beyond 1980. State energy conservation plans may be developed by states if they so desire. Many of the conserving actions discussed in this federal legislation and in the development of state plans deals with savings of gasoline rather than electricity. As state conservation plans are prepared and implemented, the Supply System will consider them.

15. See response number 12 to comments above.

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Forecast does. Included here should be a review of the forecast used for the Seattle City Light Energy 1990 study and how it differs from the old SCL forecast. While "Neither forecast precludes the reasonableness of the other forecast nor passes judgement as to the likelihood of which forecast will in fact occur", how has the system made such a determination? 15 16

To what extent have conservation actions already been incorporated into the forecasts being used? Isn't the real reason that the 1976 WGP forecast is lower than 1974's due to the fact that the gap between forecast and reality was becoming so great it couldn't be explained away? 17 18

Human Environment Section 4.4.1
What utility, independent of WGP, does WPR have? 19

Alternatives Section 8
This section, as usual, needs to be completely rewritten and expanded. As it stands, the section gives the impression that alternatives to the proposed action have not been given proper consideration. There is no real analysis of conservation; recent Federal legislation in this area is totally ignored. State energy conservation plans, now nearing completion and implementation, aren't even mentioned. 20 21

Conservation is not the same as no action and should not be designated as such. It is the only viable alternative to the proposed action and, unlike the proposal, could eliminate power deficits in the early 1980's. 22

Conservation Section 8.1.1
Energy conservation is a truly viable alternative that hasn't received the consideration it warrants. It should receive the same treatment as the proposed action; indeed, NEPA guidelines require as much. A regional conservation plan should be developed, taking into account any activities already begun. The plan should be an attempt to replace WGP operation with energy savings and must not be limited to activities WPPSS or its members can carry out. The BPA conservation study shows that this goal can be easily achieved. State conservation plans and recent Federal legislation should be analyzed as part of the alternative. Its impacts should be evaluated and compared to the proposed action to enable the reader to determine if the correct choice is being made. Evidence from other sources indicates that the System is making the wrong decision. 23 24 25 26 27

On page 8-8, an attempt is made to prejudice the reader against conservation by implying that it will reduce freedoms and increase governmental control over every day life. This disgraceful statement should be removed. The use of any resource carries with it the responsibility to use that resource wisely. Our present wasteful use of electricity can hardly be considered wise. Such wasteful use actually reduces our freedoms by making us more dependent on expensive, complex technological solutions to our problems and on bureaucies such as WPPSS. Conservation, with its emphasis on a small scale, soft technology locally controlled approach, has the opposite effect. 28 29

16. Each of the forecasts discussed in Chapter 3.2.3 are based on a defined set of assumptions related to factors which go into the forecast. These factors include economic and population growth rates, electrical consumption rates, prices and price elasticities, availability of other sources of energy, and other factors. The values used in these assumptions reflect the judgement of the individuals making the forecast as being, in their view, reasonably possible courses of future events. None of the forecasters claim to be predicting the future nor to exclude other, different, courses of future events than their own.

17. As stated on page 3-33 none of the forecasting methodologies presently in use explicitly take conservation into account.

18. No.

19. The WPR produces plutonium for national defense and research purposes. The steam from WPR is sold to the Supply System for use in WGP as a by-product of the plutonium production process.

20. See response number 1 to comments above.

21. See response number 14 to comments above.

22. The "no action" alternative as used in this EIS refers to the proposal of continued operation of WGP and not to the taking of no action by anyone. In this context, conservation is an alternative methodology for balancing loads and resources if "no action" is taken on the proposal. This does not imply that if the proposal is implemented conservation cannot be implemented. We would anticipate, given the probability of energy deficits in the early 1980's, that conservation will be required if loads and resources are to be balance even though operation of WGP were continued.

23. See response number 1 to comments above.

24. The Supply System agrees that a regional conservation plan should be developed. In addition, a national conservation plan should be developed. The appropriate agencies for development of these plans are governmental agencies acting under direction of the legislative and administrative branches of the federal and various state governments. The Supply System would expect input to be obtained from a representative cross section of the people in each region and the plans would be developed through numerous evolutionary comment periods. By using a coordinated regional and national approach conservation can be much more meaningful and less discriminatory than if it were applied on a state or local level.

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25. The BPA conservation study (Reference 3-32) shows that if no conservation has been implemented to date, then a five to ten percent reduction in load may be obtained without implementation of incentive or mandatory programs. Many of the conserving actions identified are in fact being implemented today.

26. See response number 14 to comments above.

27. The HGP is an existing base load resource which is used to meet existing loads in the Pacific Northwest. The Supply System is not aware of any forecast or projection which shows a reduction in electrical energy load in the Pacific Northwest below present levels which would negate the need for HGP's operation.

28. In the context of the discussion of human environmental affects, the statement on page 8 says "The people's freedom of choice in the use of electrical energy will be reduced." The Supply System does not consider this statement to be either prejudicial or disgraceful.

29. As stated in Section 3.2.3, conservation of electrical energy is being practiced today. See also response number 17 to comments by Mr. Robert G. Walton.

Replacement Generating Resources Section 8.1.2
As discussed here, this is not a viable alternative. Alternate (appropriate) technologies such as wind, solar, biofuels, co-generation, and passive systems are best suited to small scale applications yet this concept isn't even discussed. 30

Glossary
There should be one. 31

Conclusion
We feel that the proposed action is a mistake. Conservation, though inadequately analyzed here, is the preferred course of action. It costs less, in both environmental and economic terms and begins the job of making our energy use responsible and wise. A thorough analysis of the conservation alternative will show, as in the Seattle City Light case, that this is the best choice for the Pacific Northwest. When will WPPSS perform such an analysis? 32

Thank you for the opportunity to comment on this document.

Sincerely,

Bruce Hatheson
Sierra Club
Washington Energy
Coordinator

30. Large scale use of technologies such as wind, solar and biofuels are identified in Section 8.1.2 as being neither economically nor technologically practical at this time. Application of these sources of energy in a small scale and on a local level are discussed in Section 8.1.1 as supplemental energy sources. See, in addition, response number 1 to comments above.

31. A glossary has been included in Appendix A.

32. The Supply System is presently undertaking a study of alternative generation methodologies including conservation. This analysis will be used by the Supply System, its Board of Directors and members in assisting the development of future policies.

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RECEIVED
DEC 16 1976

December 11, 1976

Mr. R.A. Chitwood
Manager, Licensing and Environmental Programs
Washington Public Power Supply System
Richland, Washington

Dear Sir:

I have been asked by the Washington Environmental Council to review the Draft Environmental Impact Statement on Continued Operation of the Hanford Generating Project. I have done so, and would like to submit my comments to you for consideration in the final report.

Depending on the mail service, these comments may or may not reach your office by the December 15 deadline. I hope that you will find these to be of use in your work, and I offer my assistance should you have any questions about my comments.

I have enclosed a paper written by Dr. William Brewer that you may find of use.

Thank you for this opportunity to comment on your work.

Sincerely yours,

Robert G. Walton
401 25th Ave. E
Seattle, Washington
98112

Thank you for your review.

Comments on WPPSS DEIS on HGP

Page	Line	Comment	
1	3	Recommend mentioning here or some other early point that the extention of for 5 years- it is unclear as it is written.	1
1-2 2-18 4-33 7-1	19	Regarding the statement "continued operation of the NPR has utility independent of the HGP and may occur regardless...", this is ambiguous and deserves additional explanation. A discussion of how a WPPSS decision regarding HGP might affect ERDAS decision to continue operation of NPR is needed. Does the benefit of revenue from WPPSS enter into ERDA's analysis or not? Any influence that the WPPSS decision might gave is worthy of mention, and likewise, if ERDA's actions are totally independent of WPPSS, that should be stated.	2
1-4	16	Recommend insertion of "by the West Group Forecast (see page 3-32)" after "is projected".	3
	18	Recommend "according to this forecast" be added after "75%".	
		Both of these comments relate to the fact that the projections mentioned are controversial and the sources should be identified. I have enclosed a copy of Dr. William Brewer's paper on the subject of PNUCC forecasts as background and substantiation.	4
2-1	19	Is the 50-50 split of power between public and private utilities still the most preferable one? Can or should this be renegotiated?	5

Response to Comments
Mr. Robert G. Walton
Page 2

1. This EIS considers the continued operation of the HGP for an indefinite period of time, at least into the 1990s. The present negotiations between the Supply System and ERDA contemplate a contract of five years duration.

2. The NPR produces plutonium for national defense and research purposes. The steam is sold to the Supply System for use in HGP as a by-product of the plutonium production process. See response number 1 to comments by the U.S. Environmental Protection Agency.

3. Appropriate changes have been made in the final EIS.

4. See response number 15 to comments below.

5. This proposal does not consider alternative splits between public and private utilities for disposition of power from HGP. The differences in environmental impacts associated with such alternatives are not reasonably anticipated to be discernable.

Page	Line	Comment p 2	
2-5	5	The first sentence of this paragraph is unclear- could be: "...1977, it contains..."	6
	6 para 4	Recommend identifying which projections are referred to. Recommend explaining what is meant by "public utilities would in turn transfer their rights to this power..." Is this net billing?	7
2-5,6		Last sentence of page 2-5 is not finished in my copy- is a page or paragraph missing?	8
2-10	4	One made is used... instead of are used?	9
2-21	para 3	(state laws do apply) If state laws apply, recommend a explanation of the relationship of NPR, HGP, etc. to EFSEC certification requirements- do they apply or are they exempted because NPR, HGP preceeded the law? (This was an issue that was raised during the Initiative 325 campaign).	10
3-1	17	Are all government plutonium production reactors closed down except NPR? This statement implies that they are. How many others are operating in the U.S.?	11
3-6	21	Recommend explaining kcfs- 1000 cubic feet per second?	12
3-26	15	The last sentence of para 2 is out of context and incomplete. I recommend expanding it into a separate paragraph and explaining its significance, or deleting it.	13
3-31,32		Recommend a discussion of the significance of an energy	

6. This sentence has been rewritten.

7. The disposition of HGP power is virtually identical to "net billing" although at the time the arrangements were originally made the term "net billing" had not been used.

8. A portion of the paragraph was inadvertantly omitted. Correction has been made in the final EIS.

9. This sentence has been corrected.

10. State laws do apply to the Hanford Reservation. The HGP is not subject to EFSEC certification requirements because it was in operation prior to February 23, 1970, the date the siting act specified as a cut off date for EFSEC responsibility. The NPR, being a federal facility, is not subject to state (or EFSEC) regulation.

11. In addition to the NPR, which is a dual purpose reactor, there were eight U.S. Government plutonium production reactors at Hanford. The last of these eight reactors was closed down in 1971. Three other plutonium production reactors are presently capable of operating in the U.S. They are located at ERDA's Savannah River facility in Georgia.

12. The appropriate changes have been made on page 3-6.

13. The appropriate changes have been made on page 3-26.

Page	Line	Comment p 3	
		deficit- what are the anticipated costs, to whom, etc. Pages 8-3 and 8-4 contain the beginnings of such a discussion, but do not treat the subject with much detail. The implication is that the HGP is needed or else greater deficits occur, but no treatment is given to the questions: "What is the harm in an occasional energy deficits?" and "Can the region absorb a deficits without major costs?"	14
3-32	18	Reference 3-34 is not listed in the back. I recommend reference to Dr. Brewer's paper at this point (see encolsed paper)	15
3-32	para 4	Recommend a statement that Oregon's 1976 forecast was considerably lower than West Group's.	16
3-33	para 2	Recommend a discussion of utility conservation programs- and how they might be enhanced. The wording implies that the utilities are making a respectable effort to promote conservation, but (with the exception of Seattle City Light, which has a City Council mandated energy conservation program) this is certainly open to question!	17
4-34:		Section 4.5.3 Recommend a full discussion of the Muncuso- Stewart study of the cause of death of atomic workers at Hanford, as reported in the Seattle Post Intelligencer on October 26, 1976, p. 7. What are the implications of this study with respect to health standards, and what is ERDA's response?	18

14. The question of what level of reliability should be used as a planning goal is a very important one. The reliability of service through the provision of adequate electric energy supplies requires the construction of a given amount of generating capacity. (We are speaking here only of energy resources rather than peaking capacity and only of generating resources rather than transmission and distribution facilities.) Yet the construction of too much capacity utilizes money and resources needlessly. It is very difficult to quantitatively determine what level of reliability (or conversely the frequency of a deficit) is acceptable to a society for a number of reasons. For example, what is considered an "occasional deficit"? What is considered a "major cost"? In addition, many other factors mask the impacts of previous energy shortages or predictions of energy shortages. Historically, during the past 30 years, the Pacific Northwest has experienced three energy deficits (1953/53, 1958/59, and 1973/74) caused by either low water or a lack of generating capacity. Hence on the average there has been about a 10% chance for an energy deficit in any given year. This level of reliability appears to have been acceptable in the past by the citizens in the Pacific Northwest since no action has been taken to mandate that the utilities provide a lower or higher level of reliability. The 1976 West Group forecast shows that in the next ten years (1977/78 through 1986/87) the probability of meeting loads is below this historical level. The cost of overbuilding and underbuilding generating resources are discussed further in reference 3-22.

15. Reference 3-34 has been added to the list of references. Dr. Brewer's paper has been reviewed by the Supply System. The paper is based upon the work presented in reference 3-31. The paper does not present any new information on the subject of load forecasting and its referencing in this EIS is not considered necessary.

16. The model being used in the Oregon forecast is not yet complete. The results obtained to date cannot be considered valid at this time for comparing to other forecasts in the region.

17. Utilities in the Northwest generally believe they have a duty to serve customers in their service area. Discussion of this duty to serve is provided in reference 3-22, a portion of which is excerpted below for the reader's information.

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"While not specifically set forth in any Federal or state statute, it has been universally held by the courts that an electric utility, including a municipality which furnishes a given type of electric service to the public, generally has a duty to furnish it on a reasonable and nondiscriminatory basis to any applicant within the territory within which it has dedicated its properties. It cannot cut off the power without good cause, if proper charges are paid or tendered. (See generally Am. Jur. 2d, Public Utilities, Section 16 et seq. and Section 133 et seq.; see also McQuillin, Municipal Corporations, Sections 34.89, 34.90, 35.35 and 35.35(e)). A public utility may be liable in damages or subject to other judicial relief, depending upon the facts, for failure to provide service to its customers. Recently enacted legislation may modify the foregoing principles to exempt a utility for refusing to deliver by reason of its complying with conservation orders (Chapter 5, Laws of Oregon, Special Session, 1974; and Title 61, Chapter 5, Laws of Idaho). The law appears to be unsettled as to the duty and right of a utility to furnish power to new customers where there is a supply shortage. The law is also unsettled as to the consequences to a utility for failure to take steps to meet foreseeable prospective demand. Relief from liability is provided in Idaho law which authorizes curtailment in an emergency (Ida. Code, § 61-531 et seq)..."

"In general, actions relating to curtailment of electric energy supply apply only to short-term emergency conditions and does not affect the necessity for long-term planning by utilities. There are no known circumstances where a U.S. utility has been granted the authority to plan, in the long term, energy supplies which are insufficient to meet anticipated demands."

As discussed in Section 8.1.1 of this EIS, public utilities in the Northwest do not presently have the general legal authority to implement incentive or mandatory conservation programs. Their conservations efforts are limited to educational programs. Many of the utilities in the Pacific Northwest are conducting informational and educational type conservation type programs.

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18. A full discussion of the health effects of radiation is outside the scope of this EIS. The specific report referred to in the comment, the Mancuso-Stewart report, is only one of many that have been written in the last few years. An article by Drs. Marks and Gilbert, "Comments On Mortality Experience of Workers In Atomic Energy Industry By Mancuso, Stewart and Kneale", BNWL-SA-6012 critiques the Marcuso-Stewart report and show that several systematic and mathematical errors were incorporated in that report, and these would account for their reported results.

For further information on this subject, see: "The Effects On Populations of Exposure to Low Levels of Ionizing Radiation", Report of the Advisory Committee on the Biological Effects of Ionizing Radiations, National Academy of Sciences, National Research Council; "The Argonne Radiological Impact Program, Part I. Carcinogenic Hazard from Low-Level, Low-Rate Radiation" N. A. Frigerio, K. F. Eckerman, and R. S. Stowe, ANL/ES-26 Part I; "The Hazards in Plutonium Dispersal" by B. L. Cohen, University of Pittsburgh, "Study of the Lifetime Health and Mortality Experience of Employees of AEC Contractors", T. F. Mancuso and B. S. Sanders, COO-3425-5. It should be noted these selected articles are but a few of the scores of articles available on this subject.

Page	Line	Comments p 4	
5-2,3		Long term effects of radiation are not thoroughly discussed. For instance, will there be a buildup of radioactive levels in the area over the years?	19
5-3	4	In light of the leaks of radioactive material at Hanford in the past, the phrase "...should not pose a public health hazard " is particularly ambiguous. Recommend a more detailed discussion.	20
5-3, 6-1		The statement that "all of the resources utilized by the HGP and NPR are relatively plentiful..." is curious. I recommend a discussion of the significance of the fact that the NPR uses 700,000 lbs. of uranium annually. Recommend stating what type of Uranium is referred to- is it U_3O_8? What is the national situation with respect to this resource and its projected use? Is the NPR and HGP facility an effienct use for uranium? How does the HGP compare to newer nuclear plants in terms of kw produced per ton of uranium? (ie, do modern 1000MW plants use 2 to 3 times less uraniumthan NPR). Does the NPR/HGP facility constitute an inefficient process that is wasteful of scarce uranium?	21
7-3 para 2		DOE comments deserve more exposure.	22
8-3,4		Discussion of impact of energy deficits needs expansion. What was the cost of deficits for the industrial sector in 1973? Was there any cost to other sectors? Can such costs be mitigated in the future in the various sectors?	23

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19. See ERDA-1538 for a more detailed discussion of long term impacts of radiation.

20. See ERDA-1538 for a more detailed discussion of waste management operations at Hanford.

21. The appropriate changes have been made to Section 5.2 to clarify this statement. The use of HGP and NPR for electrical energy production only does represent a somewhat inefficient use of uranium. The NPR uses up to about 50% more uranium for each Kwhr produced by HGP than a commercial reactor would use. However, the primary product from NPR operation is plutonium.

22. See response to comments for Dept. of Ecology.

23. See response number 14 to comments Mr. Walton above.

Page	Line	Comment p. 5	
		(One approach is that being investigated by the Northwest Energy Policy Project concerning Aluminum Ingot Energy Storage) It is not clear from the discussion that the projected energy deficits are necessarily more of a burden to the region than the proposed power plants that may be needed to preclude them.	23
8-5	para 2	This paragraph is unclear- what is the conversion of NPR referred to in this section?	24
8-7	22	How should be hot.	25
8-20	Table 8.3-1	Recommend explaining Li/yr.	26
General		What is the status of HGP in terms of aging of its components? Is it "good" for 5 or more years, or is it old and in need of repair, new parts, etc.? This aspect is not discussed. Also, what about financing- is there an amortization schedule?	27

24. The appropriate change has been made in Section 8.1.

25. The appropriate change has been made in Section 8.1.1.

26. The appropriate change has been made to Table 8.3-1.

27. At the present time the HGP is in excellent condition. Problems have been encountered in the past few years with cracks appearing in some of the larger turbine blades. New blades have been installed which are expected to solve these problems. The HGP bonds will be retired by 1996.